U.S. Army Corps of Engineers

Baltimore District

Final Work Plan

Military Munitions Response Program Project 7 Boat Basin, Visitors Information Center

Remedial Investigation Wallops Flight Facility Formerly Used Defense Site Wallops Island, Virginia

June 2014

Prepared by:

U.S. ARMY CORPS OF ENGINEERS
Baltimore, Maryland

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FINAL
WORK PLAN

MILITARY MUNITIONS RESPONSE PROGRAM
PROJECT 7
BOAT BASIN, VISITORS INFORMATION CENTER

REMEDIAL INVESTIGATION
WALLOPS FLIGHT FACILITY FORMERLY USED DEFENSE SITE
WALLOPS ISLAND, VIRGINIA

Prepared By:

U.S. ARMY CORPS OF ENGINEERS
BALTIMORE DISTRICT
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______________________________________ 6/18/2014
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Greg Daloisio, PMP

TABLE OF CONTENTS

Section **Page**

TABLE OF CONTENTS (Continued)

Section **Page**

TABLE OF CONTENTS (Continued)

Section **Page**

TABLE OF CONTENTS (Continued)

Section **Page**

TABLE OF CONTENTS (Continued)

Section **Page**

LIST OF APPENDICES

LIST OF FIGURES

Title **Page**

LIST OF TABLES

LIST OF ACRONYMS

ºC	degrees Celsius
AOI	area of interest
APP	Accident Prevention Plan
ARAR	applicable or relevant and appropriate requirement
ASR	Archives Search Report
ASTM	American Society for Testing and Materials
ATF	Bureau of Alcohol, Tobacco, Firearms, and Explosives
BERA	baseline ecological risk assessment
BHHRA	baseline human health risk assessment
BIP	blow-in-place
BMP	best management practice
BTAG	Biological Technical Assistance Group
CAR	Corrective Action Request
CENAB	USACE, Baltimore District
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CLEAN	Comprehensive Long-Term Environmental Action Policy
cm	centimeter
CNAS	Chincoteague Naval Air Station
COC	chain-of-custody
CON/HTRW	Containerized Hazardous, Toxic, and Radioactive Waste
COPEC	constituent of potential ecological concern
COR	Contracting Officer’s Representative
CSM	conceptual site model
CTO	Contract Task Order
DDESB	U.S. Department of Defense Explosives Safety Board
DERP	Defense Environmental Restoration Program
DFW	definable feature of work
DGM	digital geophysical mapping
DGPS	Differential Global Positional System
DID	Data Item Description
DMM	discarded military munitions
DO	Delivery Order
DoD	Department of Defense
DoDD	Department of Defense Directive
DoDI	Department of Defense Instruction
DOT	U. S. Department of Transportation
DPT	direct push technology
DQCR	Daily Quality Control Report
DQO	data quality objectives
DTIC	Defense Technical Information Center
eco-SSL	ecological soil screening level

LIST OF ACRONYMS (Continued)

EDD	electronic data deliverable
EM	Engineering Manual
EOD	Explosives Ordnance Disposal
EP	Engineering Pamphlet
EPA	U.S. Environmental Protection Agency
EPP	Environmental Protection Plan
ERA	ecological risk assessment
ERAGS	Ecological Risk Assessment Guidance for Superfund
ESP	Explosives Site Plan
ESRI	Environmental Systems Research Institute
FGDC	Federal Geographic Data Committee
FS	Feasibility Study
ftp	file transfer protocol
FUDS	Formerly Used Defense Site
GIS	Geographic Information System
GISP	Geographic Information Systems Professional
GPO	Geophysical Prove-Out
GPS	Global Positioning System
GSV	geophysical system verification
HA	hazard assessment
HFA	Human Factors Applications, Inc.
HFD	hazardous fragment distance
HHRA	human health risk assessment
HTRW	hazardous, toxic, or radioactive waste
Hz	hertz
ID	identification
IDW	investigation-derived waste
IGD	Interim Guidance Document
ISO	industry standard object
IT	information technology
IVS	instrument verification strip
KO	Contracting Officer
m	meter
M&E	Metcalf & Eddy, Inc.
MC	munitions constituents
MCGI	Meridian Consultant Group, Inc.
MD	munitions debris
MDAS	material documented as safe
MDEH	material documented as an explosive hazard
MEC	munitions and explosives of concern
mm	millimeter
MMCX	Military Munitions Center of Expertise
MMRP	Military Munitions Response Program

LIST OF ACRONYMS (Continued)

mph	miles per hour
MPPEH	Material Potentially Presenting an Explosive Hazard
MQO	measurement quality objective
MRSPP	Munitions Response Site Prioritization Protocol
mS/m	millisiemens per meter
MSD	minimum separation distance
mV	millivolt
NA	not applicable
NAD	North American Datum
NAOTS	Naval Aviation Ordnance Test Station
NASA	National Aeronautics and Space Administration
NAVD88	North American Vertical Datum of 1988
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NG	nitroglycerin
NMEA	National Marine Electronics Association
NRL	Naval Research Laboratory
NTCRA	Non-Time-Critical Removal Action
NWP	Nationwide Permit
OESS	Ordnance and Explosive Safety Specialist
PAH	polynuclear aromatic hydrocarbon
PDA	personal digital assistant
PDF	portable document format
PETN	pentaerythritol tetranitrate
PID	photoionization detector
PM	Project Manager
PMP	Program Management Professional
POC	point of contact
PPE	personal protection equipment
PRG	preliminary remediation goal
PVC	polyvinyl chloride
QA	quality assurance
QA/QC	quality assurance/quality control
QAPP	Quality Assurance Project Plan
QASP	Quality Assurance Surveillance Plan
QC	quality control
QCP	Quality Control Plan
QR	qualitative reconnaissance
RAGS	Risk Assessment Guidance for Superfund
RCRA	Resource Conservation and Recovery Act
RDX	hexahydro-1,3,5- trinitro-1,3,5-triazine
READ	Repository of Environmental Army Documents
RI	remedial investigation
RL	reporting limit

LIST OF ACRONYMS (Continued)

RSL	regional screening level
RTK	real-time kinematic
SARA	Superfund Amendments and Reauthorization Act of 1986
SEDD	Staged Electronic Data Deliverable
SI	Site Inspection
SLERA	Screening Level Ecological Risk Assessment
SOP	standard operating procedure
SOW	Scope of Work
SSHP	Site Safety and Health Plan
std. dev.	standard deviation
SUXOS	Senior UXO Supervisor
SVOC	semivolatile organic compound
T&E	threatened or endangered
TAL	target analyte list
TBC	to be considered
TCL	target compound list
TCRA	time critical removal action
TDEM	time domain electromagnetic
TM	Technical Manual
TNT	trinitrotoluene
TP I	three-phase inspection
TP	Technical Paper
TPMC	TerranearPMC, LLC
TPP	Technical Project Planning
U.S.	United States
UFP-QAPP	Uniform Federal Policy – Quality Assurance Project Plan
USACE	U.S. Army Corps of Engineers
USAEC	U.S. Army Environmental Command
USAESCH	U.S. Army Engineering and Support Center, Huntsville
USC	United States Code
USFWS	U.S. Fish and Wildlife Service
UTM	Universal Transverse Mercator
UXO	unexploded ordnance
UXOQCS	UXO Quality Control Specialist
UXOSO	UXO Safety Officer
VAC	Virginia Administrative Code
VDEQ	Virginia Department of Environmental Quality
VHWMR	Virginia Hazardous Waste Management Regulations
VOC	volatile organic compound
VSMP	Virginia Stormwater Management Program
WESTON®	Weston Solutions, Inc.
WFF	Wallops Flight Facility
WP	Work Plan

1 INTRODUCTION

1.1 GENERAL

Weston Solutions, Inc. (WESTON®) is performing a remedial investigation (RI) at the Boat Basin, Visitors Information Center site at the Wallops Flight Facility (WFF) Formerly Used Defense Site (FUDS). The National Aeronautics and Space Administration (NASA) Goddard Space Flight Center WFF qualifies as a U.S. Army Corps of Engineers (USACE) FUDS property pursuant to the Environmental Restoration Defense Account and the Defense Environmental Restoration Program (DERP), Chapter 160 of the Superfund Amendments and Reauthorization Act of 1986 (SARA). As part of the USACE FUDS program, USACE, Baltimore District (CENAB) is responsible for execution of the USACE FUDS activities at the WFF FUDS. The project is being completed in support of the FUDS Military Munitions Response Program (MMRP). Work is authorized under the CENAB Contract W912DR-09-D-0015, Delivery Order (DO) 0035, and will be performed in accordance with the Scope of Work (SOW).

The Boat Basin, Visitors Information Center RI Work Plan (RI Work Plan or Work Plan) describes the technical approach for the MMRP RI to be conducted at the Boat Basin, Visitors Information Center. The site was recommended for further investigation, in the form of an RI/feasibility study (FS), in the Final Site Inspection (SI) Report (HFA, 2012).

1.2 PURPOSE AND SCOPE

The USACE FUDS program at WFF began in 1998. Admission into the FUDS program is based on data collected through property visits, historical documents, photographic reviews, environmental assessments, and other pertinent information. Specific issues to be addressed at the WFF FUDS include Hazardous, Toxic, and Radioactive Waste (HTRW), Containerized Hazardous, Toxic, and Radioactive Waste (CON/HTRW), and MMRP projects. USACE currently coordinates its FUDS Environmental Restoration Program at the WFF FUDS with the U.S. Environmental Protection Agency (EPA), Virginia Department of Environmental Quality (VDEQ), and NASA.

The United States (U.S.) Congress established the MMRP under the DERP FUDS to address munitions and explosives of concern (MEC) and munitions constituents (MC) located on current and former defense sites. Properties classified as operational military ranges, permitted munitions disposal facilities, or operating munitions storage facilities are not eligible for the MMRP. The DERP, including the MMRP, typically follows the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) and the National Oil and Hazardous Substances Pollution Contingency Plan (NCP).

The primary purpose of the MMRP RI at the Boat Basin, Visitors Information Center is to determine the nature and extent of MEC, MC, and chemical constituents associated with other munitions-related activities that may be present on the site. Information collected during the RI will be used to fill data gaps, update the conceptual site model (CSM), conduct an explosive hazard assessment (HA), conduct a human health and ecological risk assessment, and update the Munitions Response Site Prioritization Protocol (MRSPP). Results from the MMRP RI at the Boat Basin, Visitors Information Center will be used to provide recommendations for further investigations.

1.3 WORK PLAN ORGANIZATION

The RI Work Plan was prepared using components of the Army guidance documents, Engineering Manual (EM) 200-1-15 (USACE, 2013), Data Item Description (DID) MMRP-09-001 (USACE, 2009a), and the *Final Munitions Response Remedial Investigation/Feasibility Study Guidance* (USAEC, 2009). Work Plan sections are organized as follows:

Section 1 – Introduction
Section 2 – Technical Management Plan
Section 3 – Field Investigation Plan
Section 4 – Data Management and Reporting
Section 5 – Quality Control Plan
Section 6 – Explosives Management Plan
Section 7 – Explosives Site Plan
Section 8 – Environmental Protection Plan
Section 9 – References

The following information is appended to the Work Plan:

1.4 PROJECT FACILITY AND DESCRIPTION

The WFF FUDS is located on Wallops Flight Facility (WFF) in Accomack County on the eastern shore of the Commonwealth of Virginia. WFF consists of three separate areas: Main Base, Wallops Island, and Wallops Mainland (**Figure 1-1**). The WFF is situated on the Atlantic Coast of the Delmarva Peninsula, approximately 5 miles south of the Maryland/Virginia state boundary, west of Chincoteague Island. Wallops Island and Wallops Mainland are located approximately 7.5 miles south-southeast of the Main Base. The Main Base, which is approximately 2,230 acres, is bordered on the east by extensive marshland, swales, and tidal creeks, including Cedar Creek and Simoneaston Bay, which drain into Chincoteague Bay and Chincoteague Inlet. The Main Base is bordered to the north and west by Little Mosquito Creek. State Routes 175 and 798 form the southern and southeastern borders of the Main Base.

The Department of the Navy acquired the area in 1942 through condemnation to establish the Chincoteague Naval Air Station (CNAS) as a training facility for World War II naval aviators. Prior to being developed for the CNAS, the area principally consisted of farmland and marshes. Aerial photographs indicate that by 1943, various buildings and three runways were complete. Over the years, the mission of the facility changed numerous times.

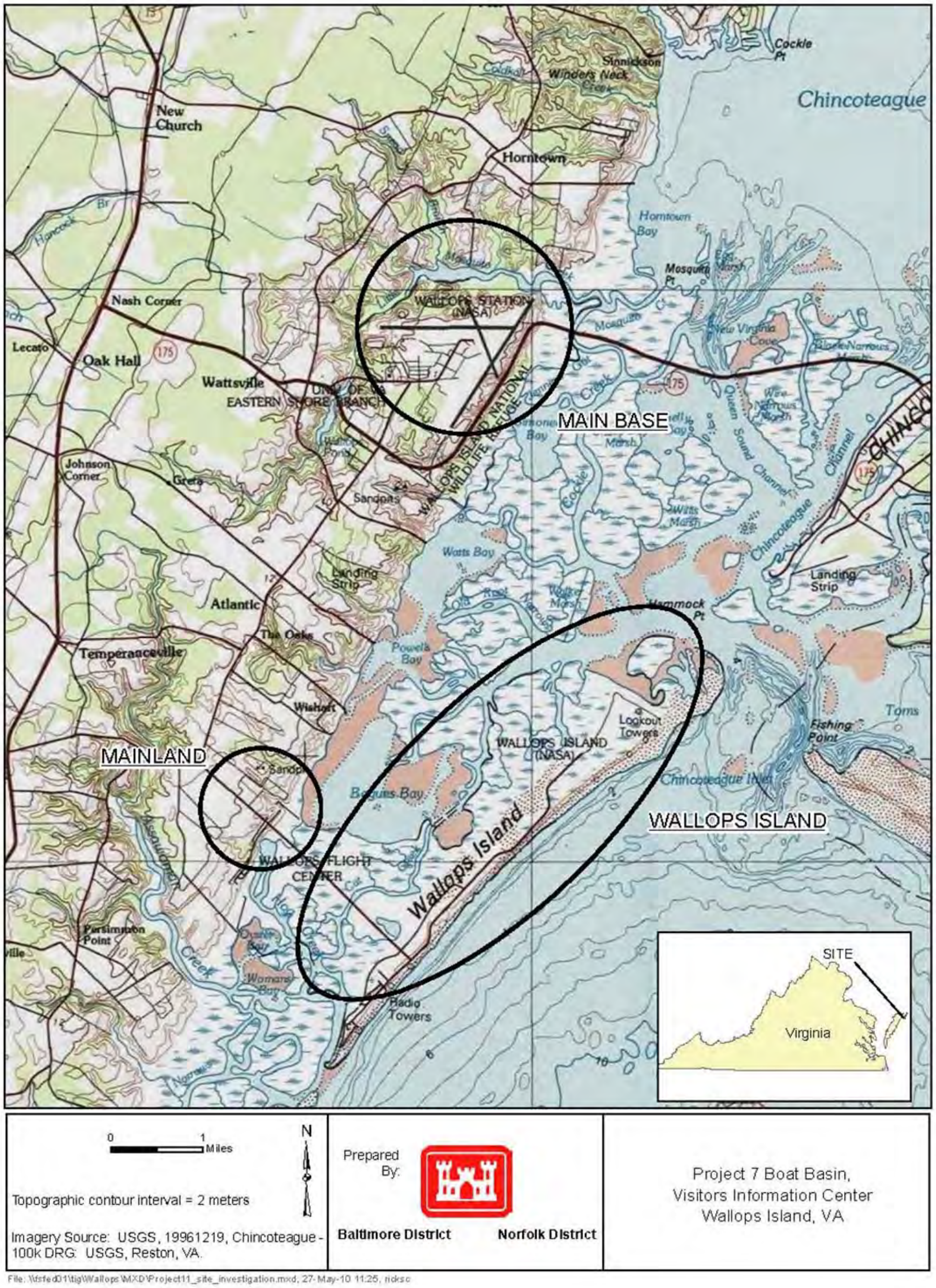


Figure 1-1 WFF Vicinity Map

The three runways were modified and extended as needed for the changing mission. The runway modification resulted in the construction, expansion, and occasional abandonment of numerous associated structures and roadways. On 26 January 1946, the Bureau of Ordnance established the Naval Aviation Ordnance Test Station (NAOTS) at the CNAS to conduct secret aviation ordnance tests and munitions experiments. In 1958, the National Aeronautics and Space Act established NASA. Although the Navy decided to shut down the CNAS, it continued to operate until 1959, when it was officially closed. On 30 June 1959, NASA took custody of the CNAS and NAOTS facilities and began acquiring the land to create the "Main Base" area. Finalization of the transfer from the Navy did not take place until 1 December 1961**.**

From 1959 to 1974, the area consisting of the Main Base, Wallops Island, and Wallops Mainland was known as Wallops Station. During this period, activities at the Station were conducted in support of the Civilian Space Program. In 1975, the facility name was changed to Wallops Flight Center. Activities were expanded to include studies of ocean processes. Noise reduction studies of aircraft on runways were conducted on the Main Base at the Wallops Research Airport. In July 1975, NASA excessed approximately 397 acres of land along the eastern extent of the Main Base to the U.S. Fish and Wildlife Service (USFWS) to establish the Wallops Island National Wildlife Refuge.

In October 1981, Wallops Flight Center was consolidated with the Goddard Space Flight Center in Maryland and the name was officially changed to WFF. Since then, WFF has become NASA's primary facility for suborbital programs (Occu-Health, 1999; Science Applications International Corporation (SAIC), 2003).

1.5 CONCEPTUAL SITE MODEL

A CSM is a description of a site and its environment that is based on existing knowledge. The CSM describes the sources of MEC, MC, and other munitions-related chemical constituent hazards at a site, actual or potential pathways, current or proposed use of property, and potential receptors to MC, other munitions-related chemical constituents, or explosives hazards. The CSM provides a planning tool to integrate information from a variety of sources, evaluate the information with respect to project objectives and data needs, and respond through an iterative process for further data collection or action. The CSM development should be viewed as a process that reflects the progress of activities at a site from initial assessment through site closeout. Depending on the complexity of the investigation, typical information needs include:

- Facility Profile – Describes man-made features at or near the site.
- Physical Profile – Describes factors that may affect release, fate, and transport.
- Land Use and Exposure Profile – Provides information used to identify and evaluate the applicable exposure scenarios and receptor locations.
- Ecological Profile – Describes the physical relationship between developed and undeveloped portions of the site, use of the undeveloped portions, and ecological use.
- Release Profile – Presents the extent of contaminants or hazards in the environment.

The CSM for the Boat Basin, Visitors Information Center is provided in **Appendix A.** The CSM outlines characteristics, such as climate and geology, over the entire site. A depiction of the CSM for the Boat Basin, Visitors Information Center is shown in **Figure 1-2**. The approximate locations of several potable supply wells are also included in **Figure 1-2**.

1.6 BOAT BASIN, VISITORS INFORMATION CENTER PROFILE

Information presented in the following sections was summarized from the Final SI Report (HFA, 2012).

1.6.1 Description

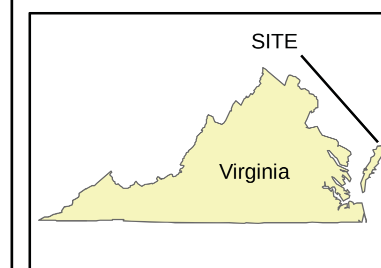
The Boat Basin, Visitors Information Center site encompasses approximately 1.53 acres of land that includes four investigation areas: Pyrotechnics Burn Area, Gun Butt Nos. 1 and 2, and South Bank Boat Basin. The site was used by NAOTS between 1946 and 1959. In June 1959, the U.S. Navy ceased CNAS training and flight operations, the NAOTS ceased ordnance and weapons testing; and the CNAS and NAOTS, including the Boat Basin, Visitors Information Center, were declared excess and transferred to the newly formed NASA in 1961. **Figure 1-3** presents the location of the Boat Basin, Visitors Information Center site as well as the four investigation areas listed above.

Legend

- Areas of Concentrated Anomalies
- Subsurface Anomaly
- Surface Anomaly
- Concrete Target Butt
- Fixed Firing Point
- Pyrotechnic Burn Area (Potential Kickouts)
- Graded Soils from Target Butts
- Supply Well (Approximate Location)

Imagery Source: ESRI, Bing Mapping Service, 2011

Coordinate System: WGS 1984 UTM Zone 18 N Feet



Prepared By:

Baltimore District Norfolk District

Figure 1-2
Conceptual Site Model
Project 7 Boat Basin,
Visitors Information Center
Wallops Island, VA

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13P-0084 Template

Figure 1-3 Investigation Areas

The Pyrotechnics Burn Area is an approximately 20-foot by 25-foot fenced-in area formerly used by the Navy to dispose of parachute flares and practice bomb signals, possibly using trinitrotoluene (TNT) blocks or flammable material such as wood or coke (USACE, 2010). The former disposal sites are still visible in specific locations within the fenced area. The date of construction or first use of the Pyrotechnics Burn Area is not known. The fencing remains, and the Pyrotechnics Burn Area is overgrown with vegetation.

Gun Butt No. 1 was constructed in 1952 and used to test and perfect the use of medium-caliber (20 millimeter (mm) – 37mm) aviation guns and ammunition. The Test Cell target range included a firing point and a concrete impact berm filled with sand or soil. Aircraft guns fired medium-caliber ammunition from Building J-8 (firing point) into the impact berm (Bldg. J-130) located approximately 350 feet to the southeast of the firing point (**Figure 3-2**). Prior to construction of the gun butts, the marsh area in front of the cell provided an ideal unobstructed overland range (USACE, 2005b).

Gun Butt No. 2 was constructed in 1952 and, similar to Gun Butt No. 1, was used to test and perfect the use of medium caliber (20mm – 37mm) aviation guns and ammunition. It should be noted that Gun Butt No. 2 was constructed prior to Gun Butt No. 1. The Test Cell target range included a firing point and a concrete impact berm filled with sand or soil. Aircraft guns fired medium-caliber ammunition from Bldg. J-17 (firing point) into the impact bunker (Bldg. J-18), which was located approximately 150 feet to the south of the firing point. A structure adjacent to the Gun Butt Nos. 1 and 2 is operated by NASA as a visitor information center. It was reported in 1950 that one section of the Test Cell, constructed of heavy reinforced concrete walls, was used for static testing of various types of jet engines used to power guided missiles and included a jet engine thrust stand (USACE, 2005b). A former circular area was identified in the 1949 and 1954 aerial photographs east of Building J-8. The former use of the circular area is unknown.

The South Bank Boat Basin consists of a boat basin and the surrounding bank. Dredging of the boat basin and channel was completed on 26 April 1949 by the Navy in order to establish a boat dock and basin to transport rocket-testing materials from the Wallops Main Base to the Wallops Island test facilities. The South Bank Boat Basin has had no known munitions use; however, numerous munitions items have been observed in the South Bank Boat Basin area. The boat basin is still in use occasionally by NASA and the Marine Science Consortium.

1.6.2 Previous Investigations

1.6.2.1 Focused Archive Search Report - USACE

In 2005, NASA funded the USACE St. Louis District to conduct an Archive Search Report (ASR) to investigate and document past historical uses of the Visitor Center complex area (called the Boat Basin, Visitors Information Center in this RI Work Plan document). USACE completed the ASR in 2005 and concluded that the Visitor Center area had been used as a Test Cell for munitions testing. The Test Cell was used during this time period to ground test aircraft guns, rocket projectors, and jet engines and included two firing points (USACE, 2005a). The Visitor Center area was used during this time period to ground test aircraft guns and ammunition and included two firing points and two firing butts. The Test Cell Target Range (called Gun Butt No. 1 and No. 2 in this document) was also used as a test cell from 1948 through 1959 to test newly produced fused munitions and machine guns.

Experimental testing of aircraft gun-type weapons, associated accessories, and lot proof testing of non-explosive aircraft ammunition was performed at the Test Cell/Gun Laboratory Range Area (USACE, 2005b). During the Focused ASR, no document was found that indicated the use of high explosive ammunition or fuzes at the Test Cell/Gun Laboratory Range Area. By design and plan, explosive ammunition was not fired at the Test Cell/Gun Laboratory Range Area.

One report reviewed for the Focused ASR indicated that 1,759 rounds of M21Al practice (non-explosive) 20-mm ammunition were used (USACE, 2005b). This report and others acquired through Defense Technical Information Center (DTIC) reporting on similar tests do not include mention of the use of high explosive ammunition or fuzes at the Test Cell/Gun Laboratory Range Area.

The Focused ASR indicated the Test Cell/Gun Laboratory Range Area included a Production Test Range, an Experimental Range, a ready service magazine, and the necessary operations and stowage spaces (USACE, 2005b). Each range fired into separate targets and firing-in butts. The

Test Cell/Gun Laboratory Range Area was used for ground firing tests and evaluations of experimental and production models of aircraft gun-type weapons, associated accessories and nonexplosive ammunition. Non-explosive aircraft ammunition includes training practice and inert solid shot, neither of which is loaded with explosives.

An approximate 4-acre portion of the open lawn, starting about 200 feet from the Visitor Center complex and extending to the east to a wetland, is the former location of the Test Cell and the firing lanes and firing-in butts. The area was inspected during the performance of a Site Assessment in 1991, and it was reported that “a large number of spent 20mm practice rounds” were found scattered in the area of one of the former firing in-butts (Metcalf & Eddy, 1992). During a subsequent visual property inspection conducted from 4 April through 8 April 2005 as part of the ASR, six spent 20mm rounds were found in the vicinity east of the display rockets, approximately 400 feet southeast of the Visitor Center (USACE, 2005a).

1.6.2.2 Unexploded Ordnance Clearance – Tetra Tech NUS

Tetra Tech NUS prepared an Unexploded Ordnance (UXO) Clearance Report in May 2006 for NASA (Tetra Tech NUS, Inc., 2006) under the Comprehensive Long-Term Environmental Action Navy (CLEAN) Contract Number N62472-03-D-0057, Contract Task Order (CTO) 036. A copy of the report is presented in **Appendix B**. The objective of the clearance activities was to locate, identify, and remove UXO and Material Potentially Presenting an Explosive Hazard (MPPEH) from the top 12 inches of soil at the Visitor Center. Figure 2-1 in the UXO clearance report in **Appendix B** presents the clearance areas.

The UXO clearance activities conducted in January and February 2006 included geophysical prove-out establishment and seeding, establishment of site grids, surface clearances, geophysical survey, reacquisition and intrusive operations, explosives handling, and material handling. Figure 2-1 in the report in **Appendix B** presents the clearance areas.

Results of the field investigations are presented as follows:

- A total of approximately 243 surface anomalies/targets were identified during the surface sweep operation. Based on a review of the grid reporting sheets, the following items were found within the site clearance grids:

  - 162 munitions items (20mm and 30mm fragments and projectiles).
  - 2 munitions-related scrap debris items (empty propellant charge canisters).
  - 21 identified scrap metal items (i.e., pipe, rebar, wire, nails).
  - 58 unidentified scrap metal items (generally small or rusted metal fragments).

- A total of 2,153 anomalies/targets in both the surface and subsurface soils were identified during the geophysical investigation at the Visitor Center site.

- A total of 2,150 target items were identified and excavated during intrusive activities at the site. As noted above, no live or fused MPPEH items were found during the intrusive investigation. Disposition of the target items was as follows:

  - Items removed from the site included:

    - 1,106 munitions items (20mm and 30mm fragments, projectiles, and empty cartridges).
    - 7 munitions-related debris items (grenade handle, Mortar fins, M-l clips, and 75mm projectiles).
    - 302 identified scrap metal items (pipe, rebar, nails, bolts, strapping).
    - 332 unidentified scrap metal items (generally small or rusted metal fragments).

  - Items left in place included:

    - 3 anomalies associated with an area identified as a probable former burn pit containing slag-like melted and consolidated metal debris, including 20mm and 30mm fragments. The area is covered by 12 inches or more of soil.
    - 10 identified scrap metal items too large to move (large metal plates, concrete and rebar).
    - 328 unidentified items at depths greater than 1 foot.

  - Items not intrusively investigated included:

    - 62 anomalies identified during the geophysical survey that coincided with known man-made cultural features (sidewalks, utility lines).

  - Items not located included:

    - 3 targets identified through the geophysical survey where no contact was made by using the metal detectors or by using hand excavations.

Based on the findings of site activities, it was concluded in the UXO Clearance Report that the portion of the Visitor Center site covered under the field investigation should be reopened for the current non-intrusive site uses; however, a dig or excavation restriction should be placed on the area.

1.6.2.3 Site Inspection - HFA

Under contract to the United States Army Engineering and Support Center, Huntsville (USAESCH), an SI at the site was conducted in 2012 by Human Factors Applications, Inc. (HFA), a wholly-owned subsidiary of TerranearPMC, LLC (TPMC). A copy of the report is presented in **Appendix B**.

SI field activities were performed on 12 December through 14 December 2011. Qualitative reconnaissance (QR) was performed during which analog geophysics was conducted and visual observations were made. Only expended and inert munitions debris (MD) have been observed historically, and no confirmed MEC (through visual observations and use of analog geophysics) was found openly visible on the ground surface during the SI field activities. Numerous surface anomalies were detected during QR, including military-related items (Marston matting at South Bank Boat Basin) and three MD at Gun Butt Nos. 1 and 2. Seven MPPEH (20mm and larger than 20mm burnt pyrotechnic items) were observed on the surface that could not be determined to not contain energetic material. In addition, 37 distinct subsurface anomalies were detected on land. Five areas of concentrated subsurface anomalies (i.e., the UXO technician was unable to count individual anomaly points) were identified, two at the Gun Butt No. 1 and Gun Butt No. 2 and three at the Pyrotechnics Burn Area (including the entire area within the Pyrotechnics Burn Area fence). Two underwater anomalies were noted during reconnaissance of the boat basin, and an undefined area along the south bank of the boat basin was noted as having a large quantity (more than 50) of surface anomalies identified as rusty metal debris.

No explosive constituents, perchlorate, or polynuclear aromatic hydrocarbons (PAHs) were detected at concentrations above their respective Reporting Limits (RLs). Several metals were detected above their respective screening levels in samples, including iron in surface soil, subsurface soil, and groundwater; aluminum in subsurface soil; and antimony in groundwater.

The maximum concentrations of antimony, copper, lead, and zinc in surface soil that exceeded the ecological soil screening levels (eco-SSLs) were selected for the Screening Level Ecological Risk Assessment (SLERA). Background concentrations were exceeded for these detections, and potentially unacceptable risks to ecological receptors were identified in surface soil. Copper was also detected in sediment above the eco-SSLs and identified as a constituent of potential ecological concern (COPEC); however, based on the infrequent and negligible exceedance, copper in sediment is not expected to present an unacceptable risk to ecological receptors. No COPECs were identified in surface water.

An RI/FS was recommended for the Boat Basin, Visitors Information Center. Additional studies were recommended to focus on MEC and MC. MD items have been observed historically at the site, and MD and MPPEH were observed during the 2011 SI field activities. The condition of seven of the items observed during the SI field activities was such that the UXO technician could not confirm that energetic material did not remain. Based on the continued finds of munitions items, human interaction, and accessibility, a qualitative MEC HA indicated that the explosive hazard was moderate at the site. In addition, numerous subsurface anomalies were detected, including distinct anomalies and areas containing dense concentrations of anomalies.

2 TECHNICAL MANAGEMENT PLAN

2.1 PROJECT OBJECTIVES

The goal for the project is to characterize the nature and extent of MEC, MC, and other munitions-related chemical constituents to complete an RI at the Boat Basin, Visitors Information Center. The following project objectives will be met:

- Characterize potential explosive hazards on the surface, in the subsurface, and in surface water (although the potential surface water explosive hazards are located within sediment). Potential subsurface explosive hazards must be detected and acquired prior to being characterized.

- Characterize MC and other munitions-related chemical constituent contamination in soil, sediment, surface water, and groundwater.

- Perform a MEC HA.

- Characterize the HTRW constituents at the Pyrotechnics Burn Area that were previously detected.

- Perform a baseline human health risk assessment (HHRA) and SLERA for MC and other munitions-related chemical constituents detected at the site.

- Determine whether no further action is warranted or whether additional investigation (e.g., feasibility study) is required.

2.2 PROJECT ORGANIZATION

The WESTON project team has the technical and administrative abilities required to safely and efficiently complete the RI at the Boat Basin, Visitors Information Center. WESTON will staff positions from our Norfolk, Virginia, and West Chester, Pennsylvania, offices for investigation activities. Subcontractor support will be provided by Aqua Survey, Inc. (water-based geophysical services), VRHabilis, LLC (dive support), Tidewater, Inc. (drilling services), Baldwin & Gregg, LTD (professional land surveying services), CompuChem Laboratories (analytical laboratory services), and Meridian Consultant Group, Inc. (data validation services).

Although the organization chart (**Figure 2-1**) presents the entire project team, the following sections describe the roles and responsibilities of the key project personnel. Project personnel will meet the necessary training and experience requirements for their assigned positions. Key project personnel will provide guidance and draw support from WESTON field staff. The project support staff also includes administrative personnel, contract administrators, cost controllers, technical editors, and information management specialists. On an as-needed basis, subcontractors will provide support to the project. Contact information for key project personnel (USACE, regulators, and WESTON) is provided in **Appendix C**. Resumes for key project personnel are provided in **Appendix D**.

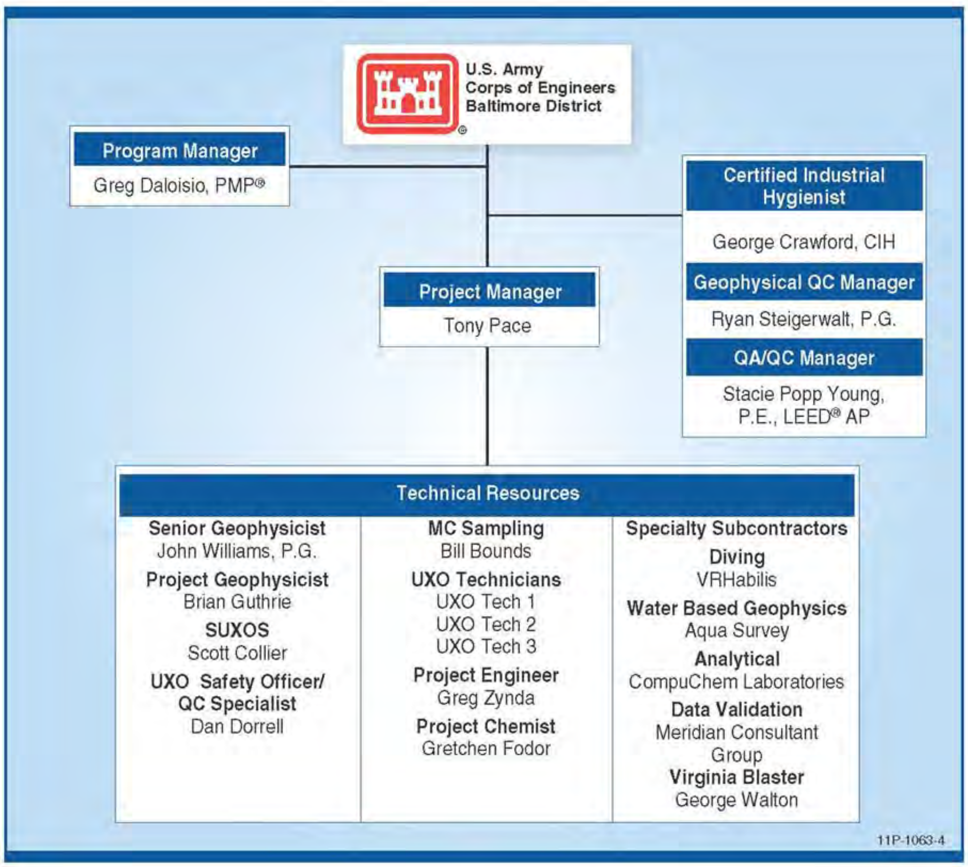

Figure 2-1 Organizational Chart

2.2.1 Project Staff - Weston Solutions, Inc.

2.2.1.1 Project Manager

Tony Pace, who is the primary point of contact (POC) for the project, has the overall responsibility for the day-to-day management of project activities. He is responsible for interacting with WESTON and USACE personnel to ensure that the RI is executed according to the SOW and project plans.

The duties of the Project Manager (PM) include the following:

- Maintaining the Project Management Plan.
- Supervising the day-to-day activities of resources to achieve project goals.
- Ensuring on-time completion and approval of deliverables.
- Ensuring compliance with the Quality Assurance Surveillance Plan (QASP).
- Notifying management of needed resources and obtaining resource commitment.
- Ensuring implementation of project health and safety and quality control (QC) procedures.
- Monitoring daily cost and schedule control.
- Maintaining effective communications with stakeholder POCs.
- Preparing project status reports as required.

2.2.1.2 Geophysical Personnel

The geophysical team consists of the Senior Geophysicist, Project Geophysicist, and trained geophysical survey teams.

2.2.1.2.1 Senior Geophysicist

John Williams is the Senior Geophysicist responsible for technical matters, including project coordination, achieving project objectives, and staff guidance. He is also responsible for determining the geophysical methods that will be employed on the RI for the Boat Basin, Visitors Information Center. His duties include selecting proper instrumentation and navigational equipment, design and implementation of a geophysical investigation plan to accomplish the project's objectives, oversight of field geophysical activities, and assurance of the overall quality and integrity of the geophysical effort. Mr. Williams will also be responsible for analyzing and directing anomaly selection for reacquisition and digital geophysical mapping (DGM) QC verification mapping. The Senior Geophysicist will work in close coordination with the PM, Senior UXO Supervisor (SUXOS), Project Geophysicist, and Geographic Information System (GIS) Analyst.

2.2.1.2.2 Project Geophysicist

Brian Guthrie, the Project Geophysicist, is responsible for the overall coordination of data acquisition and performing data processing and analysis. The Project Geophysicist is also responsible for reviewing data, monitoring technical performance of field teams, and coordinating with the field teams in the development of field reports. The Project Geophysicist is responsible for the preparing target dig lists and dig sheets, coordinating target reacquisition, and reviewing the results of excavations.

2.2.1.2.3 Experienced Geophysical Teams

The geophysical survey teams coordinate with the Project Geophysicist and SUXOS for field activities. The teams are responsible for following geophysical standard operating procedures (SOPs), recording/logging data collection activities, downloading raw data from personal digital assistants (PDAs) and field computers, and maintaining equipment. The geophysical survey teams are responsible for coordinating with the Project Geophysicist and SUXOS in planning field data acquisition schedules a day in advance and providing daily field summaries of geophysical activities.

2.2.1.3 UXO Qualified Personnel

2.2.1.3.1 Senior UXO Supervisor

Scott Collier, the SUXOS, is the senior subject matter expert in the field during the execution of the RI. The SUXOS responsibilities include the following:

- Planning, coordinating, and supervising on-site MEC-related activities.
- Implementing procedures and guidance for MEC operations (ensuring compliance with DoD directives (DoDDs) and federal, state, and local statutes and codes).

- Certifying MPPEH and/or range scrap as ready for turn-in or disposal.
- Maintaining administrative records of the project.
- Supervising multiple project teams during the RI that are performing MEC and MEC-related activities, such as the following:
  - Providing UXO escort for vegetation clearance and anomaly avoidance.
  - Conducting mag and dig surveys.
  - Performing demolition activities.
  - Transporting explosive material.

The SUXOS reports directly to the WESTON PM and has an open line of communication with the UXO Safety Officer (UXOSO) - UXO Quality Control Specialist (UXOQCS).

2.2.1.3.2 UXO Safety Officer and UXO Quality Control Specialist

Dan Dorrell, the UXOSO and UXOQCS, is the single POC for on-site safety and quality issues. Mr. Dorrell will be responsible for monitoring site activities for compliance with plans, procedures, and regulations relative to the health and safety of employees, project members, land users, residents, and visitors.

As the UXOSO, he is additionally responsible for the following activities:

- Monitoring MEC investigation, removal, and demolition activities for compliance with health and safety requirements as established in the Accident Prevention Plan (APP) provided in **Appendix E**.

As the UXOQCS, he is additionally responsible for the following activities:

- Monitoring activities affecting quality during trenching activities.
- Ensuring that procedures are being carried out in accordance with established requirements and protocols.
- Understanding WESTON's and the project's quality-related requirements and the plans and procedures that implement them.
- Performing QC activities.
- Preparing the Daily Quality Control Report (DQCR).

The UXOSO - UXOQCS reports to the WESTON PM for project-specific direction and has a direct line of communication with the Program Health and Safety Manager for administrative and technical direction on health and safety matters. Mr. Dorrell will have open frequent communications with the SUXOS.

2.2.1.3.3 UXO Technicians

UXO technicians perform mag and dig, reacquisition, removal, and disposal operations at locations where anomalies are detected. The technicians are responsible for locating, investigating, identifying, removing, and disposing of all MEC, MPPEH, and MD recovered. In addition, they are responsible for documenting required information identified in the RI Work Plan. UXO technicians will meet the qualifications of a UXO Technician I at a minimum and will be under the direct supervision of a UXO Technician III. UXO technicians will meet the requirements of U.S. Department of Defense Explosives Safety Board (DDESB) Technical Paper (TP) 18, Minimum Qualifications for Unexploded Ordnance Technicians and Personnel (DoD, 2004a).

Mag and dig transect teams are composed of two UXO technicians managed by at least one UXO Technician III. Each UXO Team participating in intrusive operations includes one UXO Technician III and one UXO Technician II. One or two additional UXO-qualified technicians will supplement the UXO Team based on grid size and location.

2.2.1.3.3.1 UXO Technician III

The UXO Technician III supervises a project team performing work on Boat Basin, Visitors Information Center RI activities. The UXO Technician III may also serve in the capacity of Demolition Supervisor during demolition and explosive demilitarization operations. The UXO Technician III is responsible for the following activities:

- Supervising the team to which he or she is assigned.
- Providing the MEC subject matter expertise to ensure the team’s safety and the project’s quality.
- Ensuring the team’s actions are accomplished safely and efficiently.

- Maintaining administrative records related to the team's operations.
- Implementing the work, safety, and quality plans.
- Supervising the conduct of all on-site evaluations directly related to MEC operations.
- Being familiar with the duties of all assigned personnel and being able to perform all of the functions enumerated for UXO Technicians I and II.

If assigned as a Demolition Supervisor during demolition operations, the UXO Technician III is also responsible for following activities:

- Training all personnel regarding the nature of the materials, hazards, and precautions.
- Coordinating with the SUXOS to ensure all notifications are completed prior to demolition.
- Being present and in direct control during all on-site disposal operations.

The UXO Technician III will report directly to the SUXOS and will have the experience and qualifications documented in DDESB TP-18.

2.2.1.3.3.2 UXO Technicians I or II

The UXO Technician I or II is the primary MEC worker at the Boat Basin, Visitors Information Center site. UXO Technicians I or II report directly to the UXO Technician III and will have the experience and qualifications documented in DDESB TP-18.

2.2.1.4 GIS Analyst

Fran Curtis, Geographic Information Systems Professional (GISP), the GIS Analyst, is responsible for preparing geophysical survey track maps, tracking MEC, incorporating WESTON's RespondFast^{SM} database tools, and performing database backups. The GIS Manager or her delegate is responsible for creating, maintaining, and providing GIS databases with accompanying metadata in accordance with Federal Geographic Data Committee (FGDC) standards.

2.2.1.5 Senior Chemist

The Senior Chemist, Gretchen Fodor, ensures that the work performed is in accordance with the Quality Assurance Project Plan (QAPP), the RI Work Plan, SOPs, and other pertinent analytical procedures. The Senior Chemist is responsible for tracking samples, managing data, coordinating with the laboratory, interpreting data, and producing analytical electronic data deliverables and reports.

2.3 PROJECT COMMUNICATION AND REPORTING

This section describes the coordination of and communication with stakeholders necessary to ensure the successful completion of the RI. Key stakeholders will be kept informed of project status, existing or potential problems, and changes required to manage the project.

WESTON promotes communication with stakeholders by using the secure, web-based TeamLink℠ system to facilitate electronic data-sharing/communication, if warranted. TeamLink provides an organized site for all stakeholders to post and view project information, provides a means of tracking project action items, and establishes various security levels to control which team members can view, access, and/or manipulate posted information. TeamLink provides USACE, EPA Region III, VDEQ, NASA, and other stakeholders with direct, secure, and reliable electronic access to project-specific documents and data from anywhere they have Internet access. If information technology (IT) security requirements present a problem, a file transfer protocol (ftp) site will be used for data-sharing and communication.

2.3.1 Monthly Status Reports

WESTON will provide monthly status reports to update USACE on the status of the project. Monthly status reports will be submitted to the Contracting Officer's Representative (COR) and USACE Project Manager by the 10th of the following month and will provide summary information that includes, but is not limited to, work completed, work scheduled, technical issues, regulatory challenges/issues, issues that may hamper project schedule, and any other project-related issues raised by any of the stakeholders.

2.3.2 Daily and Weekly Status Reports

Progress status reports will be provided to USACE on a daily and weekly basis while field work is being conducted. WESTON will post an electronic version of the daily status report on the WFF TeamLink site on the next business day. Weekly status reports will be provided electronically to the USACE Project Manager early in the following work week. The weekly status report will include a summary of the previous week's daily reports in accordance with USACE DID MMRP-09-016, Periodic Status Report (USACE, 2009b).

2.3.3 Phone Conferences/Informal Site Meetings

Phone conferences and informal meetings with USACE will be documented appropriately through follow-up email and summaries in the monthly status reports. Only the Contracting Officer (KO) or COR can provide official direction to WESTON.

2.3.4 Regulatory Negotiations

All regulatory coordination must be approved by USACE through the COR. The WESTON PM will provide the necessary support to initiate, schedule, and address all regulatory aspects of the project (e.g., organizing discussions with regulators concerning Boat Basin, Visitors Information Center response objectives and completion requirements, obtaining regulator comments on documents and appropriately addressing them, and obtaining written documentation of investigation completion from the regulators for the Boat Basin, Visitors Information Center).

The COR, or designee, will attend and represent the Army at all meetings with the regulators. WESTON will prepare and submit minutes for all significant meetings attended. With approval of the COR, WESTON may also informally discuss investigative issues with regulators and provide a subsequent report to the COR.

The Army will be the signature authority for all regulatory agreements and investigative documentation.

2.4 PROJECT DELIVERABLES

Documents will be produced in preliminary draft, draft, and final versions in both hard copy and electronic portable document format (PDF). The electronic format will have optical character recognition in accordance with the U.S. Army Environmental Command (USAEC) Repository of Environmental Army Documents (READ) requirements. WESTON will provide the number of copies of each submittal as requested by the various project stakeholders.

The COR will provide consolidated Army comments on draft documents to WESTON within 30 business days. Once initial comments are addressed, the Army will review draft-final documents before submission to appropriate regulatory and stakeholder agencies. Documents will be identified as draft-final until completion of stakeholder coordination, when they will be signed and finalized. One copy of the final document will be placed in both the project repository and the Administrative Record (for CERCLA documents).

2.5 PROJECT SCHEDULE

A resource-loaded project schedule is provided in **Appendix F** and shows the project tasks, deliverables, and milestones. The RI Work Plan also identifies stakeholder involvement, milestones, and deliverables. Changes to the project schedule are likely to occur, and updated schedules will be submitted to USACE with the monthly status reports. Updated schedules will be made available to the project team at all times.

2.6 PUBLIC INVOLVEMENT

WESTON will not make available or publicly disclose any data or report generated under contract W912DR-09-D-0015 unless specifically authorized by the KO through the COR. If any person or entity requests information about the subject of the SOW or work being conducted hereunder, WESTON will refer them to the COR. All reports and other information generated under the SOW shall become the property of the Government, and distribution to any other source by the WESTON is prohibited unless authorized by the KO.

All public participation coordination shall be approved by the KO through the COR. WESTON will provide the necessary support to initiate, schedule, and address all public participation aspects of the project (e.g., preparation of briefings, presentations, fact sheets, newsletters, and articles/public notices to news media). WESTON will be responsible for requesting and addressing all public comments consistent with applicable regulatory drivers. The COR, or designee, will attend and represent the Army at all meetings with the public.

WESTON will be required to provide the necessary support (e.g., preparation of and/or participation in briefings, presentations, fact sheets, newsletters, and notifications) for all technical and remedial PM meetings.

2.7 SUBCONTRACTOR MANAGEMENT

The WESTON team includes the following experienced, pre-qualified subcontractors to meet the specific needs on the RI for the Boat Basin, Visitors Information Center:

- Aqua Survey, Inc. – Water-Based Geophysical Services
- VRHabilis, LLC – Dive Services
- Tidewater, Inc. – Drilling Services
- Baldwin & Gregg, LTD – Land Surveying Services
- CompuChem Laboratories – Analytical Services
- Meridian Consultant Group, Inc. – Data Validation Services

WESTON will use a pool of prequalified subcontractors and vendors with whom we have prior working relationships, primarily on DoD and/or USACE projects.

2.8 MANAGEMENT OF FIELD OPERATIONS

Based on the anticipated duration of RI activities, a site field office will not be established. Project documentation and equipment will be maintained on-site within project associated vehicles and equipment. The SUXOS will serve as the Site Manager for field operations. Field operation safety and quality will be monitored by the dual-hatted UXOSO - UXOQCS.

3 FIELD INVESTIGATION

This section provides the overall approach to the RI activities at the Boat Basin, Visitors Information Center, which includes the South Bank Boat Basin, Pyrotechnics Burn Area, and Gun Butt No. 1 and Gun Butt No. 2. This RI Work Plan presents the characterization goals in the form of data quality objectives (DQOs); the approaches to achieve these objectives; and details on the methodologies to be used for the geophysical surveys, intrusive activities, and media sampling.

3.1 OVERALL REMEDIAL INVESTIGATION APPROACH

The goal of the RI is to conduct an on-site investigation at the Boat Basin, Visitors Information Center to gather sufficient data necessary to characterize the nature and extent of potential MEC, MC, and other chemical constituent contamination. The overall RI approach includes the following tasks:

- Develop DQOs and data needs through the Technical Project Planning (TPP) process.
- Determine the extent and design of ground-based DGM and analog survey requirements based on the CSM, GIS analyses, and site reconnaissance. 100% surveys will be performed at the South Bank Boat Basin, Pyrotechnics Burn Area (200-foot by 200-foot grid centered on the fenced area to fully define the boundary of this potential burial area), and Gun Butts Area to provide comprehensive and statistically defensible data.
- Perform geophysical system verification (GSV) to monitor and verify DGM and magnetometer equipment functionality during the RI geophysical mapping activities and during the intrusive investigations. Establish an instrument verification strip (IVS) based on 20mm projectiles. Develop response curves for the site setting to be used in conjunction with existing 20mm response curves developed by WESTON.
- Conduct a hydrographic survey (i.e., bathymetric and/or side scan) and geophysical investigations (land and water based) using both DGM and analog mag and dig techniques to delineate the extent of potential MEC in the following areas:
    - South Bank Water Survey – A total of 1.8 acres of full coverage hydrographic and marine geophysical surveys will be performed within the boat basin (**Figure 3-1**). The hydrographic survey will provide information to resolve the bottom structure and to assist the subsequent marine DGM survey. In addition, it will help to differentiate the bottom sediment types to assist MEC recovery operations and to delineate potential artifacts related to site history and archeology.

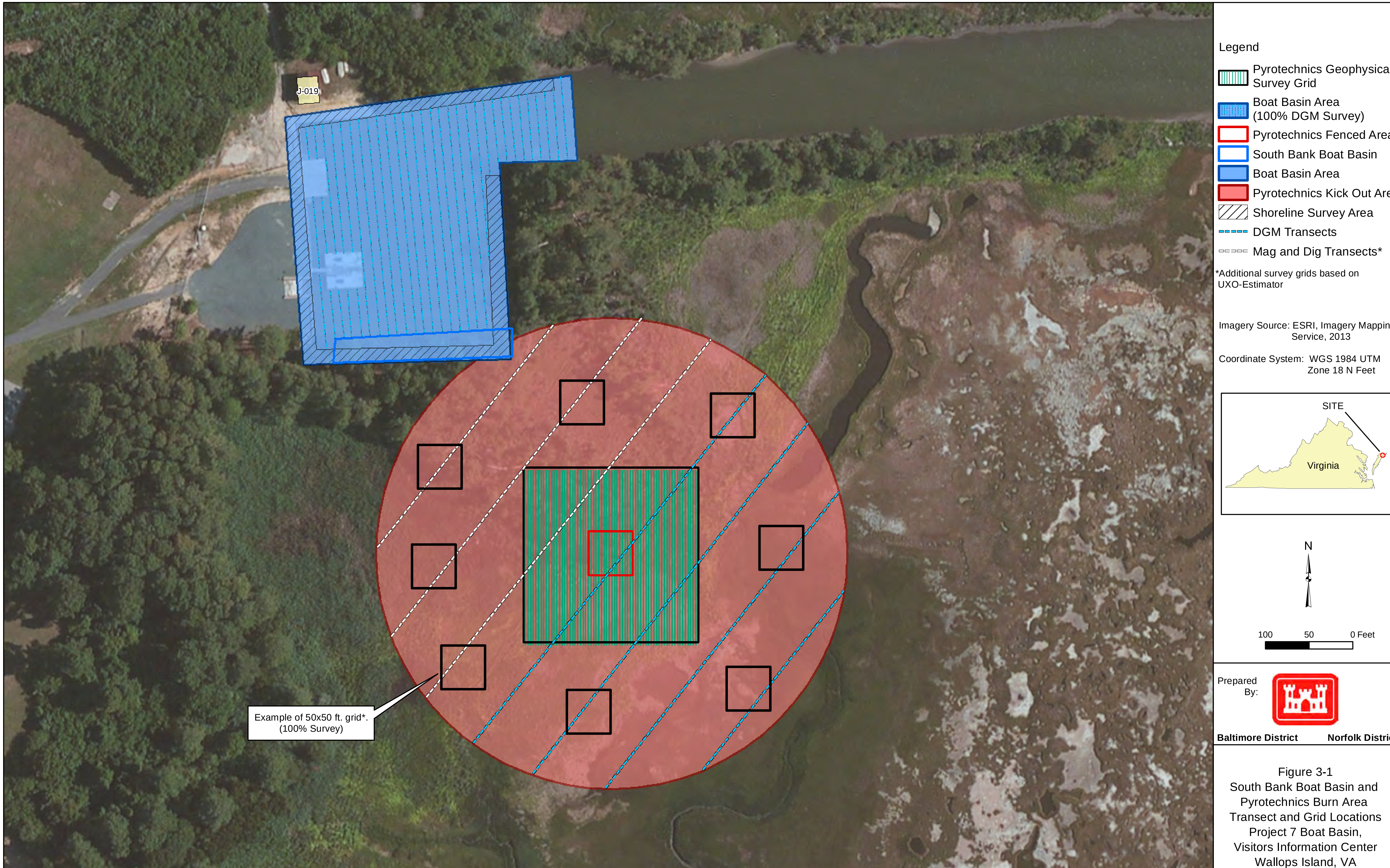

Figure 3-1
South Bank Boat Basin and
Pyrotechnics Burn Area
Transect and Grid Locations
Project 7 Boat Basin,
Visitors Information Center
Wallops Island, VA

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- South Bank Shoreline Survey – A 12-foot swath extending 1,199 feet or 0.36 acre on land around the banks of the south bank area (**Figure 3-1**) will be investigated along transects using analog mag and dig surveys. A single transect will be conducted on the western edge (bulkhead area) of the basin and two transects with a 10-foot spacing will be surveyed along the northern, southern, and eastern banks of the basin. The western shoreline area has been built up from its original grade with an iron sheet pile bulkhead and backfill. Influence from the bulkhead and 10 plus feet of backfill above the original grade preclude acquiring any meaningful data with metal detection methods immediately adjacent to the bulkhead. Additionally, no MEC or MD was noted during the soil removal conducted as part of the bulkhead reconstruction. Therefore, a single transect is proposed away from the influence of the bulkhead along the western edge.

- Pyrotechnics Burn Area – The kick-out radius surrounding the Pyrotechnics Burn Area (**Figure 3-1**) is assumed to be 270 feet (to be extended outward from the boundary of the burial area that will be assessed with a 100% coverage survey as previously discussed) and is based on a maximum soil ejecta distance for a 10-pound maximum credible event (with 1.3 times safety factor). The assumed kick-out radius is also greater than the hazardous fragment distance (HFD) of a 37mm projectile. The total acreage in the Pyrotechnics Burn Area is 5.25 acres. A combination of DGM (EM61-MK2) and analog transects (approximately 2 miles) with a 75-foot spacing will be performed across the Pyrotechnics Burn Area in search of burial features. Based on the transect results, it is anticipated that up to eight grids (50 feet by 50 feet) with 100% coverage will be placed in high-density anomaly areas to assess the nature and extent of anomalies. Grid surveys will be accomplished through use of either mag and dig (in high-vegetation-density areas) or EM61-MK2 (in more open accessible areas). In addition, a full coverage EM61-MK2 DGM survey will be conducted within the fenced area and extending outward to assess anomaly presence and density and fully define the boundary of the potential burial area. Based on observations made during the site visit and on evaluation of the GIS map, it is estimated that approximately 2.25 acres are accessible to standard mag and dig and DGM methods.

- Gun Butt No. 1 and Gun Butt No. 2 – The following activities will be conducted:

    - Full coverage EM61-MK2 DGM surveys will be performed in the open area (totaling 6.0 acres) of Gun Butt No. 1 and Gun Butt No. 2 in search of burial features (e.g., subsurface pits and trenches). The open area includes Building J-8 (firing point into the old impact berm (J-130)), located approximately 350 feet to the southeast of the firing point and Building J-17 (firing point into the old impact bunker (J-18)), which was located approximately 150 feet to the south of the firing point.

    - Comprehensive EM31-MK2 DGM survey with a 10-foot transect spacing will be performed at the former circular area identified in the 1949 and 1954 aerial photographs east of Building J-8 in search of burial features and anomalies. The former use of the circular area is unknown.

    - A total of 3,000 linear feet of mag and dig and DGM transects will be placed in the wooded areas and tidal marsh bordering the open area of Gun Butt No. 1 and Gun Butt No. 2. The transects will be spaced 50 feet apart based on a target area associated with 1.5 times the HFD of a 20mm projectile. In addition, five 50-foot by 50-foot grids providing 100% coverage will be placed to assess the nature and extent of any anomaly clusters identified in the wooded and tidal marsh areas.

- Process and analyze DGM geophysical survey data and develop an anomaly database and dig sheet for intrusive investigations.

- Prepare and submit Work Plan Technical Memorandums for the subsequent intrusive investigations and sampling events which will summarize initial geophysical mapping results, identify selected anomalies for intrusive investigations, and identify sampling locations and the required analytical program. The memorandums will be reviewed by all stakeholders, revised as necessary, and approved by all stakeholders prior to mobilization for sampling activities.

- Reacquire anomalies and perform intrusive investigations on land (by manual means only), and underwater (by a certified dive team) to evaluate the nature and extent of MEC. The details of the activities are presented in the Dive Plan, which includes an Emergency Management Plan and Safe Practices Manual (see **Appendix G**).

- Destroy the recovered MEC and MPPEH following the ESP and Demolition SOP (**Appendix K**). Both documents are site specific.

- Conduct media sampling (soil/sediment/surface water/groundwater) and laboratory analysis to evaluate MC and other munitions-related chemical constituents against the accepted criteria and to define the nature and extent of contamination throughout the site.

- Inspect and segregate MD and designate as material documented as safe (MDAS) for recycling.
- Perform an explosives HA if MEC is recovered.
- Perform a baseline risk assessment and SLERA if MC and other munitions-related chemical constituents are detected.
- Use the TPP process during the RI to solicit and respond to comments and concerns, report results, and ultimately gain stakeholder concurrence.
- Update the CSM and MRSPP.
- Submit an RI report that provides detailed information to support the decision regarding next steps for the Boat Basin, Visitors Information Center.

The field investigations will be conducted in three primary phases of work as summarized below:

- The initial mobilization and field work will include all geophysical mapping and hydrographic surveying activities.
- After geophysical and survey data processing have been completed, the second mobilization and field work will include analog mag and dig activities, anomaly reacquisition based on results of the DGM activities conducted during the initial field investigations, intrusive investigations, dive operations, MEC demolition, MD management, and the initial MC sampling associated with the identification of MEC, significant munitions debris areas (i.e., stockpiles or burial pits), and stained soils.
- The third phase will include the additional environmental media sampling activities to define the nature and extent of chemical contamination.

3.1.1 Site Characterization Goals

The objective of the RI site characterization is to collect information to complete the following tasks:

- Characterize the nature (type) and extent (distribution and concentration) of MEC, MC, and other munitions-related chemical constituents in the surface and subsurface soil, groundwater, sediment, and surface water.
- Document the information necessary to assess the risks and hazards to human health, safety, and the environment posed by MEC, MC, and other munitions-related chemical constituents found in each medium.

- Provide information to support an FS or no further action.

Geophysical survey strategies for each area are based on USACE guidance, EM 200-1-15 (USACE, 2013). Geophysical investigations will be both grid- and transect-based and subsequently tailored to the CSM, including former munitions use and/or MEC release profile, terrain, vegetation, and accessibility, for the site to exceed the coverage requirements according to UXO Estimator. The geophysical investigation will also be tailored to meet stakeholder concerns.

3.1.1.1 Field Sampling Requirements

As a result of the relatively small sizes of the South Bank Boat Basin, fenced Pyrotechnics Burn Area, and Gun Butt No. 1 and Gun Butt No. 2 (open areas), as part of the first phase of RI field activities scheduled for the site, WESTON will perform DGM surveys using 100% coverage to delineate the boundaries and density of potential MEC. Additionally, a DGM survey will be performed at the circular and lineament area east of Building J-8 to delineate the boundaries and density of potential MEC and subsurface features.

The DGM sampling strategy at the Pyrotechnics Burn Area, and Gun Butt No. 1 and Gun Butt No. 2 (wooded and tidal marsh areas) is probability-based surveys achieved using a combination of transects and grids using the UXO Estimator software. This software tool is a statistical-based approach to ensure that the right type and quality and quantity of data are collected to assist in the evaluation of anomalies and potential risk in the surface and subsurface soils. The grid locations are biased to areas with a high probability of detection based on the site history and activities.

The survey area for the Pyrotechnics Burn Area was developed using a maximum soil ejecta distance of 270 feet based on a 10-pound maximum credible event (with 1.3 times safety factor fragmentation distance). This distance is also greater than the HFD of a 37mm projectile. The fragmentation distance was used to calculate a potential impact area of 5.25 acres.

The survey design for the Gun Butt No. 1 and Gun Butt No. 2 marsh areas was developed using a fragmentation distance of 1.5 times the HFD of a 20mm projectile. The fragmentation distance was used to calculate a potential impact area of 3 acres. Transect spacing and placement were calculated to guarantee at a 95% confidence level (at a minimum) that an impact area of the pre-determined size and shape will be traversed and detected. These transects will be traversed using geophysical surveys. Survey results will be evaluated to identify the areas with increased anomaly density. Additional grid surveys may be performed to further delineate potential MEC releases and to evaluate the nature and type of geophysical anomalies detected. DQOs and specific investigation strategies for the Pyrotechnics Burn Area and Gun Butt No. 1 and Gun Butt No. 2 are presented in Section 3.1.2, Data Quality Objectives.

3.1.1.2 Munitions Constituent and Munitions-Related Chemical Constituent Field Sampling Requirements

3.1.1.2.1 MC Sampling

MC sampling will be performed during the second phase of RI field activities scheduled for the Boat Basin, Visitors Information Center. Based on the results of the geophysical mapping, potential MC sample locations will include those anomalies identified for intrusive investigations. The initial MC sampling program summary and the locations of the anomalies are presented in the RI Work Plan Technical Memorandum No. 1. A discrete sample will be collected based on visual observation at each location where MEC and significant MD areas (e.g., stockpiles or burial pits) have been identified during the intrusive investigation. Each MC sample will be analyzed for select target analyte list (TAL) metals (antimony, copper, iron, lead, magnesium, strontium, and zinc) and explosives (2,4-dinitrotoluene (DNT), 2,6-DNT, 2-nitrotoluene, 3-nitrotoluene, 2-amino-4,6-DNT, 4-amino-2,6-DNT, and 4-nitrotoluene, 2,4,6-trinitrotoluene (TNT), 1,3,5-trinitrobenzene, 1,3-dinitrobenzene, pentaerythritol tetranitrate (PETN), hexahydro-1,3,5- trinitro-1,3,5-triazine (RDX), nitrobenzene, tetryl, and nitroglycerin (NG)).

Based on the initial MC analytical results for the samples associated with identified MEC items and significant MD areas, additional samples could be collected during the third phase of work within each area (Pyrotechnics Burn Area, South Bank Boat Basin, and Gun Butt No. 1 and Gun Butt No. 2) to further define the nature and extent of MC contamination. Soil borings, temporary wells, and permanent monitoring wells will be used to assess the lateral and vertical extent of contamination.

The number of MC samples, including QC (e.g. duplicates, rinsates) samples for each area and matrix (e.g., soil, sediment, surface water, and groundwater) will not be determined until geophysical mapping and intrusive investigations have been completed.

3.1.1.2.2 Munitions-Related Chemical Constituent Sampling

As part of the third phase of RI field activities, environmental media samples will be analyzed for select metals (antimony, copper, iron, lead, magnesium, strontium, and zinc), explosives, target compound list (TCL) volatile organic compounds (VOCs), PAHs, and dioxins/furans at the Pyrotechnics Burn Area. This analytical suite was identified for this area because of past burning activities that took place and the unknown chemicals that may have been used in the burning process. Based on the results of the geophysical mapping, which is expected to identify anomalous areas where past disposal activities and/or releases may have occurred and the intrusive investigation findings, initial soil and groundwater sample locations for the Pyrotechnics Burn Area will be presented in the second RI Work Plan Technical Memorandum. Additional sampling may be warranted based on the findings of the intrusive investigations. Based on the initial sampling analytical result for the Pyrotechnics Burn Area, additional samples could be collected to further define the nature and extent of contamination. Soil borings, temporary wells, and permanent monitoring wells will be used to assess the lateral and vertical extent of contamination.

In addition to any MC sampling associated with the presence of MEC and significant MD conducted during the intrusive investigations, additional soil samples (using soil borings) will be collected at the Gun Butts Area to assess the nature and extent of explosives and metals due to the potential large-scale impacts of past firing activities and the former location of the target berm. Because of the mobility of perchlorates, groundwater samples will be collected from the Gun Butts Area and Pyrotechnics Burn Area to assess the presence and extent of contamination at and downgradient of these former source areas.

If chemical staining or other potential releases of hazardous substances are identified in other areas of the Boat Basin, Visitors Information Center, additional munitions-related chemical constituent sampling may be warranted in those areas.

The number of munitions-related chemical constituent samples, including QC samples for each area and matrix (e.g., soil, sediment, surface water, and groundwater), will not be known until geophysical mapping and intrusive investigations have been completed.

3.1.2 Data Quality Objectives

An important element inherent to developing the most appropriate investigations is defining the criteria for DQOs. The overall project DQOs were developed using EPA QA/G-4 and QA/CS-1 guidance (EPA, 2006a and EPA, 2006b). Specific DQOs applicable to MC sampling and analysis are presented in the Uniform Federal Policy – Quality Assurance Project Plan (UFP-QAPP) provided in **Appendix H.** The DQOs are qualitative and quantitative statements that define the type, quantity, and quality of data necessary to support the decision-making process during the RI. The DQOs are developed using the following seven-step process:

1. **State the problem:** Provide a concise description of the problem.
2. **Identify the decisions:** Develop decision statements to solve the problem.
3. **Identify inputs to the decision:** Identify information and measurements needed to make the decisions.
4. **Define study boundaries:** Identify conditions such as spatial and temporal boundaries.
5. **Develop a decision rule:** Qualify the decisions to understand data needs.
6. **Specify tolerable limits on decision errors:** Develop performance criteria.
7. **Optimize the design:** Design an effective data collection strategy based on the previous steps.

The following sections present the DQOs developed for the overall RI at the Boat Basin, Visitors Information Center. The DQOs developed for individual phases of work (as necessary) required to achieve the overall objectives of the RI are also presented in the following tables:

- **Table 3-1** Data Quality Objectives – South Bank Boat Basin
- **Table 3-2** Data Quality Objectives – Pyrotechnics Burn Area

- **Table 3-3** Data Quality Objectives – Gun Butt No. 1 and Gun Butt No. 2
- **Table 3-4** Data Quality Objectives – Munitions and Explosives of Concern Intrusive Investigations
- **Table 3-5** Data Quality Objectives – Underwater Mag and Dig Investigations

The DQOs developed for MC and munitions-related chemical constituent sampling are presented below.

3.1.2.1 Data Quality Objectives – South Bank Boat Basin

DQOs for South Bank Boat Basin are presented in **Table 3-1**. DGM (water-based) and analog (mag and dig along the banks of the basin) methods will be performed along grids (water-based survey) and transects (land-based survey of the basin banks) to evaluate the anomaly density variation that may be observed along transects. Selected anomalies will be investigated. Intrusive results for MEC, MD, and non-MD will be evaluated in the project GIS. If a MEC release or significant MD area is detected, discrete soil and sediment sampling will be performed to determine whether MC is present.

A full-coverage bathymetric or side scan sonar and comprehensive marine EM-61 MK2 survey in the boat basin are planned to detect unknown anomalies and define high-density areas. For the South Bank shoreline, the mag and dig analog method will be the preferred method and will be used to the maximum extent possible to achieve the required coverage. Anomaly densities will be calculated from the surveys. Intrusive results at selected anomaly locations will be used to determine the nature of the anomalies detected. The South Bank Boat Basin transect and grid design is depicted in **Figure 3-1**.

3.1.2.2 Data Quality Objectives - Pyrotechnics Burn Area

Comprehensive analog (mag and dig surveys) and DGM coverage will be performed to detect and define unknown discrete anomalies. The total area of interest surrounding the Pyrotechnics Burn Area is 5.25 acres. Based on a review of the GIS map and the site visit, it is estimated that approximately 2.25 acres are accessible to DGM/mag and dig transects and grids. DQOs for the Pyrotechnics Burn Area are presented in **Table 3-2**.

Table 3-1 Data Quality Objectives: South Bank Boat Basin

Step	Description
1. State the Problem	▪ Dredging of the boat basin and channel was completed on 26 April 1949 by the Navy in order to establish a boat dock and basin to transport rocket testing materials from the Wallops Main Base to the Wallops Island test facilities. The South Bank Boat Basin had no known munitions use; however, numerous munitions items have been observed in the South Bank Boat Basin area. ▪ Two underwater anomalies were noted during the SI reconnaissance, and an undefined area along the South Bank Boat Basin was noted as having a large quantity (more than 50) of surface anomalies identified as rusty metal debris. Surface anomalies were identified as military debris (e.g., Marston mat). ▪ Potential MEC or MD items were observed in December 2011, but specific details concerning the official designation and disposition of the items were not readily available. ▪ Although no MEC was observed during the SI, the nature and extent of MEC have not been defined. ▪ The actual occurrence and approximate density of MEC, if present, have not been verified. MC may also be present if a MEC release or significant MD area is detected. ▪ Portions of the South Bank Boat Basin are fenced and not accessible to the public. The boat basin is used occasionally by NASA and the Marine Science Consortium. The future use is not expected to change. Therefore, the human interaction and accessibility categories have been rated as moderate.
2. Identify the Decisions	▪ What is the nature and extent of MEC and MD within South Bank Boat Basin? ▪ Does MEC pose an unacceptable risk? ▪ If MC is present, (1) are MC detections in soil or sediment from a MEC release or significant MD area, (2) what is the nature and extent of MC contamination in soil, sediment, and surface water, (3) does it pose unacceptable risk to potential human and ecological receptors, or (4) is its presence due to naturally occurring conditions?
3. Identify Inputs to the Decisions	▪ A 100% marine EM-61 survey in the boat basin to ensure a high probability of detection (greater than 95%). ▪ Analog surveys will be performed along a 12-foot swath of the basin banks. Grids will be used to evaluate the anomaly density variation that may be observed along transects. Selected anomalies will be investigated. Intrusive results for MEC, MD, and non-MD will be evaluated in the project GIS. ▪ Discrete soil sampling, discrete sediment sampling, and/or discrete surface water sampling data to determine whether MC is present. ▪ Sediment sampling data, soil sampling data from soil borings, and groundwater sampling data from temporary and permanent wells to define the lateral and vertical extent of contamination. ▪ Completion of baseline human health risk assessment (BHHRA) and screening level ecological risk assessment (SLERA) to determine whether MC contamination is at acceptable or unacceptable risk levels. ▪ Background soils and groundwater data for use in the BHHRA as comparison values.
4. Define Study Boundaries	▪ The study boundaries for South Bank Boat Basin include the basin proper and 150 feet of the entrance channel consisting of 1.8 acres and a 12-foot swath of the banks bordering the basin.

Table 3-1 Data Quality Objectives: South Bank Boat Basin (Continued)

Step	Description
	▪ If MEC or MC investigation results indicate that MC contamination may extend beyond the South Bank Boat Basin boundaries, an additional MEC and/or MC investigation will be conducted to fully characterize the nature and extent of MEC and MC contamination.
5. Develop a Decision Rule	▪ If anomalies on land and underwater are above the threshold criteria (amplitude and gradient response characteristics relative to the background characteristics established from the IVS) during geophysical mapping, then they will be investigated through more intrusive investigations. ▪ If MEC or a significant MD area is detected, then discrete soil sampling, discrete sediment sampling, or discrete surface water sampling (only conducted if sediment results for the multiple discrete samples exceed sediment screening criteria) will be conducted. ▪ If a release of MC from a MEC or a significant MD source is suspected based on visual signs of distressed or leaking munitions and/or impacted soil (i.e., staining), then discrete sampling (sediment or soil) of impacted media will be conducted. ▪ If MC is detected above risk screening criteria, additional sampling and analysis will be conducted to define the lateral and vertical extent of contamination to include soil borings and additional discrete sediment sampling.
6. Specify Tolerable Limits on Decision Errors	▪ The proper instrumentation will be used to detect and define the anomaly density in both the water and land environments. ▪ Intrusive investigations will determine the source of the anomalous area and provide information on the nature and extent of MEC. ▪ The MQOs for the DGM surveys will be achieved to ensure equipment is functioning to specification and the surveys are achieving design requirements. ▪ Results from the underwater surveys will be communicated to USACE to make project management decisions for reacquisition. ▪ Data verification and validation of results will be completed and communicated to USACE prior to use of the results as the basis for conducting subsequent sampling to define the extent of MC contamination.
7. Optimize the Design	▪ A full-coverage side scan sonar and comprehensive marine EM-61 MK2 survey are planned for the boat basin to detect unknown anomalies and define high-density areas. The calculated survey coverage provides a high probability of detection for target areas anticipated to be encountered. ▪ Analog transects will be performed on the adjacent shoreline. Anomaly densities will be calculated from the transect surveys. Intrusive results at selected anomaly locations will be used to determine the nature of the anomalies detected. ▪ MC sampling will be performed at MEC or significant MD area release locations, as necessary, based on geophysical survey and intrusive investigation results. Discrete sampling may be used to characterize MEC or significant MD area releases. Specific requirements for MC sampling are presented in **Appendix I**.

Notes:
DGM – digital geophysical mapping
GIS – Geographic Information System
MC – munitions constituents
MD – munitions debris
MEC – munitions and explosives of concern
MQO – measurement quality objective
NASA – National Aeronautics and Space Administration
SI – Site Inspection
USACE – U.S. Army Corps of Engineers

Table 3-2 Data Quality Objectives: Pyrotechnics Burn Area

Step	Description
1. State the Problem	▪ The Pyrotechnics Burn Area was used by the Navy to dispose of parachute flares and practice bomb signals using either gasoline or trinitrotoluene (TNT). The date of construction or first use of the Pyrotechnics Burn Area is not known. ▪ Possible kick-out or ejecta may have occurred during its operation. ▪ Seven MPPEH (20mm, larger than 20mm, burnt pyrotechnic items) were observed on the surface that could not be determined to not contain energetic materiel. NASA was notified and the UXO technician recommended the items be removed as soon as possible. ▪ Three areas of concentrated subsurface anomalies (i.e., the UXO technician was unable to count individual anomaly points) were identified at the Pyrotechnics Burn Area, including the entire area within the Pyrotechnics Burn Area fence. ▪ The Pyrotechnics Burn Area is located on property owned by NASA. Although portions of the Pyrotechnics Burn Area and South Bank Boat Basin are fenced, the area is accessible through openings. ▪ MEC may be encountered on the ground surface, through intrusive activities, and/or exposed by surface and/or tidal erosion. ▪ Antimony, copper, lead, and zinc were detected during the SI in soil samples at concentrations greater than ecological screening criteria. The Pyrotechnics Burn Area can be accessed along the fence at the south edge of the boat basin. The boat basin is used occasionally by NASA and the Marine Science Consortium. The future use is not expected to change; therefore, human interaction and accessibility are possible.
2. Identify the Decisions	▪ If MEC is present, what is the nature and extent of MPPEH at the Pyrotechnics Burn Area and is there an MC release to the soils? ▪ If MC or significant MD is present, (1) are MC detections in soil and sediment from a MEC or significant MD area release, (2) what is the nature and extent of MC contamination in soil and sediment, (3) does it pose unacceptable risk to potential human and ecological receptors or (4) is its presence due to naturally occurring conditions? ▪ If MC is present in subsurface soils near the top of the water table at concentrations greater than screening criteria and/or WFF background, then groundwater sampling to assess potential impacts is warranted. ▪ If potential constituents (i.e., petroleum compounds, dioxins/furans, explosives, and metals) associated with former burning activities are detected, (1) are contaminant detections from residuals due to the burning activities, (2) what is the nature and extent of contamination, (3) does it pose unacceptable risk to potential human and ecological receptors, or (4) is its presence due to naturally occurring conditions?
3. Identify Inputs to the Decisions	▪ The kick-out radius surrounding the Pyrotechnics Burn Area is assumed to be 270 feet and is based on a maximum soil ejecta distance for a 10-pound maximum credible event (with 1.3 times safety factor). The radius is also greater than the HFD of a 37mm projectile. ▪ DGM and mag and dig surveys will be performed along transects and in grids. Intrusive results for MEC, MD, and non-MD will be evaluated in the project GIS.

Table 3-2 Data Quality Objectives: Pyrotechnics Burn Area (Continued)

Step	Description
	▪ Discrete soil sampling, sediment sampling, and/or surface water sampling will be performed to determine whether MC is present if MEC or significant MD is identified. ▪ Due to the potential presence of TNT and petroleum compounds, additional samples will be collected from soil borings and direct push technology wells to determine whether MC and other burning related compounds are detected. ▪ If MEC or MC investigation results indicate that MC contamination may extend beyond the Boat Basin, Visitors Information Center boundaries, additional MEC and/or MC investigation will be conducted to fully characterize the nature and extent of MEC and MC contamination. ▪ A baseline human health risk assessment (BHHRA) and screening level ecological risk assessment (SLERA) will be completed to determine whether MC contamination is at acceptable or unacceptable risk levels, which will include an initial screening against risk screening criteria. ▪ A comparison of soils and groundwater data to background will be included after the quantitative analysis and discussed in the uncertainty analysis.
4. Define Study Boundaries	▪ The Pyrotechnics Burn Area is a small fenced area measuring approximately 20 feet by 25 feet situated on the edge of the wetlands adjacent to the southern edge of the boat basin bank. ▪ The RI boundary is a 270-foot kick-out radius surrounding the Pyrotechnics Burn Area, based on a maximum soil ejecta distance for a 10-pound maximum credible event (with 1.3 times safety factor).
5. Develop a Decision Rule	▪ If anomalies are identified by the transect surveys, then three categories of anomaly density (low, moderate, and high) will be used to further define grid locations. The distribution of grids relative to low-, moderate-, and high-density anomaly areas will be determined on an ongoing basis as reconnaissance data are collected and will be submitted to the USACE QA Geophysicist prior to surveying. ▪ If the geophysical surveys detect anomalies indicative of burial features or disposal areas at mounds or depressions adjacent to the Pyrotechnic Burn Area, then an intrusive investigation will be conducted to determine the nature and extent of the features. ▪ If MEC, significant MD, and/or DMM is identified at any of the mounds or depressions, an intrusive investigation will be conducted to determine whether MC is present and to fully characterize the nature and extent of MC. ▪ If MEC or significant MD is detected, then discrete soil sampling will be conducted. If a release of MC from an MEC or significant MD source is suspected based on visual signs of distressed or leaking munitions and/or impacted soil (i.e., staining), discrete sampling will be conducted. ▪ If MC and other burning related compounds are detected above risk screening criteria in the initial soil borings and direct push technology wells, then additional sampling and analysis will be conducted to define the lateral and vertical extent of contamination.

Table 3-2 Data Quality Objectives: Pyrotechnics Burn Area (Continued)

Step	Description
6. Specify Tolerable Limits on Decision Errors	▪ The proper instrumentation will be used to detect and define the anomaly density. ▪ Intrusive investigations will determine the source of the anomalous area and provide information on the nature and extent of MEC. ▪ The MQOs for the DGM surveys will be achieved to ensure equipment is functioning to specification and the surveys are achieving design requirements. ▪ It is anticipated that a low density of ejecta material exists within the RI boundary (270-foot kick-out radius) surrounding the Pyrotechnics Burn Area. ▪ If MEC or significant MD is identified during intrusive work, additional sampling may be warranted to achieve the desired confidence level. ▪ Data verification and validation of results will be completed and communicated to USACE prior to use of the results as the basis for conducting subsequent sampling to define the extent of MC contamination.
7. Optimize the Design	▪ Comprehensive analog (mag and dig surveys) and DGM coverage (transects and grids) will be performed within the 270-foot kick-out radius surrounding the Pyrotechnics Burn Area to detect and define unknown discrete anomalies. ▪ The optimum survey design uses a combination of transects and grids and includes a 200-foot by 200-foot grid centered on the fenced area, approximately 2 miles of transects, and eight 50-foot by 50-foot grids. The mag and dig surveys will be performed using handheld Schonstedt magnetic locators. These surveys will be performed within the 270-foot kick-out radius surrounding the Pyrotechnics Burn Area, in areas inaccessible to the DGM instrumentation. DGM surveys will be performed in the accessible portions of the study area using an EM-61 MK2 TDEM device. ▪ MC sampling will be performed at MEC or significant MD release locations as necessary based on the geophysical survey and intrusive investigation results. Specific requirements for MC sampling are presented in **Appendix I**. ▪ Sampling (soil and groundwater) for burning related compounds will be performed at locations based on the geophysical survey and intrusive investigation results to assess contaminant presence, and then additional sampling will be conducted as warranted to define the extent of contamination. Specific requirements for MC sampling are presented in **Appendix I**.

Notes:
DMM – discarded military munitions
GIS – graphical information system
HFD - hazardous fragment distance
MC – munitions constituents
MD – munitions debris
MEC – munitions and explosives of concern
mm – millimeter
MPPEH – material potentially presenting an explosive hazard
NASA – National Aeronautics and Space Administration
QA – quality assurance
RI – Remedial Investigation
TDEM – time domain electromagnetic
TNT – trinitrotoluene
USACE – U.S. Army Corps of Engineers
UXO – unexploded ordnance

The optimum survey design uses a combination of transects and grids and includes approximately 2 miles of transects and eight 50-foot by 50-foot grids. The mag and dig surveys will be performed using handheld Schonstedt magnetic locators. These surveys will be performed in areas inaccessible to the DGM instrumentation. The DGM surveys will be performed using an EM-61 MK2 time domain electromagnetic (TDEM) in cart or gurney mode. The layout of the relative transects and grid design is shown in **Figure 3-1**. As depicted, transect and grid placements are based on optimum conditions. Challenges with terrain and accessibility will ultimately determine the sampling unit size, and locations may be adjusted as necessary. Any significant adjustments to the sampling design will be made after consultation with the USACE QA geophysicist.

3.1.2.3 Data Quality Objectives - Gun Butt No. 1 and Gun Butt No. 2

Gun Butt No. 1 was constructed in 1952 and used to test and perfect the use of medium-caliber (20mm to 37mm) aviation guns and ammunition. The test range included a firing point and a concrete impact berm filled with sand or soil. Aircraft guns fired medium-caliber ammunition from Building J-8 (firing point) into the impact berm (J-130) located approximately 350 feet to the southeast of the firing point.

Gun Butt No. 2 was constructed in 1952 prior to Gun Butt No. 1, and, similar to Gun Butt No. 1, was used to test and perfect the use of medium-caliber (20mm to 37mm) aviation guns and ammunition. The test range included a firing point and a concrete impact berm filled with sand or soil. Aircraft guns fired medium caliber ammunition from Building J-17 (firing point) into the impact bunker (J-18), which was located approximately 150 feet to the south of the firing point.

A former circular area was identified in the 1949 and 1954 aerials in a location east of Building J-8 in the current wooded area north of the Gun Butt open areas. Its use is unknown.

The layout of the relative transects and the grid design is shown in **Figure 3-2**. DQOs for Gun Butt No. 1 and Gun Butt No. 2 are presented in **Table 3-3**.

The size of the sampling units is based on historical information of past practices and considerations of terrain and accessibility at these locations. If, based on field observations, it becomes evident that a larger area may have been used for artillery firing, additional 0.5-acre sampling units may be added. However, challenges with terrain and accessibility will ultimately determine the sampling unit size, location, and method.

Figure 3-2
Gun Butt No. 1 and 2
Transect and Grid Locations
Project 7 Boat Basin,
Visitors Information Center
Wallops Island, VA

File: Y:\Wallops\MXD\Boat_Basin\Gun_Butt_Area_with_Actual_Grid.mxd, 9/17/2013 3:48:56 PM, ricksc

Table 3-3 Data Quality Objectives: Gun Butt No. 1 and Gun Butt No. 2

Step	Description
1. State the Problem	▪ Two areas of concentrated subsurface anomalies (i.e., the UXO technician was unable to count individual anomaly points) were identified at the Gun Butts Area. ▪ MEC was observed within the impact area during the visual surveys conducted during the SI; however, the nature and extent of potential MEC have not been defined. The actual occurrence and approximate density of MEC, if present, have not been verified. ▪ MC may also be present if a release is detected coincident with a MEC item (i.e., soil staining is present) or with a significant MD area. ▪ Currently, portions of Gun Butt No. 1 and Gun Butt No. 2 are open to the general public and have no access restrictions to the surrounding grounds.
2. Identify the Decisions	▪ If MEC or significant MD is present, what is the nature and extent and is there an MC release to the soils? ▪ If present, (1) are MC detections from a MEC or significant MD release in soil and sediment, (2) what is the nature and extent of MC contamination in soil and sediment, (3) does it pose unacceptable risk to potential human and ecological receptors, or (4) is its presence due to naturally occurring conditions?
3. Identify Inputs to the Decisions	▪ DGM surveys will be performed using nominal 2.5-foot spacing in the open area (includes the firing point and impact berm areas), amounting to 100% coverage, appropriate for detecting 20mm and 37mm items at known detection depths. ▪ DGM survey will be performing using nominal 10-foot spacing in the circular and lineament areas located east of Building J-8 to assess the potential for MEC and subsurface features. ▪ Intrusive results for MEC, DMM, and MD will be evaluated in the project GIS. ▪ If a MEC or significant MD release is detected, discrete soil sampling will be performed to determine whether MC is present. If MEC or MC investigation results indicate that MC contamination may extend beyond the Boat Basin, Visitors Information Center boundaries, additional MEC and/or MC investigation will be conducted to fully characterize the nature and extent of MEC and MC contamination. ▪ If MC is detected above risk screening criteria, additional sampling and analysis will be conducted to define the lateral and vertical extent of contamination to include sediment sampling, soil sampling from soil borings, and groundwater sampling from temporary and permanent wells as warranted. ▪ A baseline human health risk assessment (BHHRA) and screening level ecological risk assessment (SLERA) will be completed to determine whether MC contamination is at acceptable or unacceptable risk levels, which will include an initial screening against risk screening criteria. ▪ A comparison of soils and groundwater data to background will be included after the quantitative analysis and discussed in the uncertainty analysis.

Table 3-3 Data Quality Objectives: Gun Butt No. 1 and Gun Butt No. 2 (Continued)

Step	Description
4. Define Study Boundaries	▪ The study boundaries include the open area, including the firing points and former impact berm and impact bunker, a 100-foot swath inside the surrounding tree line, a former circular and lineament area east of Building J-8, and the area extending east into the tidal marsh.
5. Develop a Decision Rule	▪ If MEC is identified by the surveys, then three categories of MEC density (low, moderate, and high) will be used to further define the grids. The distribution of grids relative to low-, moderate-, and high-density anomaly areas will be determined on an ongoing basis as reconnaissance data are collected and will be submitted to the USACE QA Geophysicist prior to surveying. ▪ If geophysical surveys are conducted in the marsh, then they will coincide with +/- 2 hrs of maximum low water, to maximize access into shallow areas. ▪ If potential MEC is identified during the geophysical mapping, then intrusive investigations will be used to define the nature and extent of MEC. ▪ If MEC or significant MD is detected, then discrete soil sampling, discrete sediment sampling, or discrete surface water sampling will be conducted. ▪ If a release of MC from a MEC or significant MD source is suspected based on visual signs of distressed or leaking munitions and/or impacted soil (i.e., staining), then discrete sampling of impacted media will be conducted. ▪ If MC is detected above risk screening criteria, then additional sampling and analysis will be conducted to define the lateral and vertical extent of contamination to include soil borings, temporary wells, and permanent wells, as warranted.
6. Specify Tolerable Limits on Decision Error	▪ The MQOs for the DGM surveys will be achieved to ensure equipment is functioning to specification and the surveys are achieving design requirements. ▪ Cultural features will be mapped to differentiate related anomalies from those indicative of a potential buried pit or trench-like feature. ▪ Tolerable limits for anomaly selection will be determined based on evaluation of 20mm response curves established from the IVS and several currently existing in the WESTON database. Anomalies above the background levels established from the IVS will be used in dig list development. ▪ Intrusive investigations will determine the source of the anomalous area, provide information on the nature and extent of MEC, and provide focus for potential MC sampling. ▪ Data verification and validation of results will be completed and communicated to USACE prior to use of the results as the basis for conducting subsequent sampling to define the extent of MC contamination. ▪ Munitions constituents sample results in soils and groundwater that exceed project screening levels will be reviewed during the risk assessment in the context of local background samples.

Table 3-3 Data Quality Objectives: Gun Butt No. 1 and Gun Butt No. 2 (Continued)

Step	Description
7. Optimize the Design	▪ Full coverage DGM surveys will be performed in the open area of Gun Butt No. 1 and Gun Butt No. 2 using a Geonics EM61-MK2 TDEM. The full-coverage surveys provide a high probability of detection for target areas with the munitions anticipated to be encountered at the Gun Butt No. 1 and Gun Butt No. 2. ▪ DGM survey will be performed east of Building J-8 in the area where a circular and lineament feature was identified in 1949 and 1954 aerials using a EM31-MK2 instrument with 10-foot transect spacing. ▪ The optimum survey design in the marsh uses a combination of transects and grids and includes approximately 3,000 linear feet of transects and five 50-foot by 50-foot grids. ▪ The mag and dig surveys will be performed in areas deemed inaccessible or unsafe for the DGM method. ▪ MC sampling will be performed at MEC or significant MD release locations, as necessary, based on geophysical survey and intrusive investigation results. Discrete sampling may be used to characterize MEC or significant MD releases. Specific requirements for MC sampling are presented in **Appendix I**.

Notes:
DGM – digital geophysical mapping
DMM – discarded military munitions
GIS – graphical information system
IVS – instrument verification strip
MC – munitions constituents
MD – munitions debris
MEC – munitions and explosives of concern
mm – millimeter
MQO – measurement quality objective
QA – quality assurance
SI – Site Inspection
TDEM – time domain electromagnetic
USACE – U.S. Army Corps of Engineers

3.1.2.4 Data Quality Objectives - Munitions and Explosives of Concern Intrusive Investigations

Data quality objectives for MEC intrusive investigations are presented in **Table 3-4.**

Table 3-4 Data Quality Objectives: Munitions and Explosives of Concern Intrusive Investigations

Step	Description
1. State the Problem	▪ DGM anomalies above the background levels established from the IVS response curves will be used in dig list development and intrusively investigated. ▪ Anomaly source information is needed to determine density, depth, and nature of MEC and MD.
2. Identify the Decisions	▪ Has a detailed process been designed to establish a logical basis for selection and prioritization of point source anomalies based on the attributes of the geophysical signature and correlation to known standards? ▪ Have all anomalies selected for characteristic been reacquired and investigated? ▪ Have the items' characteristics, including type, depth, and descriptions of surface and subsurface items, been documented?
3. Identify Inputs to the Decisions	▪ Anomaly locations from the EM31-MK2 and EM61-MK2 DGM marine- and land-based surveys. ▪ Dig results from the intrusive investigations at anomaly locations.
4. Define Study Boundaries	▪ Anomalies will be investigated within the boundaries of the EM31-MK2 and EM61-MK2 DGM transect and grid surveys.
5. Develop a Decision Rule	▪ If anomalies are detected during the DGM surveys, then investigate selected anomalies to identify the anomaly source. ▪ If material is recovered during intrusive investigations, then record item attributes as they are recovered. ▪ If MEC and MD are recovered, then demonstrate a 95% confidence that the nature (type and density) of MEC and MD has been achieved. ▪ If MEC is recovered, then demonstrate that a 95% confidence has been achieved for bounding the potential depth of MEC.
6. Specify Tolerable Limits on Decision Error	▪ Minimize errors by using qualified UXO technicians and dive teams to perform intrusive investigations. ▪ Perform follow-up quality control operations to confirm all anomalies were investigated and the recovered item corresponds to the measured geophysical response.
7. Optimize the Design	▪ Plan intrusive investigation operations in a manner that will reduce the time exclusion zones will be active. ▪ Report findings to the project team so status and results can be monitored.

Notes:
DGM – digital geophysical mapping
IVS – instrument verification strip
MD – munitions debris
MEC – munitions and explosives of concern
UXO – unexploded ordnance

3.1.2.5 Data Quality Objectives - Underwater Mag and Dig Investigations

DQOs for underwater mag and dig investigations are presented in **Table 3-5.**

Table 3-5 Data Quality Objectives: Underwater Mag and Dig Investigations

Step	Description
1. State the Problem	▪ MEC and MD density in the water is unknown. ▪ The dynamic environment can cause MEC and MD to migrate.
2. Identify the Decisions	▪ Are MEC and MD present in the water within the boat basin? ▪ Have the nature and extent of MEC and MD at the boat basin been delineated if present?
3. Identify Inputs to the Decisions	▪ Actual underwater mag and dig transect locations. ▪ Number of anomalies investigated. ▪ Results from the anomaly investigations. ▪ Real time detection of potential MEC and MD.
4. Define Study Boundaries	▪ Underwater mag and dig surveys will be performed from mean low tide. ▪ The study area will include the interior water portion of the boat basin and extend approximately 150 feet up the entrance channel.
5. Develop a Decision Rule	▪ If MEC and MD are identified at the boat basin or any other location along the underwater mag and dig transects, then define nature and extent. ▪ If anomalies are detected and investigated, then report findings to USACE daily and hold formal meetings at increments of 25 anomalies. ▪ If 50 anomalies are investigated, then determine final approach with project team. ▪ If anomalies are detected during surveys, their locations will be noted.
6. Specify Tolerable Limits on Decision Error	▪ Minimize errors by using qualified UXO technicians with dive certifications to perform underwater mag and dig transect surveys. ▪ Track transect and anomaly locations to maintain a record of where investigation took place to avoid overlap or to continue with MEC and MD delineation.
7. Optimize the Design	▪ Diver(s) will search an area of 1 meter in radius around the anomaly location using a metal detector. Located anomalies will be dug to a maximum depth of 18 inches and each item will be recovered when possible and fully documented. If an item is not uncovered after excavating 18 inches, the hole will be re-scanned with a magnetometer to determine if the object is deeper and if the anomaly persists, it will be so noted and its location recorded utilizing a GPS and it will remain in-place.

Notes:
MD – munitions debris
MEC – munitions and explosives of concern
USACE – U.S. Army Corps of Engineers
UXO – unexploded ordnance

3.1.3 Geophysical Metrics

The geophysical objectives establish the specific metrics concerning sensor performance, navigation accuracy, data density, data processing standard, and anomaly selection criteria to meet the minimum goals for the investigation (see **Table 3-6**). Metrics will be confirmed or appropriately adjusted based on the TPP and the results of the GSV.

Table 3-6 Geophysical Metrics

DQO	Metric	Measurement
Navigation - Global Positioning		
Raw Positional Data	Kinematic positional error at known monuments will not exceed +/- 20 cm.	QC audit of positioning system error test records.
Navigation - Line and Fiducial		
Grids with Line/Fiducial Positioning	Grid corners are internally consistent within 30 cm on any leg or diagonal.	Geodetic Internal Consistency.
Geophysical Equipment – EM-61-MK2		
Standard Deviation of Background Noise	Background: EM61-MK2 < 2.5 mV std dev.	Run statistics on all data below a reasonable level (between +/-2.5 mV).
Mean Acquisition Speed	< 3 mph. 95% within maximum project design speed or demonstrated speed. A 10 Hz sampling rate will be used.	Run statistics on velocity between points in each file (created a velocity channel).
Along-Track Measurements	98%< = 25 cm along line.	Run statistics on distance between points in each file.
Cross-Track Measurements	The across-track line spacing will not exceed 2.3 feet. 95% of the data in a grid must meet the metric. 5% of the data may lie between 2 and 2.5 feet. This will allow for variation in spacing reporting caused by rough terrain.	Run statistics on distance between data lines in each file and a manual review based on gridded data between lines.
Coverage (Grids)	>90% coverage at project design spacing.	By data set or grid.
	QC ISO test item anomaly characteristics (peak and size) repeatable to =/- 25%, with allowable variation.	Minimum (1) ISO QC test item per grid.
Dynamic Positioning	Transects – Demonstrate IVS reacquisition (reac ampl. ~ original and offset <=1 m).	Daily IVS check.
	Grids – Position offset of test item <=50 cm +1/2 line spacing for fiducially positioned data.	Daily IVS check and QC Seed verification.
Standard Response	Response above background to standard object will not vary more than +/- 20%	Standardization tests: QC audit of response test records.

Table 3-6 Geophysical Metrics (Continued)

DQO	Metric	Measurement
Data Processing –Geosoft Oasis Montaj Software – Processing EM61-MK2 Data		
Processing Statement	All leveling and/or filtering routines that are applied to data sets will be evaluated, on a data set by data set basis, to confirm that those routines do not alter the nature of the original measured response.	Not applicable.
Target Selection	All dig list targets are selected according to project design/selection criteria and classification scheme.	By grid or data set. Visual and manual review by Project Geophysicist.
Anomaly Resolution	Resolved is defined as: (1) there is no geophysical signal remaining at the flagged/selected location, or (2) a signal remains but it is too low or too small to be associated with UXO/DMM, or (3) a signal remains but is associated with surface material that when moved results in low, or no signal at the interpreted location, or (4) a signal remains and a complete rationale for its presence exists.	Per anomaly.
Anomaly Reacquisition		
Flag Placement	Flags will be placed within 20 cm of the position reported by the Project Geophysicist.	Not applicable.
Flag Completeness	100% of reported anomaly positions will be flagged.	Not applicable.

Notes:
cm – centimeter
DMM – discarded military munitions
DQO – data quality objective
Hz – hertz
ISO – Industry Standard Object
IVS – instrument verification strip
m – meter
mph – miles per hour
mV – millivolt
QC – quality control
std. dev. – standard deviation
UXO – unexploded ordnance

3.1.4 Technical Project Planning

A Boat Basin, Visitors Information Center TPP meeting for the Work Plan was not conducted, however, a TPP for the report will be conducted to identify and discuss project findings with the project team members and stakeholders. The project team will include representatives from USACE, EPA, NASA, and VDEQ. Meeting minutes will be prepared and appended to the Final Report.

3.1.5 Munitions and Explosives of Concern Exposure Analysis

The release mechanisms for the Boat Basin, Visitors Information Center include potential MEC existing in the South Bank Boat Basin, burial at the Pyrotechnics Burn Area, and remnant MEC from practice artillery testing at Gun Butt No. 1 and Gun Butt No. 2. Because the public has uncontrolled access to the portions of the firing point and Gun Butts Area, the exposure pathway is a concern because MEC and MD were previously identified during the SI.

As part of the RI report, a MEC HA will be conducted in accordance with the Interim MEC HA Methodology (EPA, 2008) to evaluate explosive hazards at each area within the Boat Basin, Visitors Information Center. The information gathered during the RI will be used to assess the three components of the MEC HA, including severity, accessibility, and sensitivity. Additional information on the MEC HA is provided in Section 4.3.

3.1.6 Data Incorporation into the RI Report

The geophysical survey and intrusive investigation results will be entered into the project GIS database that will be continually updated and managed over the course of the project. These data will be incorporated into the RI report.

Analytical data collected during the RI will be screened preliminarily against the project screening levels established in the UFP-QAPP (**Appendix H**) for these activities. Observed exceedances above screening levels will ultimately be evaluated for risk posed to human health and the environment. Any identified risks will be presented in the RI report.

3.1.7 Time-Critical Removal Actions

Time-critical removal actions (TCRAs) are removal actions intended to address the imminent safety hazard posed by explosives hazards. During the course of the RI, if an area is found that poses an imminent danger, USACE will be notified for the purpose of reevaluating the area for a TCRA.

In accordance with EP 1110-1-18 (USACE, 2000), USACE may initiate a TCRA to address situations in which the degree of hazard posed by MEC and/or MC is such that on-site removal activities would begin within 6 months. The TCRAs are not part of the RI Work Plan, because they are not included in the scope of contract W912DR-09-D-0015.

3.2 GEOPHYSICAL SYSTEM VERIFICATION

The GSV approach will be used to monitor and verify mag and dig and DGM equipment functionality during the land- and water-based RI geophysical mapping activities and intrusive investigations. The GSV approach uses an IVS and is a USACE-accepted alternative to the traditional Geophysical Prove-Out (GPO). The GSV approach capitalizes on the known performance of the geophysical sensors (Naval Research Laboratory (NRL), 2009). The GSV approach provides the advantage of reallocating resources traditionally devoted to a GPO to support a simplified, yet more rigorous, verification method for geophysical system operations. In addition, the approach incorporates a blind seeding program to continually check and monitor production mapping work within the Boat Basin, Visitors Information Center.

3.2.1 Instrument Verification Strip

For the land-based surveys, an IVS will be constructed within a portion of the site by linearly seeding a strip with five surrogate industry standard objects (ISOs). For the water-based surveys, an IVS will be constructed in a portion of the Boat Basin by linearly seeding a strip with two surrogate ISOs. The objective of the IVS will be to verify that the geophysical detection systems are operating properly. The IVS targets should be observed in the data with signals that are consistent with both measurements and physics-based dipole predictions for the appropriate geophysical sensor. Ambient site noise will be measured to confirm that targets of interest can be detected reliably to their depth of interest under the site conditions. Analog mag and dig survey instrumentation also will be tested at the IVS each day.

3.2.1.1 Instrument Verification Strip Designs

The IVSs will be linearly seeded with a mix of inert 20mm projectiles and small ISOs, as listed in **Table 3-7**. The seeds will be distributed in the IVS to prevent overlapping signals. The proposed seed layout of the land-based IVS is detailed in **Figure 3-3**. The proposed seed layout of the water-based IVS will be the same, with the exception of three fewer seed items.

The items will be buried horizontally (least favorable orientation) with the long axis aligned parallel to the ground surface and at depths between ground surface and anticipated detection depth near the noise and least favorable orientation response curve intersection. The items will be placed at the discretion of the Project Geophysicist and the USACE Quality Assurance (QA) Geophysicist based on site conditions. Item types will be confirmed with the USACE QA Geophysicist prior to mobilization. Seed locations will be surveyed by a Virginia-licensed professional surveyor to a minimum of third order accuracy. Item parameters (i.e., surveyed location, size, depth, orientation) will be recorded and entered into the database. An unseeded test strip will be established adjacent to the seeded portion of the IVS to monitor background noise. The unseeded test strip will be cleared of any site-related MEC/MD prior to use.

Table 3-7 Industry Standard Objects Characterized for Use as Munitions Surrogates (Adapted from NRL/MR/6110_09_99183)

Item	Nominal Size	Outside Diameter	Length	Part Number*	ASTM Specification
20 mm (Inert)	NA				
Small ISO	1"	1.315" (33.4 mm)	4" (204 mm)	44615K466	A53/A773

Notes:
*Part number from the McMaster-Carr catalog.
Inert munitions will be seeded based on the Boat Basin, Visitors Information Center CSM.
ASTM – American Society for Testing and Materials
ISO – Industry Standard Object
mm – millimeter
NA – not applicable

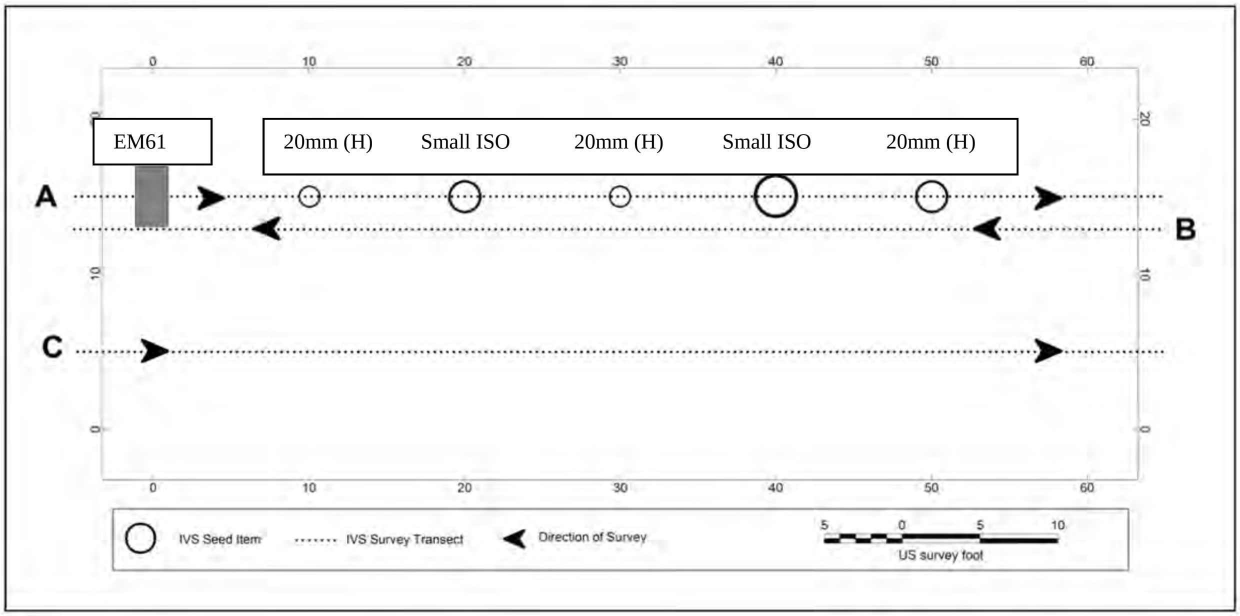

Figure 3-3 Proposed IVS Layout and Process

Notes:
Line A: Directly over Instrument Verification Strip (IVS) seeds; used to verify that instrument response is within established response curve metrics.
Line B: Adjacent to Line A to use for offset detection and evaluate latency.
Line C: 10-foot offset from seeded IVS transect; used to measure local background noise.

3.2.1.2 Instrument Verification Strip Construction

Prior to the burial of any seed items, a background survey will be conducted within the proposed IVS area to determine the suitability of using the Boat Basin, Visitors Information Center for placement of QC seed items and to assist the Project Geophysicist in placing them. Following the background survey, the seed items will be buried in accordance with the proposed IVS layout (**Figure 3-3**), each at a depth between ground surface and the anticipated detection depth (to be determined based on background noise). The locations and depths of the seed items will be surveyed and recorded. For the land-based IVS, each seed item, and the start and end points of each IVS transect will be marked at the surface with polyvinyl chloride (PVC) pin flags or wooden stakes. For the water-based IVS, the seed item, and the start and end points of the IVS will be marked with surface buoys or survey poles advanced into the substrate.

DGM transects will be performed over the IVS using the EM31-MK2 and EM61-MK2 following the transect pattern detailed in **Figure 3-3**. The data collected will be evaluated to determine a seed item response baseline to compare against production surveys.

3.2.2 Blind Seeding

The geophysical grids will be seeded with ISOs as indicated in **Table 3-7**. The seed locations will be surveyed by a Virginia-licensed professional surveyor and will be blind to the data collection teams. The objective of the seed program will be to provide ongoing monitoring of the quality of the geophysical data collection and the target selection process in comparison to the production survey for the Boat Basin, Visitors Information Center. Each geophysical grid will include at least one ISO seed item similar to the items used within the IVS.

After each data set is collected, the Project Geophysicist will overlay the locations of the blind seeds on the processed data and verify that the detection and navigation DQOs are met in the data set. The response of each ISO will be compared to the IVS results and the instrument response curves.

3.2.3 Geophysical System Verification Procedures

The IVS and unseeded test strip will be visited daily before and after DGM surveys. Analog mag and dig instrumentation will be tested each day at the IVS before surveys are performed. For each IVS survey event, the EM31-MK2 and EM61-MK2 operator will first traverse the unseeded area and then the IVS. The data processing methodology will be similar to the production mapping data.

3.2.4 Geophysical System Verification Results

Initial results of the IVS will be discussed by the WESTON Project Geophysicist and the USACE QA Geophysicist. Peak responses from the IVS seed items will be plotted against their respective instrument response curves. Blind seed items also will be monitored for positional accuracy and response and compared to the IVS results. All seed item responses should plot within 20% of their calculated values along the least favorable orientation response curve. Average noise values across the unseeded test strip and geophysical grids will be calculated and monitored for the life of the project. Seed items detected during the mag and dig surveys will be catalogued and tracked with RespondFast^{SM} – UXO Investigation in the project GIS database. GSV results will be included for all digital geophysical data packages. The IVS results for each day will include the following:

- As-built drawing of the IVS, including depth and orientation of seeded items.
- Representative photographs of the ISO and inert seed items (initial results).
- Color plots of the DGM data.
- Instrument response curves.
- Seed target list showing comprehensive results.

3.3 LOCATION SURVEYING AND MAPPING

A location survey will be conducted by a Virginia-licensed professional surveyor. Global Positioning System (GPS) or a system with equivalent accuracy will be used to perform the location survey. In areas where the topography or tree canopy prevents the use of GPS, traditional line-of-sight survey methods will be used.

A UXO Technician II or higher will perform a surface sweep of accessible areas within the Boat Basin, Visitors Information Center site that will be included in the geophysical investigation in conjunction with the location survey. The UXO technician will also escort survey personnel and provide anomaly avoidance support as needed for intrusive work. Pertinent information related to items recovered during the surface sweep process will be entered into the GIS database and included in the RI report.

The surveyor will establish control monuments or survey markers with a minimum of third order accuracy. Horizontal control Class I, third order will be established for all new primary control monuments. Horizontal control is referenced to the Universal Transverse Mercator (UTM), North American Datum (NAD) 83 and Virginia State Plane coordinates, with units of U.S. Survey Feet. Staking of all control points and points of interest will be accomplished by driving wooden stakes for temporary markers. Six-inch steel spikes will also be used to mark temporary survey points for relocation purposes. The surveyed geographic position and UTM coordinates will be accurate to +/-1 foot and will be referenced to the primary control monuments established for the project. Vertical control for MEC or topography will not be surveyed.

Survey locations of geophysical grids will be shifted away from large cultural features (e.g., concrete pad and buried utility lines), as needed, to ensure that coverage requirements are achieved for each area. If large, prominent cultural features are observed in a grid during surveyor activities, the location of the object will be recorded. Other cultural features that are observed during DGM operations will be logged by the geophysical team and presented on the grid contour maps for evaluation during target selection processes.

A UXO Technician II or higher will escort authorized and survey personnel and will provide anomaly avoidance support as needed for intrusive work. Pertinent information related to items recovered during the surface sweep process will be entered into the GIS database and will be included in the RI report.

All temporary and permanent wells installed for the MC and environmental sampling program will be surveyed for vertical and horizontal control. Each temporary and permanent well will include vertical elevations to be recorded at two locations (ground surface and top of well casing for temporary well and top of well casing and outer protective casing for the permanent well) and one horizontal (X,Y) coordinate. All vertical distances will be recorded to the nearest 0.01 foot, and all horizontal bearings to the nearest 1 foot. Horizontal control will be based on UTM NAD 1983 and Virginia State Plane in feet and vertical control will be based on the North American Vertical Datum of 1988 (NAVD88) in feet.

3.4 BRUSH CLEARING AND FENCE REMOVAL

The goal of the brush clearing and fence removal is to collect the necessary data without significant impact to the surrounding environment. Brush clearing will be conducted within the Pyrotechnics Burn Area and Gun Butt No. 1 and Gun Butt No. 2 investigation areas as necessary to perform geophysical transects and grids. Only the minimum amount of vegetation will be removed to facilitate the geophysical surveys. Brush clearing will be conducted immediately following the location survey and will be mainly within the DGM grid footprints established by the surveyor. No trees larger than 2 inches will be removed unless coordinated with WFF POCs.

The fence surrounding the Pyrotechnics Burn Area will be disassembled by hand, removed, and set aside to help facilitate work in this area. A UXO Technician II or higher will escort the brush clearing and fence removal crew. All areas designated for brush clearance will be approved by USACE and WFF POCs prior to any clearing activities.

3.5 GEOPHYSICAL INVESTIGATION PLAN

The Geophysical Investigation Plan details the statistical approach to develop investigation area coverage, equipment, operating procedures, and QC protocols that will be used for the water based, ground-based, and underwater investigations that will be performed during the RI. The overall RI approach and DQOs are presented in Subsection 3.1. The following sections provide additional details.

3.5.1 Hydrographic Instrumentation

A side scan/bathymetric survey will be performed throughout much of the interior boat basin and entrance channel to generate a detailed map of the bottom structure and sediments. The rationale for conducting the hydrographic surveys and for mapping bottom structure is threefold: (1) to identify obstructions to avoid in the subsequent marine EM survey; (2) to differentiate bottom sediment types to assist MEC recovery operations; and (3) to delineate artifacts potentially related to site history and archeology to avoid disturbing them.

The side scan/bathymetric surveys will be performed from a hydrographic survey vessel, using an Odom CVM single beam/single frequency fathometer, notebook computer, and a Real-Time Kinematic Differential Global Positional System (RTK-DGPS). The Boat Basin area to be surveyed will be provided on a map to aid real-time navigation. The survey crew will run lanes for the hydrosurvey at 25-foot spacing using HYPACK software for survey control, ship track recording, and data acquisition. Vertical accuracy will be +/- 0.1 foot.

In addition, the survey crew will use their EdgeTech 4125 dual-frequency, side scan sonar system to collect images of the basin bottom to chart obstructions and distinguish sediment types. This system will be run at a lane spacing of 50 feet to provide 100%+ coverage.

3.5.2 Geophysical Instrumentation

A combination of analog and DGM instrument-aided surveys will be performed using well-suited geophysical equipment, configurations, and processes as described below. For the open water DGM, a marine EM61 array will be used.

For DGM transect and grids, the Geonics electromagnetic terrain conductivity EM31-MK2 and EM61-MK2 will be used. These instruments have been demonstrated to be the most effective at MEC detection, and have been accepted by the USACE Military Munitions Center of Expertise (MMCX).

3.5.2.1 Marine EM61 Surveys

The marine EM geophysical survey in the boat basin will be conducted using an 18-foot center console power boat towing a high-powered marine coil coupled to a Trimble R6 RTK-GPS instrument, and HYPACK hydrographic software to provide real-time positional control. The survey team will utilize a modified EM61 1-meter, high-powered submersible underwater munitions detection system geopositioned with a DGPS mast. The EM system will be supported by a customized benthic sled constructed of robust, non-interfering materials. The sled and its electronic instrument package can be used for both the underwater and near shoreline survey components.

Prior to the deployment of the towable EM single-coil sled system, a side scan sonar survey will be performed to chart rocks, wrecks, debris, and other possible features that could be an obstruction to the electromagnetic sled’s underwater safe passage. The data are collected by and processed with HYPACK software and provided as raw data and processed data in the coordinate system and datum requested.

In accordance with USACE guidelines, daily GPS quality assurance/quality control (QA/QC) checks will be performed for the Trimble R6 RTK-GPS instrument at established control benchmarks. The results of the daily GPS QA/QC checks will be provided.

3.5.2.2 Geonics EM31-MK2

The Geonics EM31-MK2 is battery-powered and operates at a frequency of 9.8 kilohertz. This system consists of a transmitting coil (primary field source), receiving coil (sensor), phase sensing circuits, and an amplifier. A fixed 12.1-foot intercoil spacing is standard for the EM31-MK2. The instrument measures apparent conductivity in units of millisiemens per meter (mS/m) in materials with conductivity ranging up to 1,000 mS/m.

Both quadrature (apparent conductivity) and inphase (metal detection) components of the electromagnetic signal will be collected in the vertical dipole mode. The quadrature component is sensitive to conductors with low induction numbers (i.e., low conductivity materials). The inphase measurements (relative conductivity values) have a greater sensitivity to buried metal objects. The effective depth of penetration is approximately 18 feet below ground surface, as measured from the center point of the transmitter/receiver coil.

3.5.2.3 Geonics EM61-MK2

The EM61-MK2 sensor is a high-resolution, time-domain metal detector system manufactured by Geonics. The system transmits a time-varying electromagnetic pulse in the subsurface capable of detecting, with high spatial resolution, ferrous and non-ferrous objects. The EM61-MK2 is battery-powered, consists of air-cored coincident transmitter and receiver coils (1.0- by 0.5-meter coils), and operates at a maximum output of 10,000 millivolts (mV). The transmitter generates a pulsed magnetic field that induces eddy currents in conductive objects within the subsurface. These currents are proportional to the conductive nature of the material below the instrument. When conductive objects are present below the instrument, the amplitude and decay time of the induced eddy currents vary in response to the size, mass, and orientation of the objects. The receiver measures the amplitude of these eddy currents at 216, 366, 660, and 1260 micro-second intervals during the decay period. A single EM61-MK2 sensor will be hand-pulled on a wheel-mounted cart (see **Figure 3-4**). A GPS antenna/receiver will be mounted over the center of the sensor. The receiver captures the real-time differential corrections from a fixed local base station and outputs a National Marine Electronics Association (NMEA) GGA (a code used by NMEA that provides 3D location and accuracy data from the GPS unit) message directly into the Allegro Data Logger® at one-second intervals. Direct interfacing between the GPS and EM61-MK2 uses a single clock and streams position information directly into the raw MK2 data file. A sampling frequency will be set at no less than 10 hertz (Hz), resulting in an average sampling rate of between 3 to 4 measurements per linear foot. Measurements of the four time gates of the bottom coil will be digitally recorded and stored in memory using the Allegro Data Logger®. The instrument system will be validated using a test strip, as described in Section 3.2.

Figure 3-4 Geophysicist Performing DGM Surveys Using the EM61-MK2

3.5.2.4 Schonstedt GA-52Cx

The Schonstedt GA-52Cx magnetic locator is a hand-held unit that detects changes in the Earth's ambient magnetic field caused by ferrous metal. Two fluxgate sensors are mounted a fixed distance apart and aligned in gradiometer configuration to eliminate a response to the Earth's ambient field. The magnetic locators generate an audio output and a meter deflection when either of the two sensors is exposed to a disturbance of the Earth's ambient field associated with a ferrous target and/or the presence of a permanent field associated with a ferrous target. Schonstedt detectors (see **Figure 3-5**) will be used by UXO-qualified personnel for all mag and dig operations associated with the visual survey transects, the reacquisition of DGM anomalies, and as a screening and avoidance tool. Schonstedt detectors will be checked and tested at the ISV each day they are used. Documentation of these checks will be included in the QC log provided in **Appendix J**.

Figure 3-5 UXO Technicians Performing Visual Survey Using Schonstedt Detectors

3.5.2.5 Navigation and Positioning Systems

Several types of navigation and positioning systems will be used by the project team during the RI for the Boat Basin, Visitors Information Center. The systems include:

- **Trimble RTK-GPS –** Increases the accuracy of GPS readings by using a stationary receiver that sends real-time corrections to the rover (grid and transect surveys). The RTK-GPS instrument will also be used to place grid corners and IVS and grid seed items.
- **Trimble Pro-XRS or Geo6000 –** Capable of sub-meter accuracy and will be used for the EM31-MK2 survey.

3.5.3 Site Utilities

Work is being performed in the vicinity of the dock and the Visitors Information Center. Above and below ground utilities are present.

3.5.4 Manmade Features Potentially Affecting Geophysical Operations

Attempts to avoid features that may interfere with the geophysical data will be made prior to the field efforts by using aerial photography and GIS maps. During DGM coverage placement, manmade features will be avoided to the extent practicable. Transect segments may be modified and grids may be shifted away from features.

3.5.5 Measurement Quality Objectives

The geophysical performance criteria provided in **Table 3-8** are based on the most recent version of Table D-1, Performance Requirements for RI/FS Using DGM and Analog Methods (USACE, 2009c). The geophysical quality measurement criteria establish the specific metrics concerning the sensor performance, navigation accuracy, data density, data processing standard, and anomaly selection criteria to meet the minimum goals for the investigation. The metrics will be confirmed or appropriately adjusted based on the TPP process and the results of the GSV.

3.5.6 Instrument Standardization

To verify the instrument accuracy, the instruments will be checked at the beginning and end of each workday based on the tests and frequencies identified in **Table 3-9**. Dynamic data will be collected over the IVS daily.

Additional function checks may be performed throughout the day, as the operator deems necessary. The data from each system test will be compared with the data collected on previous days. If there is a significant change in the results, the instrument will be rechecked. If the difference in the data cannot be accounted for, the instrument will be taken out of service until repaired.

Table 3-8 Digital Geophysical Mapping Measurement Quality Objectives

Measurement Quality Objectives	Measurement Performance Criteria	Testing Method
EM DGM Surveys		
System and Data Positioning – Potential MEC burial features and possible individual MEC items can be effectively reacquired.	Known surveyed positions and detected anomaly positions in DGM survey data for seed items and calibration spike objects are within specification offsets: EM61-MK2 transect surveys within survey design specs. EM61-MK2 grid surveys within 3.3 feet. EM31-MK2 transects surveys within 5 ft (due to GPS accuracy).	Use GSV process for EM61-MK2 surveys (ISOs in IVS and grid survey areas). Perform calibration spike tests for EM31-MK2 transect surveys to verify positional accuracy under tree canopy.
Data Density – Data density along line and across line are sufficient to detect potential MEC burial features and possible individual MEC items.	EM61-MK2 grid survey: Across track spacing for EM61-MK2 full coverage surveys will be verified using IVS. 98% of data along line will be spaced no greater than 0.6 foot. 95% of across track data will not exceed 3 feet. EM61-MK2 transect survey: 98% of data along line will be spaced no greater than 0.5 foot. Transects will be spaced based on wide area assessment results. EM31-MK2 transect surveys will be run on a pre-designed spacing. 98% of data along line will be spaced no greater than 10 ft,	Use Geosoft™ and spatial analysis tools to identify locations where data density does not achieve measurement performance criteria. Verify instrument functionality daily at IVS.
Anomaly Detection Performance – ISO and calibration spike object responses are repeatable.	ISOs and inert 20mm calibration objects will not vary more than 20% from test to test or ISO to ISO.	Monitor and compare spike test data daily before and after survey. Evaluate IVS results daily before and after survey.
Repeatability – Positional and detection performance are consistent for the duration of the project.	Review DQOs and spot trends or exceedances from performance criteria.	Use a quantitative review of test data daily and weekly. Evaluate detection and positional information at IVS daily.

Notes:
DGM – digital geophysical mapping
DQO – data quality objective
GSV – geophysical system verification
ISO – Industry Standard Object
IVS – instrument verification strip
MEC – munitions and explosives of concern

Table 3-9 DGM QC Test Frequency and Acceptance Criteria

Test Description	Acceptance Criteria	Power On	Start of Day	End of Day	1st Day of Project for Each Operator	Daily part of IVS
Equipment Warm-Up	Equipment Specific (5-8 minutes)	X				
Record Sensor Positions	+/- 1 inch (2.54 cm)		X			
Personnel Test	Personnel, clothing, etc. should have no effect on instrument response		X			
Vibration Test (Cable Shake)	Data profile does not exhibit spikes		X		X	
Static Background	Background: EM61-MK2 < 2.5 mV EM31-MK2 in phase: 0+/- 0.1		X	X		
Static Spike	+/-20% of standard item response		X	X		
Repeat Data	Repeatable +/- 20 % of response amplitude. +/- 20 cm for positional accuracy EM61 transect surveys within 3.3 feet. EM61 grid surveys within 3.3 feet. EM31-MK2 transect surveys within 5 ft (due to GPS accuracy).					X

Notes:
cm – centimeter
IVS – instrument verification strip
mV – millivolt

3.5.6.1 Instrument Function Checks

Prior to conducting the QC function tests, spot measurements will be taken at various locations around the proposed DGM survey area to identify the most suitable area to establish a QC station. The IVS, static background, static spike, and cable connection tests will be performed daily before and after surveying at the fixed QC station identified from the spot measurements.

The QC test statistics will be entered and saved to a database, which will be electronically submitted with each data package.

- **Static Test:** The purpose of the static test is to determine the ability of the EM61-MK2 and EM31-MK2 instrumentation to collect stable readings consistently throughout the survey. Instrument functionality and ambient EM cultural noise are the likely sources of non-repeatable readings.
- **Static Spike Test:** The static spike test demonstrates the sensor's sensitivity to a chosen test object. A ferro-magnetic spike item of appropriate size will be used for the EM31 and EM61 tests to quantify the instrument response and to document its ability to collect stable readings.
- **Cable Connection Test:** The cable connection test is used to identify mechanical and electrical problems with the EM31-MK2 and EM61-MK2 instrumentation. Large anomalous spikes within the test data indicate poor connectivity between the cables and the field data logger.
- **IVS:** The IVS is used to demonstrate instrumentation repeatability and accuracy. The peak response and gradient parameters from the IVS seed items will serve as a baseline for evaluating anomaly characteristics from the production surveys.
- **EM-31:** The EM-31 will be nulled and function checks performed in accordance with the manufacturer instruction manual prior to each usage and additionally as needed (i.e., if temporal drift is observed).

3.5.6.2 Corrective Measures

One of the main goals throughout the RI will be to achieve and maintain a high standard of data quality. This goal will be accomplished by a vigilant compilation of QC checks and QA reviews on data collection and processing procedures. Any deficiencies identified will require a corrective measure, and a root-cause analysis will be performed to document the issue, analysis, and corrective action. Such root-cause analyses will be submitted to USACE as memorandums and included in the RI report.

3.5.7 Records Management

The data related to the DGM surveys will be managed using Geosoft Oasis® montaj software. Spatial data will be managed using GIS, and will be stored in Environmental Systems Research Institute (ESRI)-compatible GIS file formats, primarily ArcInfo coverages and ArcView shape files.

The data will be stored in site-specific folders that indicate the individual field efforts, data type, and file extension. The DGM data will be submitted in accordance with DID MMRP-09-004 (USACE, 2009c). The data will be provided electronically to the USACE QA Geophysicist on compact disc or on the WESTON TeamLink® website and will be backed up on WESTON's internal network and project workstation.

3.5.8 Digital Data Processing

3.5.8.1 Data Storage and Preliminary Processing

The digital geophysical data will be downloaded directly from the data-logger to a work station for processing. Sensor manufacturer software (Dat61) will be used to pre-process, review, and edit the data as necessary; normalize the data to the fiducial control marks; generate profile lines; and convert the DGM data to (x,y) coordinates for contouring, map generation, and interpretation.

3.5.8.2 Standard Data Analysis

The geophysical teams will provide the raw digital data, digital records, and field notes to the Project Geophysicist after the completion of the day's field activities. The digital data will be submitted in an ASCII-delimited file (XYZ) suitable for input into the Geosoft™ analysis software.

The field crews will initially process the data to correct the file names, line numbers, survey direction, start and end line locations, and grid identification. Data spikes artificially induced from cultural interference unrelated to subsurface material will be documented and removed where appropriate. The pre- and post-survey QC data will be reviewed real-time and during the data download to identify any abnormal readings.

3.5.8.3 Advanced Data Processing, Corrections, Digital Filtering, and Enhancement

After the initial data processing procedures are complete, Geosoft's UX-Detect and QC Geophysical Mapping modules will be used to further reduce the data. The following data processes will be performed where appropriate:

- **Instrument Latency:** Instrument latency will be corrected based on the lags or time differences observed in anomaly peak positions from the IVS test. Corrections will be applied using an appropriate correction routine that accounts for instrument latency time and sensor velocity. Chevron effects should not be visible in the data maps when plotted at the scales used to detect the smallest amplitude signal for a given MEC item.

- **Instrument Drift Correction:** A drift correction process will be applied to the EM31-MK2 and EM61-MK2 geophysical data to remove any unwanted signal indicative of instrument drift.

In addition to the standard geophysical data processing procedures, the following statistics will be calculated for each data set to ensure that the data collection is meeting measurement quality objective (MQOs):

- **Background Noise:** The standard deviation will be calculated in areas free of anomalous responses to identify the background noise levels.
- **Along-Track Sampling:** The along-track sampling will be evaluated with respect to the mean speed and will not exceed 0.6 foot between the data points. It is anticipated that the along-track sampling will average approximately 0.35 foot based on the sampling frequency.
- **Across-Track Sampling:** The across-track sampling for the grid survey will not exceed 5% of the 2.5-foot spacing. Minor data gaps may occur if obstructions exist in the DGM grid. The data gaps resulting from obstructions will be excluded from this metric; however, data gaps will be cumulatively tracked.

3.5.8.4 Preliminary Anomaly Selection Criteria

The Project Geophysicist will use the UX-Detect Blakely Test to perform an initial automatic anomaly selection, using the parameters determined from the initial IVS results for the EM61-MK2 data. As a start, the GX parameters will be refined to produce anomaly selections of all signals between 4 and 7 times background standard deviations (above the mean) to prevent selecting measurements in the noise. Alternative levels may be required for some data sets and will be documented on a case-by-case basis. A review of the EM61-MK2 decay profiles (for the four channels) at all suspect and/or low-amplitude anomalies will be performed to remove from the list anomalies not exhibiting response characteristics typical of buried metallic objects. This review may be performed using a scripted routine that will automatically find the nearest peak and compare the values for all associated channels in order to compute, identify, and flag negative time constants. Flagged anomalies not having the decay characteristics of buried metallic objects will be removed. A manual review of the remaining anomalies will be conducted to center the anomaly response as needed.

All corrected geophysical data and anomaly locations will be exported to a database. Throughout the geophysical survey, the field personnel will use logbooks to record observations such as variances in the background interference and/or noise when collecting data, and/or note changes in the soil characteristics. Such observations will provide valuable insights during the selection of anomalies in the areas where significant variations in background interference/noise exist. The DGM coverage maps and anomaly results will be presented to the project team.

3.5.8.5 Anomaly Selection Decision Criteria

For mag and dig transects conducted during the intrusive investigations that are a part of the second mobilization field activities, anomalies will be flagged in real time as the UXO team advances along the transect. These anomalies will be intrusively investigated on the same day that they are marked during the mag and dig survey.

For DGM grids conducted during the geophysical mapping activities that are part of the first mobilization field activities, the geophysicist will evaluate anomalies and select targets using amplitude and gradient characteristics relative to background levels established from the IVS. Dig lists will be uploaded into the project GIS server or TeamLink® on a weekly basis. All selected anomalies will be approved by the USACE QA Geophysicist before intrusive investigations occur.

3.5.8.6 Dig Sheet Development

Following the identification of the potential target anomalies from the geophysical data evaluation listed above, the anomaly locations will be digitized based on the position of the target in UTM Zone 18, NAD coordinates in U.S. Survey Feet on a Target Dig Sheet (**Appendix J**). The Project Geophysicist will assign each anomaly a unique target identifier and will enter the corresponding information for the target into the database. The dig sheet will also include the QC target anomalies. At a minimum, the following information will be included in the database for each target anomaly:

- Unique Target Identification (ID) including grid ID (A19-01, {grid ID-target number}).
- Unique Polygon ID for the potential MEC burial areas.
- Easting and northing position.

- Channel ID.
- Response amplitude of the peak response.

One dig list will be generated for all anomalies, including the MEC burial pits for the EM61-MK2. Each polygon will have a unique ID that can be input in the target list consistent with the individual anomalies. The database will include a column or entry for anomaly 'notes' that explain any cultural feature associated with that anomaly (e.g., QC nail, aluminum can, manhole cover).

3.5.9 Anomaly Reacquisition and Marking

Anomaly reacquisition will be performed once the geophysical and location data are processed. The selected targets will be located in the field using an RTK-GPS or laser total station system. The geophysical target location will be marked with a non-metallic pin flag. Potential burial pits will be marked with non-metallic pin flags with GPS waypoint information and placed along the perimeter of the potential pit. A UXO technician will refine the location prior to excavation using the peak response detected by the handheld all-metals detector. Offsets between the reacquired location and the excavated location will be entered into the database. In the event that the handheld all-metals detector is unable to resolve the DGM anomaly location, the EM61-MK2 will be used as an alternative.

3.5.10 Anomaly Excavation and Reporting

The SUXOS will maintain records of all material recovered on the project. These records will be kept using the RespondFast[SM] electronic data entry program on a hand-held PDA. The data entered into the PDA will be transferred to a computer and project database each day and subsequently loaded into the project GIS so that all anomaly information is contained in the project GIS.

3.5.10.1 Feedback Process

The Senior Geophysicist or his designee will review the RespondFast database to assess whether the physical characteristics of the item(s) found are consistent or appropriate relative to the size and amplitude of the detected geophysical anomaly.

If it is determined that the item was likely not the entire source of the anomaly, the anomaly location will be reinvestigated using the same instrument as during the initial survey. This type of anomaly location will be tracked separately in the database in the event that future analysis is required. In addition, the information derived from the feedback process of comparing the dig results to the predicted results will be continually evaluated to identify the improvements that can be incorporated into the anomaly selection process.

The measured response values will be compared only with the excavated item characteristics. The UXO Team will confirm there is a reduction in signal with the hand-held instrumentation during the anomaly investigation.

3.6 GEOSPATIAL INFORMATION AND ELECTRONIC SUBMITTALS

Transects and grids completed in each of the surveys will be used to characterize the Boat Basin, Visitors Information Center. The transects and grids will be uniquely labeled based on the site name for surveying and tracking purposes. The RTK-GPS instrument will be used to mark the location of each of the survey grid corners intended for DGM. If large cultural features are observed in a grid location, the location of the feature will be recorded. The geophysical team will use GPS or fiducial positioning at the control points to reference the geophysical data to the UTM Zone 18 projection, NAD 83 datum, with units of U.S. Survey Feet.

3.6.1 Control Points

A licensed professional surveyor will establish horizontal control Class I, third order monuments or survey markers at the Boat Basin, Visitors Information Center as a reference prior to flagging or pinning grid corners or transect lines. Staking of the control points and the points of interest will be accomplished by driving wooden stakes for temporary markers.

3.6.1.1 Geographic Information System Incorporation

Investigation results will be referenced to the grid or transect where the item was recovered, the feature of interest was observed, or the sample was collected. File names for the electromagnetic data will be referenced to the grid in which the data were collected. Information will be logged using WESTON's RespondFast – UXO Investigation field data software for seamless integration into a GIS database.

3.6.1.2 Plotting

The X/Y locations and the descriptions of all MEC, MD, and non-MD items identified during the course of the RI will be recorded electronically on a field computer. All locations will be compiled, tracked, and plotted in a GIS database. In addition to the MEC locations, grid corners and inaccessible areas will be stored in the GIS database. Maps will be generated as applicable. The information overlaid on the base maps will include, at a minimum, a point referencing the location of the MEC and grid ID. Because of the extensive number of points anticipated, all other data (such as northing, easting, anomaly ID, anomaly description, depth) will be recorded on the dig sheet (**Appendix J**) and stored in a database for retrieval at a later date.

3.6.1.3 Mapping

The GIS data are being stored and managed using ESRI ArcGIS software, and are spatially referenced to the UTM Zone 18 projection, NAD 83, and U.S. Survey Feet units. Metadata are created for all GIS layers managed by WESTON on the RI for the Boat Basin, Visitors Information Center and conform to Federal Geographic Data Committee metadata standards.

3.6.1.4 Electronic Submittal

At the close of the project, the DGM data will be submitted in accordance to MMRP-09-004 (USACE, 2009c). The GIS data will be submitted in non-proprietary Spatial Data Transfer Standard format, as well as in the proprietary format used for the execution of the project, specifically AutoCAD 2000 and ESRI ArcGIS geodatabases. The final DGM data will be submitted in accordance with DID MMRP-09-004 in electronic format on digital video disk. The daily or weekly submittals will be performed through the TeamLink project website. The pertinent in-progress and field GIS data, design drawings, survey data, relational databases, and other related data will be made available online to the government on the project's TeamLink website. The formal GIS data submittals will be made on PC-compatible compact disk. Each submittal will be accompanied by a freeware viewer application appropriate for reviewing the proprietary formatted GIS data (e.g., ArcExplorer for ESRI format geodatabases). Instructions will be included with each submittal for loading the data and the viewer application. No other additional software is required, and no data modification is required for viewing the submittal.

3.7 INTRUSIVE INVESTIGATION

3.7.1 General Methodology

Anomalies will be selected for investigation during the initial geophysical mapping effort. Anomaly reacquisition will be performed by an anomaly reacquisition team under the direction of the UXO Team Leader and Project Geophysicist. Anomalies will be intrusively investigated using hand tools. Prior to excavations, each mag and dig transect will be evaluated for underground utilities by the SUXOS and the UXOSO. Non-essential personnel will be evacuated from the area in accordance with the appropriate minimum separation distance (MSD). The MSD will be provided in the USACE-approved Explosives Site Plan (ESP).

The UXO Team will excavate at the anomaly location to determine/assess whether MEC and/or MPPEH are present. The depths of the excavations will not exceed 4 feet because of safety considerations and because anomalous targets are not expected beyond this 4-foot depth. If an anomalous source is suspected at depths below 4 feet, the UXO Team will conspicuously mark the site with flagging material and continue to the next location. The anomaly will be reported to the SUXOS for documentation and evaluation of the anomaly, and notification to the Ordnance and Explosive Safety Specialist (OESS) and project team to determine appropriate future actions.

If the subsurface contact proves to be MD or non-MD, the item will be removed and the hole rechecked with a geophysical instrument. If the hole is “clear” of MEC and/or MPPEH, MD, or non-MD related material, the hole will be refilled and tamped. Following inspection, identified MD will be certified as free of explosive hazards and will be transported off-site for recycling. Identified non-munitions related material will be transported off-site for disposal as solid waste, subject to recycling pending material identification. Any material that can be of cultural significance will be reported to USACE.

If the subsurface contact is MEC and/or MPPEH, the item will be disposed of in accordance with the procedure detailed in Subsection 3.8, MEC/MPPEH Disposal. Each MEC item will have its condition and identification determined by UXO technicians.

Detonation holes will be cleared of all detonation debris to ensure that no post-detonation contamination (explosives, MC) is present at levels above risk-based screening values. Once cleared, the excavation/detonation holes will be backfilled with the soils excavated from the hole to the extent possible. The soil excavated from the hole will be sampled to ensure it contains no MEC/MD/MC prior to use as backfill.

3.7.2 Accountability and Records Management for Munitions and Explosives of Concern

WESTON will maintain records of all items recovered on the project. These records will be kept using an electronic data entry program on a hand-held computer. The software program, WESTON's RespondFast – UXO Investigation, has modules for the surface and subsurface recovery information. The data acquired during the course of the RI for the Boat Basin, Visitors Information Center will be maintained in accordance with the data requirements specified in DID MMRP-09-004 (USACE, 2009c). The data entered into the field computer will be transferred to a computer and the project database each day and subsequently loaded into the project GIS so that all anomaly information is contained in the project GIS.

3.7.3 Identification of Munitions and Explosives of Concern

The positive identification and the inspection/certification of MEC and/or MPPEH will be conducted in accordance with the standard explosive ordnance reconnaissance procedures, Department of Defense Instruction (DoDI) 4140.62 (DoD, 2008) and EM 200-1-15 (USACE, 2013). The physical characteristics and field information about the item will be recorded into WESTON's RespondFast – UXO Investigation.

3.7.4 Storage of Munitions and Explosives of Concern

No MEC or MPPEH will be stored on-site during the RI for the Boat Basin, Visitors Information Center. The MEC recovered will be disposed of daily. If an item cannot be destroyed on the day it is discovered, the item will be guarded until demolition can be conducted.

The donor explosives will be stored in an explosives magazine in compliance with Section 55.208 of the Department of the Treasury - Bureau of Alcohol, Tobacco, Firearms and Explosives (ATF) Publication 5400.7, ATF Explosives Law and Regulations (ATF, 2012), state and local requirements.

3.8 MEC/MPPEH DISPOSAL

3.8.1 General Procedures

The MEC and/or MPPEH will be disposed of in one of three ways: (1) blow-in-place (BIP), (2) transport to a safe area within the site to be destroyed, or (3) response by Explosives Ordnance Disposal (EOD).

Demilitarization by explosive demolition of any item will not occur until the item has been positively identified. The SUXOS or designee will notify the USACE OESS, who may request EOD support if the following scenarios are encountered during the course of the RI for the Boat Basin, Visitors Information Center:

- MEC cannot be identified as a conventional explosive.
- The fuse cannot be identified by type or function.
- Chemical warfare materiel is suspected.

The USACE OESS and EOD will coordinate and determine the proper course of action.

3.8.2 Demolition Activities

WESTON will conduct the demolition activities on an as-needed basis and in accordance with the USACE-approved ESP and the Demolition Standard Operating Procedure (**Appendix K**). The demolition activities will follow the requirements of Technical Manual (TM) 60A-1-1-31, EM 385-1-97, applicable ATF, and federal, state, and local regulations. The inspection and/or certification of MEC and/or MPPEH will be conducted in accordance with DoDI 4140.62 and

EM 200-1-15. The MEC and MPPEH will be BIP unless authorization is granted to move the item within the site by the SUXOS and UXOSO. If an item cannot be destroyed on the day that it is discovered, then the item will be guarded until the demolition can be conducted. WESTON will use remote firing devices to ensure the safety of personnel. WESTON will coordinate with USACE and local authorities prior to demolition activities. The demolition activities will not commence until all parties on the notification roster have been informed. The Demolition Notification Roster is provided in **Table 3-10**.

Table 3-10 Demolition Notification Roster

Call Order	Contact Name	Contact Information
FIRST CALL	Paul Greene Explosive Safety Manager USACE	(410) 962-6741 (office) Baltimore District, USACE Baltimore, MD 21201
SECOND CALL	Sher Zaman Project Manager USACE	(410) 962-3134 (office) (410) 320-9516 (cell) Baltimore District, USACE Baltimore, MD 21201
THIRD CALL	Tony Pace Project Manager WESTON	(757) 819-5310 (office) (757) 362-2461 (cell) Weston Solutions, Inc. Norfolk, VA 23513
FOURTH CALL	T.J. Meyer CERCLA/Remediation Manager NASA WFF	(757) 824-1987 (office) (443) 366-2283 (cell) NASA WFF
FIFTH CALL	WFF Security	(757) 824-2467 (dispatch)

Notes:
USACE = U.S. Army Corps of Engineers
WESTON = Weston Solutions, Inc.

The designated Demolition Supervisor will possess a Virginia Blaster's License and will be responsible for all aspects of conducting demolition operations. Detonations will be scheduled by the SUXOS in conjunction with the DDESB based on the weather and logistical considerations.

A minimum of three UXO-qualified personnel, one of whom will be the Team Leader, will conduct demolition operations. An electrical firing system provides better control of the demolition activities. The control of the initiation devices will remain with the Demolition Supervisor until attachment to the firing circuit.

The demolition materials will be accounted for by the Demolition Team at all times. Only the estimated amount needed to complete the day's demolition operations will be removed from the magazine and transported to the work area.

The unique demolition sites will be photographed with a digital camera prior to, and after firing of the shot, and the photograph(s) will be saved electronically for the RI report. At a minimum after each detonation, the detonation points and general demolition site will be inspected to ensure that a misfire, low order, or kick-out has not occurred. The area where demolition operations are being conducted will remain secured until the SUXOS, in consultation with the USACE OESS and UXOSO, gives the "all clear."

3.8.3 Evacuation and Site Control

The control of the demolition site must be maintained during the demolition operations. The personnel who are not essential to demolition operations must evacuate to a safe area. The occupied buildings must be evacuated and the access roads entering the detonation area will be blocked during the explosive disposal operations to ensure that unsuspecting individuals are not placed in jeopardy by the explosion. The UXOSO and Demolition Supervisor will ensure that the area is clear of unauthorized personnel and equipment prior to permitting the attachment of the initiation devices to the priming charge.

An observer will be stationed where there is a good view of the approaches to the demolition site. It will be the responsibility of the observer to notify the Demolition Supervisor to suspend firing if a vehicle or person is seen approaching the general demolition site.

In the event of a fire or unplanned explosion, site personnel will be responsible for extinguishing the fire. If they are unable to do so, they will notify the NASA WFF Fire Department and evacuate the area. NOTE: Do not attempt to fight explosive fires.

Prevailing weather condition information will be obtained from a reliable source. These data will be logged before each on-site detonation. The demolition charges will not be primed or connected for electrical firing during the approach or presence of a thunderstorm. Other weather conditions (high winds, dust storms, temperature inversions, low altitude clouds, or cloud coverage of more than 50%) may adversely impact planned demolition operations. The SUXOS will consider these conditions when determining whether or not to conduct demolition operations. If the weather conditions preclude the detonation, WESTON personnel will secure and cover the UXO with sandbags, properly mark the area, and cordon off the area to prevent access until favorable conditions allow the demolition. The personnel will remain at the Boat Basin, Visitors Information Center as long as the possibility of fire exists as the result of a demolition operation.

3.8.4 Engineering Controls

WESTON will use engineering controls in accordance with HNC-ED-CS-S-98-7 (USACE, 1998 and 2011) to reduce the fragmentation distances of demolition shots. A copy of HNC-ED-CS-S-98-7 will be on-site and available to site personnel. Additional engineering controls that may be used include the buried explosion module in accordance with DDESB Technical Paper 16 and water mitigation in accordance with HNC-ED-CS-S-00-3. In areas where an acceptable fragmentation distance cannot be achieved, items acceptable to move may be moved to the approved demolition area, with the concurrence of the USACE OESS. If these methods of disposal are determined to be impractical, WESTON will notify the on-site USACE OESS.

3.8.5 Fragmentation Distance

Fragmentation distances and overpressure distances are based upon the net explosive weight of a single demolition item plus the donor charge, which will be outlined in the MSD calculations in the DDESB-approved ESP. The calculation of the fragmentation and overpressure distances is important to ensure the safety of not only site personnel, but also the public. These distances will be calculated using DDESB Technical Paper 16.

Detonating multiple shots will be timed sequentially to ensure they are not simultaneous. The K328 overpressure for the consolidation shot will not exceed the maximum fragment distance for the munitions with the greatest fragmentation distance. WESTON ensures that all demolition shots are conducted using the appropriate MSDs for the munitions and donor explosives involved. If meeting the appropriate MSDs is not possible, tamping or other engineering controls will be used.

3.8.6 Material Potentially Presenting an Explosive Hazard

WESTON UXO technicians will inspect MPPEH in accordance with DoDI 4140.62 to determine whether material is MEC, material documented as an explosive hazard (MDEH), or MDAS. WESTON will classify items of undetermined explosive hazard as MDEH and will dispose and/or vent the item with other demolition shots. The MEC and MPPEH containing explosives will be disposed of by detonation using the standard demolition procedures outlined in TM 60A -1-1-31, Disposal EOD Procedures, and procedures described in the Demolition Standard Operating Procedure in **Appendix K**.

WESTON ensures that the materials are inspected on the exterior and interior surfaces to be certain that these items do not present an explosive hazard. WESTON employs a four-level process for the inspection of MPPEH as follows:

1. 100% inspection and 100% re-inspection by the UXO Team, once by a UXO Technician II, and once by the UXO Team Leader (Technician III).
2. Inspection by the UXOQCS during daily audits of the procedures used by UXO Teams for processing MPPEH.
3. The UXOQCS ensures that the procedures and responsibilities for processing MPPEH for certification as MDAS are being followed and performs random checks of processed MDAS and metal debris.
4. The SUXOS and/or UXOQCS is responsible for ensuring that the Work Plan details the specifics of the procedures to be followed to process MPPEH. The SUXOS will perform or witness a 100% re-inspection and will sign the DD Form 1348-1A. The UXOQCS or other technically qualified personnel will perform or witness the 100% inspection or an independent QA inspection of the processed material using an approved sampling method.

3.8.7 Munitions Debris and Non-Munitions Debris

During the intrusive operations, metal scrap will be inspected by an UXO Technician II and segregated into the following three categories:

1. Other related scrap (e.g., nails, wire, tin cans).
2. Suspected MDAS (e.g., fragments, shrapnel, and munitions components free of explosives).
3. Suspected MDEH requiring venting to ensure it is free of explosive hazards.

A UXO Technician III will perform a second inspection of the metal scrap to ensure that the metal scrap is segregated correctly and to ensure that materials are not comingled for transport to the MDAS holding area. The UXOSO and SUXOS will determine whether a MEC item is acceptable to move. The UXOSO and SUXOS will certify/verify all MDAS before it is placed in lockable containers in the holding area, and will maintain chain of custody until the MDAS is transported to a suitable disposal/recycle facility.

Daily operating procedures will include venting or destroying any recovered MDEH the same day it is found. Other related scrap metal and MDAS will be transported to a secure area prior to final disposition off-site.

When certified and verified as free of explosive hazards, the material collected during the RI will be placed in suitable containers and locked. Only the SUXOS and UXOQCS will have access to these containers. Upon completion of the project or at a point when a large amount of material has been accumulated and needs to be removed, the MDAS containers will be locked and sealed. Each container will be closed in a manner that requires that the seal be broken to gain access to the interior of the container. The containers will be labeled with a unique identification as follows: USACE/Weston Solutions, Inc./Container number (e.g., 0001)/Seal number.

MDAS will be certified/verified in accordance with EM 200-1-15 (USACE, 2013) and in compliance with DoD Instruction (DoDI) 4140.62 (DoD, 2008) prior to being turned over and documented using DD Form 1348-1A and MPPEH Certification, Chain of Custody. The certified/verified MDAS will be transported to an authorized disposal/recycling facility.

The DD Form 1348-1A will list the following:

- Basic material content.
- Estimated weight.
- Unique identification of each of the container and seal number.
- Location where the MDAS was obtained.

- The SUXOS and UXOQCS will sign the Certificate as follows: *"This certifies and verifies that the material listed has been 100 percent inspected and 100 percent re-inspected, and to the best of our knowledge and belief, is inert and/or free of explosive hazards."*

3.8.8 Personnel Responsibilities

Personnel responsibilities will be as follows:

- UXO Technicians II: Check, classify, and segregate all MEC, MPPEH, MDEH, and MDAS as it is recovered.

- UXO Technicians III: Re-inspect all MEC, MPPEH, MDEH, and MDAS, as it is loaded for transport to the MDAS holding area or other holding areas to ensure it is not being comingled.

- UXOSO and SUXOS will determine whether a MEC item is acceptable to move.

- SUXOS/UXOQCS will:

  - Conduct daily audits of the procedures used by the UXO Teams and of the MPPEH handling process.
  - Perform the 100% re-inspection.
  - Ensure that the specific procedures for MPPEH are being followed, performed safely, consistent with applicable regulations, and in accordance with the Work Plan.
  - Certify/verify all MDAS before it is placed in lockable containers in holding area to maintain chain of custody until it is transported to suitable disposal/recycle facility.

- SUXOS will:

  - Ensure that the specific procedures for MPPEH processing are being followed, performed safely, consistent with applicable regulations, and in accordance the project Work Plan.
  - Perform random checks to ensure that MDAS is being handled correctly.
  - Perform the 100% re-inspection.
  - Certify that MDAS is free from explosive hazards.
  - Take responsibility for ensuring that the inspected materials are secured in locked containers while awaiting shipment off-site.
  - Ensure that prior to shipping material off-site, the inspected materials are in a closed, labeled, and sealed container and are documented.

3.9 MUNITIONS CONSTITUENTS AND MUNITIONS-RELATED CHEMICAL CONSTITUENTS SAMPLING PROCEDURES

MC associated with all former activities at the site and munitions-related chemical constituents potentially associated with the Pyrotechnics Burn Area may be present at the Boat Basin, Visitors Information Center because of military munitions use and disposal at the site.

An MC Sampling Rationale Memorandum detailing the MC sampling procedures is provided in **Appendix I** of this plan. The focus of the MC Sampling Rationale Memorandum is to evaluate the types of munitions that have been used or encountered at the Boat Basin, Visitors Information Center to identify specific analytical compounds to be included in the RI. The results of the MC and other munitions-related constituent characterization will be used to perform a baseline risk assessment and support MRSPP scoring.

In conjunction with the information presented in the MC and environmental sampling procedures section, the UFP-QAPP (**Appendix H**) will be used to guide sampling teams and to ensure performance requirements are being achieved. The following sections outline sampling procedures to implement the UFP-QAPP.

3.9.1 Sample Locations

Information regarding sample locations is presented in Worksheet 18 of the UFP-QAPP. Potential MC and other constituent sample locations will be selected and identified in the second RI Work Plan Technical Memorandum, which will be prepared after the geophysical and intrusive investigation data have been collected and processed. Based on burning activities at the Pyrotechnics Burn Area, even if MEC is not noted, there will be soil and groundwater sampling and analysis conducted because of the potential for the presence of other chemical constituents including petroleum products and dioxins/furans. Based on perchlorate detection during the SI and the use of the Gun Butts Area as a firing area, additional assessment of perchlorates in groundwater (Gun Butts Area and Pyrotechnics Burn Area) and explosives and metals in soils (Gun Butts Area) will be conducted after completion of all intrusive investigations. The locations of the wells and borings will be established in the second Technical Memorandum.

Dependent upon sampling locations, samples will be analyzed for VOCs, PAHs, dioxins/furans, perchlorates, metals, and explosives. After the initial geophysical mapping, data processing, and intrusive investigations have been completed, a second Work Plan Technical Memorandum will be prepared (including a working meeting with stakeholders to establish the overall plan of action) and submitted to all stakeholders for review and approval prior to conducting field sampling activities as part of the third phase of field investigations.

Sampling and analysis will be implemented where geophysical survey results identify areas indicative of a potential MC or other munitions-related chemical constituent release.

3.9.2 Sampling Design

The following sampling scenarios planned for the field investigations are discussed in the following subsections in greater detail:

- Individual MEC items sampling.
- Multiple MEC items sampling.
- Significant MD area sampling.
- Munitions-related chemical constituent sampling.

3.9.2.1 Individual MEC Item Release Sampling Protocol

3.9.2.1.1 MEC Detects on Land

Focused discrete soil sampling will be conducted at individual MEC items or at locations where soil staining or other visible evidence of an MC release is observed. There is a potential for discrete samples to be collected based on the results of geophysical surveys. If a single, intact MEC item is observed, a discrete soil sample will be collected at a depth of 0 to 6 inches below land surface or just below the depth of the item in proximity to the item. If it appears that the MEC item partially functioned or was leaking, multiple discrete samples will be collected in proximity to the item, as necessary, which will provide sufficient lateral coverage of the potentially impacted area. Subsurface samples will be collected until no visual staining is observed.

To fully define the nature and extent of MC contamination in soils and based on initial MC sampling results, direct push technology (DPT) will be used to collect two soil samples at each boring location. The DPT borings will be used to determine the lateral and vertical extent of MC contamination in soils. DPT temporary wells will be installed in areas to assess potential MC contamination in groundwater. Additionally, permanent monitoring wells will be installed and sampled in required areas (based on the groundwater data from the temporary DPT wells) to further identify the nature and extent of MC contamination in groundwater. The specific number and locations of soil borings, temporary wells, and permanent monitoring wells will be established after geophysical mapping has been completed and after review of the initial MC data associated with the initial MEC item. This information will be presented in the second RI Work Plan Technical Memorandum which will be submitted to all stakeholders for review and comment.

3.9.2.1.2 MEC Detects within Waterways

Discrete sediment sampling will be conducted at individual MEC item locations in the waterways. There is a potential for discrete samples to be collected based on the results of geophysical surveys. If a single, intact MEC item is observed, a discrete sediment sample will be collected at a depth of 0 to 6 inches below the waterway bottom and underneath the former location of the item.

Based on the initial surficial sediment sample results, additional discrete sediment samples may be warranted to assess the lateral and vertical extent of MC contamination. Any samples needed to define the vertical extent of contamination will be collected at a depth of 2 to 3 feet below surface water bottom with a coring device. Based on the surficial and subsurface sediment sample results, deeper sampling may be warranted.

A potential release of MC from an individual MEC item would not be expected to substantially impact water quality because of the high volume of surface water exchange present in the boat basin due to tidal cycles. Therefore, surface water sampling is not anticipated.

3.9.2.2 Multiple MEC Item Release Sampling Protocol

3.9.2.2.1 Multiple MEC Detects on Land

If multiple MEC/MPPEH or discarded military munitions (DMM) items are discovered clustered on the surface or in burial pits, a single discrete sample will be collected at a 0- to 6-inch depth after the items have either been removed from the pit or blown-in-place. If there is separation between MEC clusters or individual MEC items within the pit, then additional discrete samples may be required as necessary based on field observations. Subsurface samples will be collected until no visual staining is observed.

The results of the DPT analysis and the initial MC discrete results will help define the nature and extent of MC contamination in soils. DPT will be used to collect two soil samples at each boring location. The DPT borings will be used to determine the lateral and vertical extent of MC contamination in soils. DPT temporary wells will be installed in areas to assess potential MC contamination in groundwater. Additionally, permanent monitoring wells will be installed and sampled in required areas (based on the groundwater data from the temporary DPT wells) to further identify the nature and extent of MC contamination in groundwater. The specific number and locations of soil borings, temporary wells, and permanent monitoring wells will be established after geophysical mapping has been completed and after the review of the initial MC data associated with the initial MEC item. This information will be presented in the second RI Work Plan Technical Memorandum, which will be submitted to all stakeholders for review and comment.

3.9.2.2.2 Multiple MEC Detects in Waterways

If clustered MEC/MPPEH items are discovered in waterways, multiple discrete samples at a depth of 0 to 6 inches below the items will be collected after such items have either been removed or blown-in-place.

Based on the initial sediment sample results, additional discrete sediment samples may be warranted to assess the lateral and vertical extent of MC contamination. Samples needed to define the vertical extent of contamination will be collected at a depth of 2 to 3 feet below the surface water bottom with a coring device. Based on the surficial and subsurface sediment sample results, deeper sampling may be warranted.

Surface water samples will be collected only if sediment results for the multiple discrete samples exceed the sediment screening criteria. Initial impacts from potential multiple MEC item releases within the waterways would be expected in the sediments under the items. If sediment criteria are not exceeded, it would be highly unlikely that surface waters would be impacted because of the high exchange volume of water present in the boat basin due to tidal cycles. If warranted, three discrete surface water samples will be collected at the mid-depth of the waterway, each within 10 lateral feet of the sample location where the sediment results indicated exceedances of screening criteria. The three surface water samples will provide sufficient assessment of water quality in the area of the sediment exceedances.

3.9.2.3 Significant MD Area Release Sampling Protocol

If MD items are discovered clustered on the surface or in burial pits, a single discrete sample will be collected at a 0- to 6-inch depth after the items have either been removed from the pit or surface stockpile area. If there is a separation between significant MD areas within a subsurface pit, then additional discrete samples may be required as necessary based on field observations. Subsurface samples will be collected until no visual staining is observed.

The initial MC discrete results will help define the nature and extent of MC contamination in soils. Subsequent DPT borings will be used to determine the lateral and vertical extent of MC contamination in soils if the initial MC data indicate a release. The specific number and locations of additional soil borings will be determined after the review of the initial MC data associated with the significant MD area. This information will be presented in the RI Work Plan Technical Memorandum No. 2, which will be submitted to all stakeholders for review and comment.

3.9.2.4 Munitions-Related Chemical Constituent Sampling Protocol

It is anticipated that the munitions-related chemical constituent sampling will focus primarily on the area at the Pyrotechnics Burn Area. Past burning activities took place in this area and there is the potential for residual contamination associated with the pyrotechnics and the materials (e.g., petroleum compounds) used to initiate the burning. If chemical staining or other potential releases of hazardous substances are identified in other areas of the site, additional munitions-related chemical constituent sampling may be warranted in those areas.

To fully define the nature and extent of chemical constituent contamination in soils at the Pyrotechnics Burn Area and other areas of the site if warranted, DPT will be used to collect two soil samples at each boring location. The DPT borings will be used to determine the lateral and vertical extent of chemical constituent contamination in soils. DPT temporary wells will be installed at each DPT boring to assess potential chemical constituent contamination in groundwater. Additionally, permanent monitoring wells will be installed and sampled in required areas (based on the groundwater data from the temporary DPT wells) to further identify the nature and extent of chemical constituent contamination in groundwater. The specific number and locations of soil borings, temporary wells, and permanent monitoring wells will be established after geophysical mapping and intrusive investigations have been completed.

In addition to any MC sampling associated with the presence of MEC and significant MD conducted during the intrusive investigations, additional soil samples (using soil borings) will be collected at the Gun Butts Area to assess the nature and extent of explosives and metals due to the potential large-scale impacts of past firing activities and the former location of the target berm in that area. The number and locations of these borings and the required sampling interval will not be determined until the intrusive investigations have been completed. A second technical memorandum will be prepared to present the rationale for the Gun Butts Area soil sampling and analysis program as it is anticipated that the soil borings for the Gun Butts Area will be installed in locations biased towards the locations of subsurface anomalies; however, it is anticipated that soil borings will also be installed at some unbiased locations throughout the Gun Butts Area.

Groundwater samples will be collected from the Gun Butts Area and Pyrotechnics Burn Area to assess the presence and extent of contamination at and downgradient of these former source areas. Temporary and permanent monitoring wells will be used to assess the lateral and vertical extent of perchlorate contamination. The number and locations of these wells will not be determined until the geophysical mapping and intrusive investigations have been completed.

The above information will be presented in the second RI Work Plan Technical Memorandum, which will be developed during a working meeting and subsequently submitted to all stakeholders for review and comment.

3.9.3 Sampling Protocol

3.9.3.1 Discrete Soil MC Sampling

Discrete soil samples will be collected from 0 to 6 inches below the identified MEC items (after blow-in place or MEC removal activities have been completed) or from significant MD areas. Discrete samples will be collected using disposal plastic scoops. Samples will be collected in a resealable plastic bag. The soil will be homogenized and organic material and rocks will be removed from the sample. The sample will then be transferred to the appropriate size sample container, which will be labeled for transport to the laboratory. Surface soil sampling protocols are presented in SOP SS-4 provided in the Final WFF Site-Wide UFP-QAPP (WESTON, 2011).

Analyses of the MC samples will include explosives and metals. In addition, QA/QC samples will include duplicates, trip blanks, rinsate, matrix spike, and one matrix spike duplicate. The appropriate number of QA/QC samples shall be collected in accordance with *DoD Environmental Field Sampling Handbook, Rev 1.0* (DoD, 2013). Data validation is required for all samples collected.

In many instances, the types of samples to be collected will be determined in the field based on observations and geophysical survey results. The field decisions are documented in Technical Memorandum No. 1, which was provided to the stakeholders for review and approval.

3.9.3.2 Discrete Sediment MC Sampling

Waterways at the Boat Basin, Visitors Information Center will be subject to discrete sediment samples collected from 0 to 6 inches below the identified MEC items (after blow-in place or MEC removal activities are completed). For shallow water conditions (less than 6 inches deep) or a significant MD area, discrete samples will be collected using disposal plastic scoops. For deeper water, a core sampler will be used to collect the sediment samples from the required 0- to 6-inch sampling depth. Samples will be collected in a resealable plastic bag. The sediment will be homogenized and organic material and rocks will be removed from the sample. The sample will be transferred to the appropriate size sample container, which will be labeled for transport to the laboratory. Sediment sampling protocols are presented in SOP SS-3 provided in the Final WFF Site-Wide UFP-QAPP (WESTON, 2011).

Based on the initial sediment sample results, additional discrete sediment samples may be warranted to assess the lateral and vertical extent of MC contamination. Samples needed to define the vertical extent of contamination will be collected at a depth of 2 to 3 feet below surface water bottom with a coring device. Analyses of the MC samples will include explosives and metals. In addition, QA/QC samples will include duplicates, trip blanks, rinsate, matrix spike, and one matrix spike duplicate. The appropriate number of QA/QC samples will be collected in accordance with *DoD Environmental Field Sampling Handbook, Rev 1.0* (DoD, 2013). Data validation is required for all samples collected.

3.9.3.3 DPT Soil Boring Sampling

DPT soil borings will be installed to assess the lateral and vertical extent of MC and other munitions-related chemical constituent contamination. For characterizing MC contamination associated with MEC items, in significant MD areas, and in the Gun Butts Area in front of the former firing points, the total depth of the borings and the sampling interval will be established after the review of the initial MC sample depth of the MEC items, significant MD areas identified, or review of specific information about subsurface anomalies found during the intrusive investigation. For DPT borings to be installed at the Pyrotechnics Burn Area, it is anticipated that the samples will be collected at the surface (0 to 24-inch depth) and at 3 to 5 feet below land surface to characterize munitions-related chemical constituent contamination unless visual contamination or subsurface containers are observed at other depths requiring additional sampling. All DPT sample intervals will be scanned with a photoionization detector (PID) and the soil logged. Photographs of each 4-foot core length will be taken. The log for each boring will note any odors or staining present in the soil core. Soil sampling using DPT protocols is presented in SOP SS-2 provided in the Final WFF Site-Wide UFP-QAPP (WESTON, 2011).

Analyses of the samples could include VOCs, PAHs, dioxins/furans, explosives, and select metals (antimony, copper, iron, lead, magnesium, strontium, and zinc) dependent upon the reason for collection of DPT soil samples. It is anticipated that only metals and explosives will be analyzed for in the samples collected from borings installed in areas of MEC, significant MD, and the Gun Butts Area, whereas the analytical suite for borings at the Pyrotechnics Burn Area will include VOCs, PAHs, explosives, dioxins/furans, and metals. In addition, QA/QC samples will include duplicates, trip blanks, rinsate, matrix spike, and one matrix spike duplicate. The appropriate number of QA/QC samples will be collected in accordance with *DoD Environmental Field Sampling Handbook, Rev 1.0* (DoD, 2013). Data validation is required for all samples collected.

3.9.3.4 Groundwater Sampling

All DPT borings where temporary well installations are planned will extend to a minimum of 5 feet below the water table to adequately sample the groundwater. Temporary wells will consist of 1-inch slotted PVC screen installed directly into the open borehole. Depth to groundwater during previous investigations in the area was encountered within 15 feet below ground surface. The groundwater samples shall be collected from each temporary well following EPA low-flow sampling procedures, including purging and recording of field parameters.

Required permanent monitoring wells will be constructed using 2-inch PVC ID casing and a single screened interval. Upon completion, all new monitoring wells will be developed, and will require 2-foot square pads with bollards to retard vegetation and assist in locating the wells in the future.

Numerous SOPs, including well installation (SOP GW-3), well development (SOP GW-4), water level and well depth measurements (SOP GW-9), and low flow sampling (SOP GW-2), are provided in the Final WFF Site-Wide UFP-QAPP (WESTON, 2011).

Analyses of the samples could include VOCs, PAHs, dioxins/furans, perchlorates, explosives, and select metals (antimony, copper, iron, lead, magnesium, strontium, and zinc) dependent upon the reason for installation of the wells. It is anticipated that only metals and explosives will be analyzed for in the samples collected from wells installed in areas of MEC or significant MD, whereas the analytical suite for wells at the Pyrotechnics Burn Area will include VOCs, PAHs, perchlorates, explosives, dioxins/furans, and metals. Additional perchlorate sampling and analysis of groundwater will be conducted in the Gun Butts Area to assess the presence of contaminants and to delineate their extent. In addition, QA/QC samples will include duplicates, trip blanks, rinsate, matrix spike, and one matrix spike duplicate. The appropriate number of QA/QC samples will be collected in accordance with *DoD Environmental Field Sampling Handbook, Rev 1.0* (DoD, 2013). Data validation is required for all samples collected.

3.9.4 Standard Operating Procedures

SOPs for the field activities and analytical procedures are referenced throughout the UFP-QAPP and are provided in the Final Site-Wide UFP-QAPP (WESTON, 2011). In addition, Worksheets 19 and 21 contain a summary of all applicable SOPs.

3.9.5 Anomaly Avoidance

Anomaly avoidance will be performed prior to any intrusive activities (e.g., background sampling). Anomaly avoidance support will be provided by UXO technicians to prevent accidental exposure to potential MEC while acquiring samples. The UXO technician(s) will accompany field sampling personnel who are working within the sampling area to identify potential subsurface anomalies. A UXO Technician II or higher will escort the MC sampling personnel.

3.9.6 Global Positioning System Surveying

Coordinates of all sample locations will be collected using GPS to an accuracy of at least 1 meter. Horizontal coordinates will be measured in the field using a Trimble Pro-XRS unit or equivalent. Coordinates will be reported in the UTM 18N coordinate system and the NAD83.

3.9.7 Laboratory Analysis

The analytical methods listed in **Table 3-11**, which are identified in Worksheet 19 of the UFP-QAPP, will be used during the Boat Basin, Visitors Information Center RI.

Table 3-11 Analytical Methods

Matrix	Analytical Group	Concentration Level	Analytical and Preparation Method / SOP[2]
Soil / Sediment[1]	Explosives	Low	SW-846 8330B (SOP A-13)
Soil / Sediment[1]	Metals	Low	SW-846 6010B/C (SOP A-9)
Soil / Sediment[1]	Mercury	Low	SW-846 7471A (SOP A-11)
Soil	VOCs	Low	SW-846 8260 (SOP A-2)
Soil	SVOCs	Low	SW-846 8270 (SOP A-6)
Soil	Dioxins	Low	SW-846 8290 (SOP A-15)
Groundwater	Explosives	Low	SW-846 8330B (SOP A-13)
Groundwater	Metals	Low	SW-846 6010B (SOP A-9)
Groundwater	Mercury	Low	SW-846 7470A (SOP A-10)
Groundwater	VOCs	Low	SW-846 8260 (SOP A-1)
Groundwater	SVOCs	Low	SW-846 8270 (SOP A-6)
Groundwater	Perchlorate	Low	SW-846 6850 (SOP A-18)
Groundwater	Dioxins	Low	SW-846 8290 (SOP A-15)

Notes:
[1]All sediment samples should have % solids ≥30%. If the % solids is <30%, an additional sample needs to be collected and analyzed to ensure that detection limits are met.
[2]Specific analytes will be requested under these methods in accordance with Worksheet 18 of the Uniform Federal Policy-Quality Assurance Project Plan (UFP-QAPP).
SOP – standard operating procedure
SVOC – semivolatile organic compound
VOC – volatile organic compound

3.9.8 Field Quality Control Samples

Field quality control samples will be collected throughout the RI sampling effort. Worksheet 20 of the UFP-QAPP identifies the types and frequency of field quality control samples.

3.9.9 Sample Documentation

Sample collection data will be recorded in logbooks by the sampling team. The following information will be recorded for each sample:

- Date and time of collection.
- Boat Basin, Visitors Information Center.
- Sample team personnel.
- Sample identification number.
- Sample collection method (discrete).
- Analytical method to be used.
- Sample location and rationale for selection.
- Soil conditions (a general description of the soil, e.g., sandy, clay, moist, organic matter).
- GPS coordinates for sample location.
- Photograph number.

Sample collection information will also be recorded on the sample jar label (Figure 27-3, UFP-QAPP). Custody of the samples will be maintained at all times as outlined on Worksheet 27 of the UFP-QAPP. Sample custody information will be documented on the chain-of-custody (COC) record (Figure 27-1, UFP-QAPP).

3.9.10 Sample Packaging and Shipping Requirements

All samples sent to an off-site laboratory will be packaged carefully to avoid breakage or contamination, and will be shipped to the laboratory at proper temperatures. The following sample packaging requirements will be followed:

- Sample bottle lids will not be mixed. All sample lids will stay with the original containers.
- If the sample volume level is low because of limited sample availability, the level will be marked on the outside of the container with a grease pencil to assist the laboratory in determining whether any leakage occurred during shipment.
- Custody seals (Figure 17-2, UFP-QAPP) will be used on sample containers or on plastic bags containing multiple sample containers when there is a chance that custody seals or sample containers may be tampered with, such as if the sample container must be stored for any period of time in an unsecured location or refrigerator, or if the sample container must leave the custody of sampling personnel for any reason either unpackaged or in a cooler or shipping container not otherwise custody sealed.

- All glass sample bottles will be wrapped in bubble wrap or equivalent and sealed in resealable plastic bags to minimize the potential for contamination and breakage during shipment.
- All samples will be cooled unless "no cooling" has been specified. The sample containers will be packed in coolers. The coolers will then be filled with ice within resealable bags or frozen gel packs. Sufficient ice shall be included for the samples to arrive at 4 degrees Celsius (ºC) + 2 ºC. A temperature blank will be included in each cooler for temperature determination upon receipt at the laboratory.
- Empty space in the cooler will be filled with inert packing material such as bubble wrap. Under no circumstances will locally obtained material (e.g., sawdust, sand) be used.
- The original COC record (Figure 17-1, UFP-QAPP) will be sealed in a self-sealing plastic bag, taped to the inside lid of the cooler, and transported along with the coolers to the laboratory.
- All samples should be shipped upright.
- All shipping containers will be sealed with packing tape and custody sealed (Figure 17-2, UFP-QAPP) for shipment to the laboratory. The shipping containers will be transported as environmental samples to the laboratory as expeditiously as possible, most likely by Federal Express overnight delivery service or courier.

3.9.11 Data Validation Procedures

WESTON will employ the services of Meridian Consultant Group, Inc. (MCGI) to conduct an independent third-party data validation (Tier III). Worksheet 35 of the QAPP (**Appendix H**) provides a detailed description of the process for the verification and/or validation of the sampling data and analysis, and the responsible personnel.

Data that are generated will be sufficient for the data validation in accordance with EPA Region III *Modifications to the Laboratory Data Validation Functional Guidelines for Evaluating Inorganics Analyses* and *Innovative Approaches to Data Validation* (EPA, 1993, 1995) and *Modifications to National Functional Guidelines for Organic Data Review* (EPA, 1994). Ten percent manual data validation will be included.

3.9.12 Investigation-Derived Waste

Investigation-derived waste (IDW) (soil from soil borings, temporary well installations, and soils from hollow stem auger during permanent monitoring well installations and groundwater from well development, purging, and sampling) will be generated during the field investigations primarily associated with the Pyrotechnics Burn Area investigations. Containerized IDW will be properly labeled and staged within the fenced boat basin area.

3.9.12.1.1 Soil IDW

Soil cuttings from drilling activities and any excess soil from sampling activities will be containerized in 55-gallon drums, properly labeled and staged on-site, and sampled for appropriate disposition in accordance with SOP G-7. A composite sample will be collected from the staged drums (up to five drums per composite sample) and analyzed for constituents identified by the IDW contractor. Sampling requirements will be forwarded to the USACE PM prior to the scheduling of IDW sampling and analysis.

3.9.12.1.2 Decontamination and Purge Water

Equipment decontamination and purge water from well development, purging, or sampling will be containerized, properly labeled and staged on-site, and sampled for appropriate disposition as documented in SOP G-7. A composite sample will be collected from the 300-gallon polyethylene storage tank and analyzed for constituents identified by the IDW contractor. Sampling requirements will be forwarded to the USACE PM prior to the scheduling of IDW sampling and analysis.

3.9.12.1.3 Field Equipment and Supplies

Non-contaminated disposable wastes such as bags, washed gloves, and material scrap will be kept separate from other wastes. Field investigation disposal equipment and supplies such as tubing, nitrile gloves, and disposable sampling equipment (e.g., mixing bowls and scoops) will be rinsed off and bagged. Abandoned well materials (e.g., well cap, PVC well screen, and PVC well riser) will be rinsed off and bagged or otherwise contained and disposed of in solid waste disposal containers (e.g., dumpster) at the Boat Basin, Visitors Information Center in accordance with SOP G-7.

Contaminated disposable wastes (e.g., visually contaminated rags, personal protection equipment (PPE), or other materials with hazardous substances or petroleum products) will be bagged and placed in wrangler-type boxes (e.g., plastic storage containers) unless field screening results of soil and/or waste residuals indicate non-elevated results in accordance with SOP G-7.

The following SOPs present the protocols and methodologies that will be adhered to during the soil investigation and sampling activities conducted at each site. The SOPs are presented in the WFF Site-Wide UFP-QAPP (WESTON, 2011).

- SOP G-1: Field Documentation
- SOP G-6: Decontamination
- SOP G-7: Management of IDW

3.9.13 Background Data

As appropriate, available background data sets will be used for comparison of analytical results. Two background data sets were used for comparison of MC in the *Site Inspection Report for Wallops Flight Facility Project 07* (HFA, 2012). One of the data sets was a background soil and groundwater investigation conducted for the Main Base Area of WFF by NASA (NASA, 2004). The second data set included background sediment samples collected for the 2012 Site Inspection Report within the WFF FUDS boundary, but outside the Boat Basin, Visitors Information Center boundary. The background surface and subsurface soil data sets selected considered the appropriate soil type for comparison. The Site Inspection Report included background comparisons for COPCs/COPECs in the soil and groundwater of the Pyrotechnics Burn Area, the Gun Butts Area, and the South Bank Boat Basin (HFA, 2012).

At the Pyrotechnic Burn Area, copper, lead, and zinc concentrations were elevated relative to background surface soil values (HFA, 2012). Aluminum concentrations were elevated relative to background subsurface soil values.

At the Gun Butt Nos. 1 and 2, copper concentrations were elevated relative to the background surface soil value and iron concentrations were elevated relative to the background groundwater value (HFA, 2012).

At the South Bank Boat Basin, copper was greater than the maximum surface soil value (HFA, 2012). The sediment copper concentrations were elevated relative to the background value.

4 DATA MANAGEMENT AND REPORTING

4.1 DATA MANAGEMENT

The land surveying, geophysical survey, and intrusive investigation results will be entered into the project GIS database that will be continually updated and managed over the course of the project. These data will be incorporated into the RI report. Data (sample depth, soil type) associated with the sampling will be entered into the Geology electronic data deliverable (EDD) as previously provided to WESTON from USACE.

Analytical data collected during the RI will be presented in Staged Electronic Data Deliverable (SEDD) format from the analytical laboratories, and screened (during completion of the risk assessment) preliminarily against the project screening levels established in the UFP-QAPP for these activities. The SEDD data package as well as a summary of the data in Excel format will be submitted to USACE for their use and records at the completion of the project.

Hard copy and electronic data will be archived in the WESTON West Chester office with the following information submitted to the USACE PM at the conclusion of the project:

- GIS files.
- Geophysical surveying shape files.
- Geology EDDs.
- Analytical SEDD files.
- Field documentation (e.g., field boring logs, well construction forms, sampling forms, daily quality control reports, daily work logs) (submitted as an appendix to the RI report).

4.2 GEOSPATIAL INFORMATION AND ELECTRONIC SUBMITTALS

4.2.1 Geographic Information System Incorporation

Investigation results will be referenced to the area of interest or individual anomaly where the item was recovered, the feature of interest was observed, or the sample was collected. File names for the electromagnetic data will be referenced to the grid in which the data were collected. Information will be logged using WESTON’s RespondFast – UXO Investigation field data software for seamless integration into a GIS database.

4.2.1.1 Plotting

The X/Y locations (based on use of a GPS) and the descriptions of all MEC, MD, and non-MD items identified during the course of the RI will be recorded electronically using a field computer. All locations will be compiled, tracked, and plotted in a GIS database. In addition to the MEC locations, all surveying points (corners, trench locations, and individual anomaly locations) will be stored in the GIS database. Maps will be generated as applicable. The information overlaid on the base maps will include, at a minimum, a point referencing the location of the MEC. Because of the extensive number of points anticipated, all other data (such as northing, easting, anomaly ID, anomaly description, depth) will be recorded in the dig sheet (**Appendix J**) and stored in a database for retrieval at a later date.

4.2.1.2 Mapping

The GIS data are stored and managed using ESRI ArcGIS software, and are spatially referenced to the UTM Zone 18 projection, NAD 83, and U.S. Survey Feet units. Metadata are created for all GIS layers managed by WESTON on the RI for the Boat Basin, Visitors Information Center and conform to Federal Geographic Data Committee metadata standards.

4.2.1.3 Electronic Submittal

At the close of the project, the DGM data will be submitted in accordance to MMRP-09-004 (USACE, 2009c). The GIS data will be submitted in non-proprietary Spatial Data Transfer Standard format, as well as in the proprietary format used for the execution of the project, specifically AutoCAD 2000 and ESRI ArcGIS geodatabases. The final DGM data will be submitted in accordance with DID MMRP-09-004 in electronic format on digital video disk. The daily or weekly submittals will be performed through the TeamLink project website. The pertinent in-progress and field GIS data, design drawings, survey data, relational databases, and other related data will be made available online to the government on the project's TeamLink website. The formal GIS data submittals will be made on PC-compatible compact disk. Each submittal will be accompanied by a freeware viewer application appropriate for reviewing the proprietary formatted GIS data (e.g., ArcExplorer for ESRI format geodatabases). Instructions will be included with each submittal for loading the data and the viewer application. No other additional software is required, and no data modification is required for viewing the submittal.

4.3 RI WORK PLAN TECHNICAL MEMORANDUMS

Two RI Work Plan Technical Memorandums will be prepared; one after completion of the geophysical mapping field efforts and associated data processing and the other after completion of the intrusive investigations. Technical Memorandum No. 1 summarizes the initial geophysical mapping results, identification of selected anomalies for intrusive investigations, and a summary of the initial MC sampling program. Technical Memorandum No. 2 will include the identification of sampling locations and types of samples (e.g., soil, sediment, surface water, temporary well) to be collected, and a description of the required analytical program. The memorandums will be reviewed by all stakeholders, revised as necessary, and approved by all stakeholders prior to mobilization.

4.4 RI REPORT

An RI report will be prepared at the conclusion of the field investigations. The RI report will summarize the findings of the field investigations conducted as part of the MEC and MC characterization, including intrusive investigations and laboratory results. The report will describe explosive hazards that may influence current and future use of the Boat Basin, Visitors Information Center. The RI will also recommend a path forward (TCRA, Non-Time Critical Removal Action (NTCRA), FS) to address any explosive hazards discovered.

An assessment of MEC hazards using the MEC HA protocol will be included in the RI report. An HHRA and SLERA, both for MC, will be included in the RI report if MC is detected. An HHRA and SLERA will not be included in the RI report if MC is not detected. Details of the assessments are provided in the following sections.

4.5 ASSESSMENT OF MEC HAZARDS

Potential explosive hazards to human receptors at the Boat Basin, Visitors Information Center will be assessed using the Interim MEC HA Methodology guidance document (EPA, 2008). The severity, accessibility, and sensitivity of the MEC found will be evaluated in accordance with this guidance so that the project team can compare the effects of explosive hazards to remedial action alternatives and establish a baseline hazard assessment in support of the CERCLA process. The MEC HA will also enable the project team to assess the site on the most appropriate scale by dividing the Boat Basin, Visitors Information Center into subunits if necessary.

4.6 ASSESSMENT OF MUNITIONS AND MUNITIONS-RELATED CHEMICAL CONSTITUENT RISKS

As part of the RI report, a baseline human health risk assessment (BHHRA) and SLERA will be prepared based on the results of the MC and munitions-related chemical constituent investigation. Human health and ecological screening values are presented in Worksheet 15 of the UFP-QAPP presented in **Appendix H** of the RI Work Plan.

4.6.1 Baseline Human Health Risk Assessment

The potential for current and future risks to human health posed by exposure to MC and other munitions-related chemical constituents at the Boat Basin, Visitors Information Center will be evaluated by preparation of a BHHRA. The BHHRA will be prepared in accordance with the *EPA Region III guidance and EPA's Risk Assessment Guidance for Superfund (RAGS): Volume I Human Health Evaluation Manual Part D, Standardized Planning, Reporting, and Review of Superfund Risk Assessments (RAGS Part D)* (EPA, 2001) and the most current EPA risk assessment guidance at the time of the assessment. The BHHRA will be composed of hazard identification, exposure assessment, toxicity assessment, and risk characterization components. The receptors to be evaluated include current site workers and recreationists and current and future residents and construction workers. Details of the BHHRA methodology are presented in **Appendix L**.

4.6.2 Screening Level Ecological Risk Assessment

A SLERA will be prepared in accordance with the EPA's Ecological Risk Assessment Guidance for Superfund (ERAGS) (EPA, 1997 and updates). The SLERA will include Steps 1 and 2 of ERAGSs and a refinement Step 3A and may expand into a baseline ecological risk assessment (Steps 3 through 8). Step 3A will be conducted to refine some exposure criteria with more realistic parameters. The results of Step 3A will be used to determine if threats to ecological receptors are negligible and an appropriate risk management decision may be made to end the ecological risk assessment (ERA) process, or potential threats are still indicated and a baseline ecological risk assessment (BERA) should be initiated.

The objective of the SLERA will be to determine the potential for risk to ecological receptors from exposure to MC and other munitions-related chemical constituents detected at the Boat Basin, Visitors Information Center and to prepare a report that facilitates risk management decisions. The SLERA will include screening-level problem formulation/ecological effects evaluation and screening-level preliminary exposure estimates/risk calculation components. Details of the SLERA methodology are presented in **Appendix L**.

5 QUALITY CONTROL PLAN

The Quality Control Plan (QCP) outlines and details the quality requirements to be implemented to ensure that overall project activities are accomplished using a set of controls and systematic procedures to ensure the quality of data and to ensure DQOs are achieved. The intent of such controls is to eliminate conflicts, errors, and omissions and to ensure the technical accuracy of deliverables. The QCP is applicable to the project activities that will be performed by WESTON and its subcontractors for the RI for the Boat Basin, Visitors Information Center. The QC requirements for specific technical tasks are presented in Section 3.

The QC requirements for the chemical data sampling and laboratory analysis are presented in the UFP-QAPP (**Appendix H**).

5.1 QUALITY MANAGEMENT STRUCTURE

WESTON's staff of experienced technical professionals and subcontractors will execute the project. The project organization chart is presented in **Figure 2-1**. Project personnel are responsible for ensuring that quality methods and procedures are implemented. The specific responsibilities of the quality management personnel are detailed in the following subsections and **Table 5-1.**

Table 5-1 Definable Features of Work and Inspection Checklist

Inspection Description	Frequency of Inspection	Inspection Responsibility	Possible Action if Failure Occurs
1. SITE SETUP/ MOBILIZATION OF PERSONNEL, EQUIPMENT, AND SUPPLIES			
Verify planning documents have been approved and are available on-site and that substantive permit requirements are met.	Once at mobilization and as required if new documents are generated or revised.	UXOQCS	Do not proceed with field activities until approval has been granted.
Verify work personnel are available and are qualified to perform the work.	Once prior to mobilization and follow up as new employees mobilize.	Project Manager, SUXOS, UXOQCS	Do not allow personnel on-site until training and qualifications are confirmed.
Verify all personnel have read and understand the planning documents.	Once at mobilization and follow up as new employees mobilize.	UXOQCS	Do not proceed with field activities until inspection is passed.
Confirm all personnel have signed the WP and APP acknowledgement forms.	Once at mobilization and follow up as new employees mobilize.	UXOQCS	Do not proceed with field activities until inspection is passed.
Calibrate and test equipment initially to confirm it is functional.	Once as equipment arrives on-site.	UXOQCS, Geophysicist	Do not proceed with field activities until inspection is passed.
2. VEGETATIVE CLEARANCE AND FENCE REMOVAL			
Ensure equipment is available, properly operated, and maintained.	Once and follow up for duration of vegetation clearance and fence removal activities.	UXOQCS	Do not proceed with field activities until inspection is passed.
PPE is properly worn and maintained.	Daily	UXOQCS, UXOSO	Do not proceed with field activities until inspection is passed.
Confirm brush is sufficiently thinned so that digital surveys can be conducted while compliance with the EPP is maintained.	Once following clearance of a grid or area. Follow up as needed.	UXOQCS, Geophysicist	Return to location and clear vegetation as necessary to pass inspection.

Table 5-1 Definable Features of Work and Inspection Checklist (Continued)

Inspection Description	Frequency of Inspection	Inspection Responsibility	Possible Action if Failure Occurs
3. GROUND-BASED GEOPHYSICAL SURVEY ACTIVITIES			
Verify survey team has appropriate qualifications, including safety and other training and state licensing.	Once at start of survey activity.	Project Manager, SUXOS, UXOQCS, UXOSO	Surveyor must provide qualifications, training certificates, and licensing prior to starting work or change surveyor.
Confirm location of established control points is suitable for use (located in proximity to work area, no tree canopy) with the RTK base station.	As control points are being established.	Geophysicist	Move control to improved location and resurvey.
Corner points for DGM grids requiring survey have been located and marked as described in the WP.	As grid points are being surveyed.	Geophysicist	Resurvey and mark corner points.
Each DGM grid has at least one seed item as described in the WP (location, depth, orientation, and seed type are recorded).	As grid points are being surveyed.	UXOQCS or UXO escort	Return to grid, place seed item, and survey.
IVS was constructed in accordance with the WP (type and number of seed items, depth, and separation).	Once during IVS construction.	Geophysicist	Reseed and resurvey seed items.
Confirm geophysical sensors (digital and analog) selected for the project are capable of achieving detection performance requirements based on noise levels and depths to be encountered.	Once after initial IVS surveys.	UXOQCS, Geophysicist	Repair sensors or recommend changing instrumentation and/or method. Rerun IVS.
Positioning systems are capable of achieving accuracy requirements documented in the WP.	Once after initial IVS surveys.	Geophysicist	Repair equipment or recommend changing positioning system. Rerun IVS.

Table 5-1 Definable Features of Work and Inspection Checklist (Continued)

Inspection Description	Frequency of Inspection	Inspection Responsibility	Possible Action if Failure Occurs
Responses for seed items fall on or above the least favorable orientation sensor response curves within the appropriate tolerance as documented in the WP.	Once after initial IVS surveys.	Geophysicist	Rerun IVS.
Noise levels, anomaly selection thresholds, and appropriate processes are documented and approved by the USACE Geophysicist prior to performing production surveys.	Once after initial IVS surveys.	Project Manager, UXOQCS, Geophysicist	Do not allow production surveys to commence before approval.
Confirm digital functionality tests are performed before and after surveys and results are verified against metrics established in the WP.	Daily and following repair or maintenance.	Geophysicist	Re-collect data between tests where discrepancies were observed if a resolution cannot be determined.
The IVS procedures documented in the WP are being performed by each DGM team before and after surveys.	Daily	Geophysicist	If data quality is poor and IVS data are not available to support a resolution, data may need to be re-collected for the time period in question.
Analog instruments are tested on the IVS to confirm functionality before transect and grid mag and dig activities.	Daily and following repair or maintenance.	UXOQCS	Replace or repair instrument if functionality is questionable.
Confirm DGM processes detailed in Section 3 are being performed and metrics are being achieved.	Daily during DGM.	UXOQCS, Geophysicist	Data may need to be repackaged, reprocessed, or re-collected.
Confirm digital data packages are submitted for USACE review.	Weekly and as needed.	Project Manager, UXOQCS, Geophysicist	Data may need to be repackaged, reprocessed, or re-collected based on results from USACE review.

Table 5-1 Definable Features of Work and Inspection Checklist (Continued)

Inspection Description	Frequency of Inspection	Inspection Responsibility	Possible Action if Failure Occurs
4. MARINE-BASED GEOPHYSICAL SURVEY AND RECOVERY ACTIVITIES			
Verify dive team has appropriate qualifications, including safety and other training and state licensing and equipment.	Once at start of survey activity and daily for equipment.	Project Manager, SUXOS, Dive Coordinator.	Team must provide qualifications, training certificates, and licensing prior to starting work.
Confirm location of established control points for water transects with RTK base station.	As control points are being established.	UXOQCS and Aqua Survey, Inc.	Reconfirm via way points or from benchmark.
Instruments checked to confirm functionality before mag and dig activities.	Daily and following repair or maintenance.	Aqua Survey, Inc.	Replace or repair instrument if functionality is questionable.
Confirm all personnel have the appropriate PPE and supplies.	Daily	Aqua Survey, Inc. and Diver Coordinator	Stop activities until PPE and supplies are in place.
Verify all QC items have been recovered within a specific transect using pingers (or other means).	As required, prior to start of transect.	Aqua Survey, Inc.	Re-inspect equipment, recalibrate, and/or re-perform.
Observe mag and dig operations for accuracy and completeness.	Daily and as required.	UXOQCS and Diver Supervisor	Stop activities until WP procedures are being followed and any activities not performed within compliance are reevaluated and re-performed if necessary.
Confirm UXO dive teams are recording/logging all required parameters during item recovery.	Daily	UXOQCS	Retrain or replace personnel.
Verify procedures and equipment in place to transport and/or BIP MEC and/or MPPEH.	Each anomaly.	UXOQCS	Retrain or replace personnel.
Verify disposal procedures are being conducted in accordance with the WP.	Each MEC item, as required.	UXOQCS	Stop activities until WP procedures are being followed and any activities not performed within compliance are reevaluated and re-performed if necessary.

Table 5-1 Definable Features of Work and Inspection Checklist (Continued)

Inspection Description	Frequency of Inspection	Inspection Responsibility	Possible Action if Failure Occurs
5. MUNITIONS AND EXPLOSIVES OF CONCERN INTRUSIVE ACTIVITIES			
Ensure the appropriate exclusion zones are established and maintained in active work areas.	Daily	SUXOS, UXOQCS, UXOSO	Stop activities until the appropriate exclusion zones have been established and maintained.
Verify team separation distances.	Daily	SUXOS, UXOQCS, UXOSO	Stop activities until the appropriate separation distance is being followed.
Confirm all personnel have the appropriate PPE and supplies.	Daily	SUXOS, UXOQCS, UXOSO	Stop activities until PPE and supplies are in place.
Observe anomaly reacquisition and/or intrusive work accuracy and completeness.	Daily and as required.	UXOQCS	Stop activities until WP procedures are being followed and any activities not performed within compliance are reevaluated and re-performed if necessary.
Observe mag and dig operations for accuracy and completeness.	Daily and as required.	UXOQCS	Stop activities until WP procedures are being followed and any activities not performed within compliance are reevaluated and re-performed if necessary.
Confirm UXO Teams are recording and/or logging all required parameters during item recovery.	Daily	UXOQCS, Geophysicist	Retrain or replace personnel.
Verify all seed items have been recovered within a specific grid or area.	As required, at completion of grid.	UXOQCS, Geophysicist	Resurvey grid and resubmit for QC.
Conduct anomaly/area verification sampling when removal activities are complete in a grid or area.	At completion of grid or area.	UXOQCS	Resurvey grid or area and resubmit for QC.
Verify excavations have been backfilled and properly restored.	Daily	UXOQCS	Return to excavation to perform necessary restoration.

Table 5-1 Definable Features of Work and Inspection Checklist (Continued)

Inspection Description	Frequency of Inspection	Inspection Responsibility	Possible Action if Failure Occurs
Verify the determination of acceptable to move MEC and/or MPPEH for consolidation is appropriate.	Each MEC and/or MPPEH item, as required.	UXOQCS	MEC and/or MPPEH item will be BIP. Retrain or replace personnel.
Ensure appropriate notifications and procedures are in place to transport MEC and/or MPPEH and the designated consolidation point is used for demolition.	Each MEC and/or MPPEH item, as required.	UXOQCS	Do not move MEC and/or MPPEH item until the item passes inspection. Retrain or replace personnel.
Verify disposal procedures are being conducted in accordance with the WP.	Each MEC item, as required.	UXOQCS	Stop activities until WP procedures are being followed and any activities not performed within compliance are reevaluated and re-performed if necessary.
6. MUNITIONS AND MUNITIONS-RELATED CHEMICAL CONSTITUENTS SAMPLING			
Confirm all personnel have the appropriate PPE and supplies.	Daily	SUXOS, UXOQCS, UXOSO	Stop activities until PPE and supplies are in place.
PPE is properly worn and maintained.	Daily	UXOQCS, UXOSO	Do not proceed with field activities until inspection is passed.
Confirm environmental sampling protocols are adhered to.	Once during RI sampling	Experienced field person not involved in this project	Retrain field personnel on appropriate protocols
Ensure field screening equipment is available, properly operated, maintained, and calibrated.	Once and follow up for duration of activities.	UXOQCS	Do not proceed with field activities until inspection is passed.
Confirm UXO and/or sampling teams are recording and/or logging all required parameters during item recovery.	Daily	UXOQCS, Geophysicist	Retrain or replace personnel.
Verify excavations have been backfilled and properly restored.	Daily	UXOQCS	Return to excavation to perform necessary restoration.

Table 5-1 Definable Features of Work and Inspection Checklist (Continued)

Inspection Description	Frequency of Inspection	Inspection Responsibility	Possible Action if Failure Occurs
7. DEMOBILIZATION			
Confirm all site features, equipment, supplies, and personnel are removed and all work locations are restored as documented in the WP.	Completion of project.	Project Manager, SUXOS, UXOQCS, Geophysicist	Perform inspection following completion of definable feature of work.

Notes:
APP – Accident Prevention Plan
BIP – blow-in-place
DGM – digital geophysical mapping
EPP – Environmental Protection Plan
IVS – instrument verification strip
MEC – munitions and explosives of concern
MPPEH – material potentially presenting an explosive hazard
PPE – personal protection equipment
QC – quality control
RTK – Real-Time Kinematic
SUXOS – Senior UXO Supervisor
USACE – U.S. Army Corps of Engineers
UXO – Unexploded Ordnance
UXOQCS – UXO Quality Control Specialist
UXOSO – Unexploded Ordnance Safety Officer
WP – RI Work Plan

5.1.1 Project Manager

The PM is responsible for project activities and for ensuring that contractual requirements are met and that the project is performed in an efficient, safe, and quality manner.

Additional responsibilities include implementing project QC procedures, analyzing QC failures with the QC Managers and field managers (SUXOS, UXOQCS, and UXOSO), and ensuring that corrective actions are implemented and lessons learned are documented.

5.1.2 Senior Unexploded Ordnance Supervisor

The SUXOS is responsible for managing, overseeing, and guiding MEC operations and UXO Teams. The SUXOS is responsible for ensuring that field personnel are properly trained and indoctrinated, and that they have the necessary experience and skills to perform the assigned task. The SUXOS will ensure that the RI activities are in compliance with DoD directives and federal, state, and local statutes and codes. Additionally, the SUXOS is responsible for providing subject matter expertise and leadership to ensure the team's safety and the quality of the project.

5.1.3 Unexploded Ordnance Quality Control Specialist

The UXOQCS is responsible for monitoring site activities affecting quality and for ensuring that these activities are being carried out in accordance with established requirements and protocols in the QCP. The UXOQCS is responsible for conducting QC inspections of intrusive and explosives operations for compliance with the established procedures. The UXOQCS will perform daily surveillance of the work activities and issue corrective actions as necessary. The UXOQCS will prepare daily QC reports documenting QC processes and results and will execute the three-phase inspection (TP I) process.

5.1.4 Geophysics Quality Control Manager

The Geophysics QC Manager is responsible for the quality of the digital geophysical data. His responsibilities include performing reviews of raw and processed geophysical data and audits of geophysical team procedures, and recommending actions to be taken in the event of geophysical data QC nonconformance. The Geophysics QC Manager recommends and provides solutions to problems involving quality.

5.1.5 QA/QC Manager

The QA/QC Manager is responsible for ensuring the implementation of the MC sampling QC program in accordance with project requirements, as specified in the UFP-QAPP. In addition, the QA/QC Manager is responsible for reviewing the technical quality of the analytical data, the data validation, and the reports, as identified in the UFP-QAPP.

5.2 PERSONNEL QUALIFICATIONS AND TRAINING

Project staff will be qualified to perform the specific tasks they are assigned on the project, as discussed in Section 2. The health and safety training requirements for on-site personnel and visitors are discussed in the APP/SSHP (**Appendix E**). The UXO-qualified personnel and/or UXO technicians will meet the requirements of DDESB TP-18, Minimum Qualifications for Unexploded Ordnance Technicians and Personnel (DoD, 2004a).

At the beginning of the project, personnel will provide their training and qualification records to the PM for approval. These records will also be maintained on-site by the UXOQCS and will be reviewed periodically to ensure that they are current. Prior to beginning field work and any new phases of work, the UXOQCS will review the work processes with project personnel to ensure that they are adequately trained or refreshed in the phase of work requirements, standards, and procedures.

Prior to allowing any visitors on-site, the UXOQCS will review their training and qualifications and will determine appropriate visitation access based on the APP/SSHP and the daily site activities. Visitors will be given a project and safety briefing by the SUXOS - Site Manager or designee, will sign off on the briefing, and will be accompanied by site personnel during their visit as appropriate.

5.3 THREE-PHASE INSPECTION PROCESS

A TP I process will be used to ensure that project activities comply with approved procedures and methods and that opportunities for improving processes are documented and changes (if approved) are implemented. The UXOQCS or designee is responsible for implementing the TP I process. The TP I process includes a preparatory, initial, and follow-up and/or final phase inspection for each project definable feature of work (DFW) as described in the following sections. The DFWs, inspection descriptions, responsible personnel, and potential failure actions are provided in **Table 5-1**. Specific geophysical inspection methods and failure criteria are presented in **Table 5-2**.

Table 5-2 Geophysical Inspection Methods and Failure Criteria

Activity	Inspection Method	Failure Criteria
Equipment and instrument checks	Observe operation by personnel. Record results on appropriate forms.	Equipment is not operational. Personnel are not proficient with operation.
Process and procedure inspections	Visual observations of personnel and accuracy of methods being employed. Part of the follow-up inspection phase. Confirm the requirements of the Work Plan, and ensure that inspections for DFWs, regulations, and industry standards comply with project objectives.	Any discrepancies identified will need to be resolved as discussed in the QCP. Unresolved discrepancies or nonconformance will require a CAR. If the same discrepancy is reoccurring, prepare a CAR.
DGM operations	Discussed in Section 3.	Discussed in Section 3.

Table 5-2 Geophysical Inspection Methods and Failure Criteria (Continued)

Activity	Inspection Method	Failure Criteria
Anomaly reacquisition and investigation	Document surveyor has reacquired and marked all AOIs and individual anomalies. Confirm excavations have been restored to Work Plan specified conditions.	Failure to reacquire all anomalies. Failure to investigate subsurface anomalies that were reacquired. MEC and/or MPPEH, MD, and non-MD (size of a 37mm or greater) were found within 2 feet of dig location. Restoration not performed or incomplete.

Notes:
AOI = area of interest
CAR= Corrective Action Request
DFW = Definable Feature of Work
DGM = digital geophysical mapping
MEC = munitions and explosives of concern
MD = munitions debris
mm = millimeter
MPPEH = material potentially presenting an explosive hazard
QCP = Quality Control Plan

5.3.1 Preparatory Phase Inspection

The preparatory phase inspection consists of the planning and design process leading up to the field activities. The preparatory phase inspection will be performed prior to initiating each DFW. The UXOQCS or designee will review the appropriate documentation to ensure the requirements to carry out each DFW are in place and compliant with the appropriate regulations.

The UXOQCS will verify that required planning documentation, including the Work Plan and appendices, have been approved and are available to site personnel. Equipment, sensors, and materials delivered to the Boat Basin, Visitors Information Center will be inspected to ensure they are calibrated and functional and that all required components have been inventoried. Personnel certifications will be reviewed to ensure that appropriate training, medical clearance, instruction, and licenses have been obtained based on assigned responsibilities and site-specific requirements. The UXOQCS or designee will determine whether the personnel needed to carry out the DFW are identified, available, meet the qualifications of the position, and fill those positions accordingly.

Where site conditions or constraints prohibit carrying out a specific DFW, the UXOQCS will designate personnel to correct or resolve discrepancies. RI Work Plan discrepancies will be corrected and subsequently verified by the UXOQCS or designee before beginning the DFW.

5.3.2 Initial Phase Inspection

The initial phase inspection will begin at the startup of a DFW. The work performed as part of the DFW will be inspected for compliance with established procedures so that a high level of quality can be obtained from task commencement to completion. The UXOQCS will document the inspection results in the QC logbook that will be transcribed daily to the QC Report. The QC Report will list the DFW(s), QC requirements, and inspection processes performed that day based on the DFW checklist.

If the inspection results identify discrepancies between the approved plans and site practices, a discrepancy resolution process will be implemented. The appropriate expert based on discipline (DGM, chemistry, safety, munitions) will be engaged to support the PM and project team in resolving discrepancies immediately after they are identified. The ultimate resolution will be made by the PM. If the discrepancy cannot be resolved, the nonconformance will be documented in a Corrective Action Request (CAR) as described in Subsection 5.3.4. When an unresolved discrepancy is identified as potentially causing a nonconformance, the work activities will be stopped until a resolution can be documented and approved.

5.3.3 Follow-Up Phase Inspection (Surveillance)

Scheduled and unscheduled inspections will be performed as part of the follow-up phase. The purpose of these inspections is to ensure a high level of quality is maintained throughout the work activity by monitoring compliance to the project plans and procedures on an ongoing basis. The UXOQCS has primary responsibility for on-site verification of the work practices in relation to the DFW inspection requirements. However, the SUXOS and Geophysicist are also responsible for monitoring performance. The following activities will be performed for each DFW:

- Inspections and surveillance to ensure compliance with project plans.
- Inspections and surveillance to ensure a high level of workmanship is maintained.
- Inspections and surveillance to ensure logbooks are complete.
- Inspections and surveillance to ensure compliance with the inspection frequency and requirements documented in **Table 5-1**.

Results of the follow-up phase inspections will be documented in the UXOQCS logbook and summarized in the QC Report.

5.3.4 Final Phase Inspection

At the completion of all work associated with a DFW, the UXOQCS will conduct an inspection of the work. The work will be inspected for conformance to plans, specifications, quality, workmanship, and completeness. An itemized list will be compiled that includes a summary of work not properly completed, inferior workmanship, and work not conforming to plans and specifications. The list will be documented as a nonconformance in the QC Report with an estimated date for correction of each discrepancy. If the discrepancy cannot be reconciled, a CAR will be prepared.

Following correction of work, a second inspection will be conducted by the UXOQCS to ensure that all deficiencies have been corrected. The inspections and resolutions will be completed within the schedule stated for completion of the entire work, or any particular increment thereof if the project is divided into increments by separate completion dates.

5.3.5 Definable Features of Work

The DFWs for each aspect of the project are presented in **Table 5-1**, which includes the inspections required for each DFW, the frequency of inspections, the person responsible for inspections, and the possible course of action if there are inspection failures. The primary DFWs are as follows:

1. Site setup and/or mobilization of personnel, equipment, and supplies.
2. Anomaly reacquisition and marking.
3. Intrusive activities.
4. MC sampling.
5. Demobilization.

5.3.6 Geophysical Inspection Methods and Failure Criteria

In addition to the inspection criteria described above for each DFW, there are operation-specific inspection methods and failure criteria for the geophysical confirmations of the individual anomalies. These inspection methods and failure criteria are presented in **Table 5-2**.

5.4 AUDITS

The Geophysics QC Manager will periodically conduct on-site audits of the field work and QC documentation. Procedures for auditing activities will be identified prior to implementation of the audits. The audit process involves identifying, documenting, and reporting non-conformances or deficiencies; initiating corrective actions through appropriate channels; and conducting a compliance review. Auditing tasks and findings will be documented in an audit report and provided to USACE as an attachment to the QC Report.

5.5 DOCUMENTING DEFICIENCIES AND CORRECTIVE ACTIONS

The UXOQCS will be responsible for verifying compliance with the QCP through daily inspections, documenting deficiencies in the QC Report, and ensuring appropriate corrective actions. The Geophysics QC Manager will be responsible for verifying compliance with the QCP through periodic on-site audits, documenting deficiencies in audit reports, and ensuring appropriate corrective actions. The PM will coordinate with all QC personnel as deemed necessary following reviews, audits, and inspections at the project level to confirm that work is progressing in accordance with the RI Work Plan.

5.5.1 Corrective Action Process

The PM and UXOQCS will be responsible for ensuring that the procedures for reporting, evaluating, and correcting nonconformance are addressed through the planned QC procedures. The determination of any nonconforming conditions must be supported with objective evidence. The nonconforming conditions will be evaluated and corrected and may be considered as opportunities to improve the process during the project.

5.5.2 Continuous Improvement

Personnel are encouraged to continuously review their processes and to suggest changes that improve the process; provide benefits; or improve project efficiency, safety, and quality. These suggestions can be submitted formally through a written memorandum to the SUXOS or UXOQCS or submitted informally through verbal discussions at project meetings.

5.5.3 Deficiency Identification and Resolution

Personnel have the responsibility to identify and to report conditions adverse to quality. The deficiencies will be identified, documented, investigated, and corrected appropriately. The PM and UXOQCS are responsible for evaluating the causes of the deficiencies or the nonconformance and for recommending solutions to correct the deficiency identified. The UXOQCS will be responsible for verifying implementation of the corrective action and for monitoring the effectiveness of the corrective action for each DFW.

5.5.4 Corrective Action Request

A CAR can be issued by any member of the project team, including subcontractor personnel. The CAR is also issued by the UXOQCS when a discrepancy is identified that cannot be resolved following the DFW inspection (at any phase). The CAR will be provided to the PM, who will evaluate the request based on input from the UXOQCS and subject matter experts. If the CAR is accepted, the PM will develop a corrective strategy, assign resources, and specify a schedule for corrective actions. The UXOQCS will verify the effectiveness of the corrective action once it has been implemented and completed. Reoccurring reviews of the CAR will be performed to ensure that the established protocols for corrective actions are being implemented properly and the desired intent is being achieved.

As part of the CAR, a root cause analysis will be conducted to identify the factors that led to the problem. Criteria to be considered in the analysis will include personnel qualifications, training, adequacy of procedures, adequacy of equipment, and adequacy of QC inspections and measures. Input will be obtained from field personnel as necessary and technical experts to support the analysis. The nonconformance will be traced back to the problem using reverse engineering as applicable.

At a minimum, the nonconformance will be documented on the CAR within 24 hours of occurrence. The date when the corrective action will need to be completed and integrated will be discussed with the project team and documented on the CAR and QC Report.

5.5.5 Corrective Action Tracking

Each CAR will be tracked with a unique identifier for the duration of the field activities. The review, approval, implementation, and completion dates will be tracked in a tabular format in the project file.

5.5.6 Lessons Learned

The CARs will be attached to the QC Reports. The intent is to transparently document discrepancies and corrective actions to share lessons learned with the project team. The CARs will also be made topics of daily tailgate meetings as appropriate to ensure that field staff are aware of the situation and the corrective strategy.

The lessons learned that may aid other projects will be shared through WESTON's internal systems.

5.6 PROJECT COMMUNICATION AND SUBMITTALS

5.6.1 Daily Project Briefings

Daily briefings will be held with the field personnel to review the project activities and to discuss technical and safety issues. The SUXOS and UXOQCS will conduct the meetings and document that they are attended by the field personnel. The UXOQCS may schedule additional meetings to discuss technical and quality issues at any time. The SUXOS will maintain communications with the project management team and report any significant problems or decisions to the PM for assistance. The project QC aspects will also be documented in the UXOQCS Log and QC Report for specific DFWs.

5.6.2 Bi-Weekly Project Meeting

During execution of the project, a project team meeting (via teleconference) will be held biweekly with project management personnel. During active field activities, the field operations team will be invited to participate to discuss project progress and QC-related issues. An agenda will be distributed prior to the meeting. Notes from the meeting will be developed and distributed for review and approval.

5.6.3 Field Documentation

The UXOQCS will monitor and track the field documentation to ensure that the daily reports, QC logs, forms, and documents are prepared, submitted, and approved as described in the QCP. The UXOQCS will delegate reviews to the appropriate quality management staff based on the document type, the content, and DFW. Copies will be maintained in the project file, and digital records will be kept on the project's TeamLink website for secure access of authorized users. **Table 5-3** lists the field documents required for each DFW. **Table 5-4** identifies the responsible preparer and minimum required content for each field document.

Any comments received during documentation review will be tracked in the project file and disseminated to the project team to ensure that corrective actions are incorporated for the life of the project.

5.6.4 Contract Submittals

The PM will control project submittals to ensure that the documents are prepared and approved in accordance with the PWS. The PM will monitor and track the submission of the project documentation and delegate reviews to the appropriate quality management and technical staff based on the document type and content. Comments received during documentation review will be tracked in the project file and disseminated to the appropriate project team members to ensure that corrective actions are incorporated for the life of the project.

Table 5-3 Field Documentation Schedule for Each Definable Feature of Work

DFW	Primary Documentation Associated with the DFW
Site setup/mobilization of personnel, equipment, and supplies	Daily Summary Report Work Plan acknowledgement APP/SSHP acknowledgement QC Report SUXOS logbook UXOQCS logbook Weekly report (as required)
Ground-based geophysical survey activities	Daily Summary Report APP/SSHP acknowledgement QC Report DGM processing form SUXOS logbook UXOQCS logbook Dig list Weekly report
Water-based geophysical survey	Daily Summary Report APP/SSHP acknowledgement QC Report DGM processing form SUXOS logbook UXOQCS logbook Dig list Weekly report
MEC intrusive activities	Daily Summary Report APP/SSHP acknowledgement QC Report SUXOS logbook UXOQCS logbook Dig list Weekly report
MC and munitions-related chemical constituent sampling	Daily Summary Report APP/SSHP acknowledgement QC Report Field screen equipment checkout SUXOS logbook UXOQCS logbook Weekly report (as required)

Table 5-3 Field Documentation Schedule for Each Definable Feature of Work (Continued)

DFW	Primary Documentation Associated with the DFW
Demobilization	Daily Summary Report APP/SSHP acknowledgement QC Report SUXOS logbook UXOQCS logbook Weekly report (as required)

Notes:

APP = Accident Prevention Plan
DFW = Definable Feature of Work
DGM = digital geophysical mapping
MC = munitions constituent
MEC = munitions and explosives of concern
QC = quality control
RI = remedial investigation
SSHP = Site Safety and Health Plan
SUXOS = Senior Unexploded Ordnance Supervisor
USACE = U.S. Army Corps of Engineers
UXO = unexploded ordnance
UXOQCS = UXO Quality Control Specialist

Table 5-4 Field Documentation Preparer and Minimum Content Requirements

Report/Form/Log Name	Description and Minimum Requirements
Work Plan acknowledgement Manager: UXOQCS	All WESTON employees and applicable subcontractors will read and acknowledge by signature they have read and understand the Work Plan.
APP/SSHP acknowledgement Manager: UXOSO/UXOQCS	All WESTON employees and subcontractors will read and acknowledge by signature they have read and understand the APP/SSHP. This form will be used as the daily sign-in sheet and tailgate safety brief acknowledgement.
Daily Summary Report Manager: SUXOS, UXOSO/ UXOQCS	This report will summarize the day's activities and tasks performed for any and all DFWs and may include the following as required: ▪ QC findings ▪ Safety and health findings ▪ DGM progress and activities ▪ SUXOS activity summary ▪ MEC recovery information ▪ MC recovery information ▪ Records of site work and progress
QC Report Manager: UXOQCS	The QC Report will provide inspection results for each activity that was monitored. The QC Report will document and summarize the information recorded in the UXOQCS log. The QC Report includes the following: ▪ Each DFW undergoing inspection ▪ Phase of inspection ▪ Results of inspection ▪ Summary of discrepancies ▪ Summary of nonconformance ▪ Resulting actions
SUXOS log Manager: SUXOS	This log is maintained by the SUXOS and records at a minimum: ▪ Activities started and completed ▪ Work stoppage ▪ Official correspondence ▪ Personnel list ▪ Team location and assigned activities ▪ Demolition activity ▪ Visitors
UXOQCS log Manager: UXOQCS	This log is maintained by the UXOQCS and records at a minimum: ▪ Equipment testing and results ▪ Quality control inspections and documentation as required by the QC Report ▪ Work stoppage due to QC issues ▪ Date and personnel observed/checked

Table 5-4 Field Documentation Preparer and Minimum Content Requirements (Continued)

Report/Form/Log Name	Description and Minimum Requirements
Analog equipment checkout Manager: UXOQCS	Analog instrument testing results at the IVS will be documented daily. Instruments will be taken out of service until repaired and functionality can be demonstrated. Serial numbers, date of test, and operability will be recorded.
DGM processing form Manager: Geophysicist	The DGM processing parameters and results will be recorded. The form also includes descriptions of field conditions, dates of survey, instrument type, and results of the QC function tests.
Dig list Manager: UXOQCS	Dig lists will be generated as anomalies are investigated during intrusive operations. Dig results will be logged using the WESTON RespondFast system. Records include the following: ▪ Date of intrusive activity ▪ Grid/transect location and ID ▪ Anomaly ID ▪ Waypoint coordinates ▪ Depth of item ▪ Appropriate offsets ▪ Item classification, type and description ▪ Dig team ID ▪ Disposition
Demolition notification list Manager: UXOQCS	The demolition notification list is provided in Section 3 of the Work Plan. All parties will be notified prior to performing demolition.
DoD Form 1348-1A Manager: SUXOS	Form will be completed when MD is transferred for flashing and recycling as required. Process and instructions for the form are provided in Section 3 of the RI Work Plan.

Notes:
APP = Accident Prevention Plan
DFW = Definable Feature of Work
DGM = digital geophysical mapping
DoD = Department of Defense
ID = identification
IVS = instrument verification strip
MC = munitions constituent
MD = munitions debris
MEC = munitions and explosives of concern
QC = quality control
RI = remedial investigation
SSHP = Site Safety and Health Plan
SUXOS = Senior Unexploded Ordnance Supervisor
UXOQCS = UXO Quality Control Specialist
UXOSO = UXO Safety Officer
WESTON = Weston Solutions, Inc.

6 EXPLOSIVES MANAGEMENT PLAN

6.1 GENERAL

The Explosives Management Plan outlines the procedures to be used by UXO personnel to acquire, receive, store, transport, and issue explosives, and to report the loss of explosives used during the RI. All personnel involved with explosives will comply with all federal, state, and local laws as required.

6.2 LICENSES/PERMITS

WESTON has a Type 33-User of High Explosives Permit from the ATF and will secure a Virginia permit to use explosives as required by local regulations. A copy of all licenses and permits will be maintained on-site and available to any local, state, or federal authority.

6.3 ACQUISITION

WESTON will purchase explosives on an as-needed-basis from a licensed commercial vendor and will utilize an explosives magazine for storage due to the remote nature of the site and increased delivery time. Should issues arise with explosives delivery or storage, on-site security will be provided for those MEC items that cannot be demolished the same day as identified. Vendor information will be provided as required. Prior to bringing the explosives on-site to be stored in an explosives magazine on private property, the SUXOS will coordinate with the USACE OESS and local law enforcement.

6.4 INITIAL RECEIPT OF EXPLOSIVES

A magazine will be established on-site for the field effort, most likely along the access road south of the boat basin. Explosives that are delivered to the Boat Basin, Visitors Information Center will be removed from the magazine and placed in an explosives container (Day Box), mounted in the bed of a truck. The following procedures will be adhered to upon initial receipt of explosive materials (see **Figure 6-1**):

- Upon the arrival of explosives at Boat Basin, Visitors Information Center, the SUXOS will escort the vendor or supplier to a designated magazine area for unloading. The designated magazine will be determined at the start of field activities.

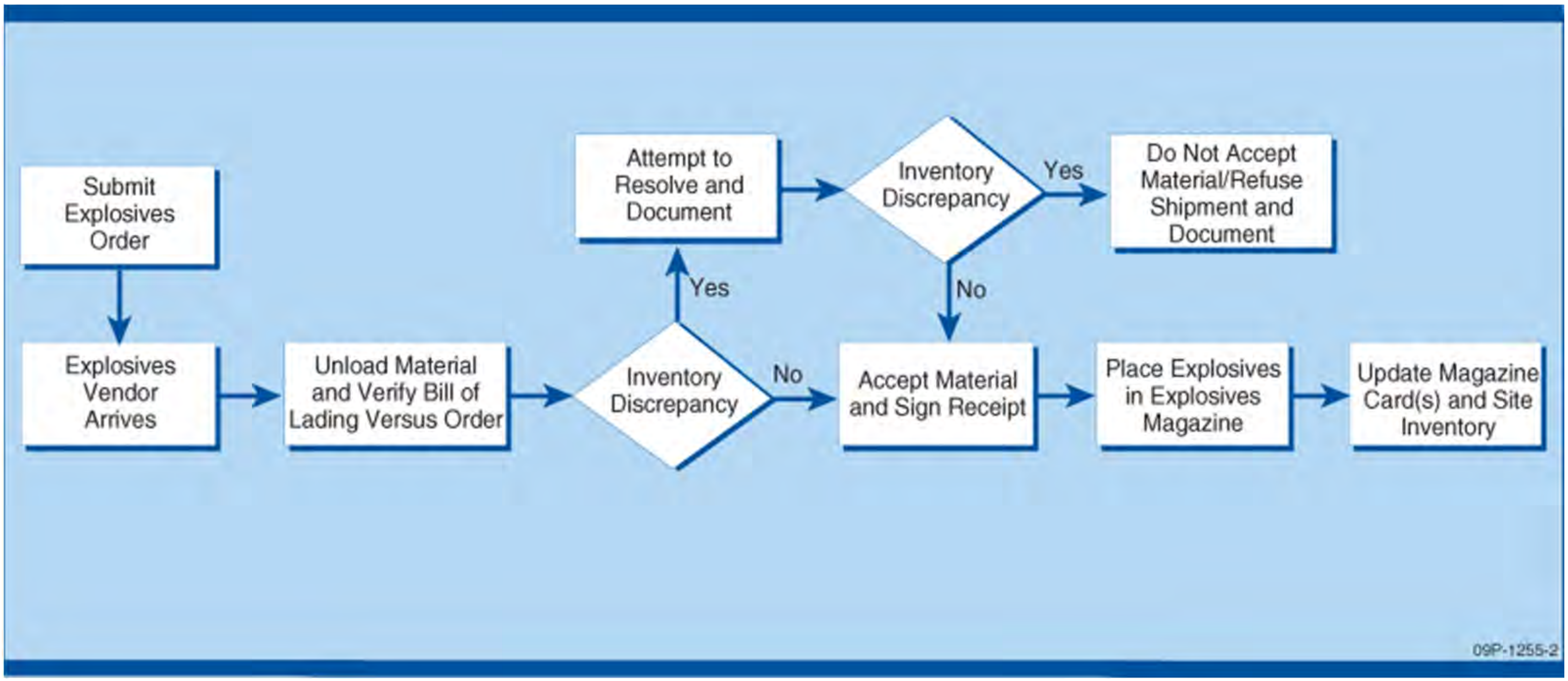

Figure 6-1 Receipt of Explosive Materials Process

- An individual authorized to receive the explosives will compare the explosives delivery record to the actual quantity delivered prior to accepting custody for the explosives.

- Once the quantity has been confirmed, the explosive delivery record will be signed and the explosives transferred to and stored in the approved explosives magazine.

- All material introduced or removed from the magazine will be entered on stack cards and explosive records will be updated.

- If it is determined that there is a discrepancy between the quantity delivered and the quantity shipped, the following will occur:

  - The UXOSO will be notified.
  - The shipment will not be accepted.
  - The shipper will be contacted immediately to resolve the discrepancy.

Note: If the discrepancy cannot be resolved within 24 hours, the local law enforcement agency, ATF, WESTON Program Health and Safety Manager, and WESTON PM will be notified.

All original receipts, shipping documents, or invoices will be retained on-site as part of records management. Copies of the documentation will be provided in the final report as an appendix.

6.5 EXPLOSIVES STORAGE MAGAZINE

An explosives storage magazine will be used in accordance with all of the ESP requirements.

6.6 TRANSPORTATION

The transportation of explosives to locations requiring demolition operations will be conducted in the following manner:

- Vehicles transporting explosives via Day Box from the explosives magazine to locations requiring demolition operations will stay on roads either improved or unimproved.

- Speeds will be kept to 20 miles per hour or less, depending on road conditions.

- Radio communications will be maintained with the UXOSO.

- Vehicles will have a safety inspection performed prior to loading explosives.

- Vehicles will be equipped with a first aid kit and fire extinguisher.
- Vehicles will be placarded during the transport of explosives.

6.7 RECEIPT PROCEDURES

Prior to accepting any explosives, the procedures outlined above in the initial receipt procedures section will be followed.

The WESTON SUXOS is authorized to purchase, receive, access, issue, transport, and use explosives for the RI for the Boat Basin, Visitors Information Center. Other project personnel who will have access, issue, transportation, and use authority for explosives will be annotated on the approved user list, which will be maintained in the explosive management records.

Upon completion of each demolition operation, an explosives consumption report will be completed to document that expenditure of all explosives occurred. The authorized person will certify in writing in the report that the explosives were used for their intended purpose.

6.8 INVENTORY

A physical inventory of all explosives will be accomplished in accordance with ATF guidelines.

6.9 REPORTING LOST OR STOLEN EXPLOSIVES

Loss or theft of explosives will be reported as stated in 27 Code of Federal Regulations (CFR) on Commerce in Explosives. **Table 6-1** lists the individuals or organizations to be notified upon the discovery of theft or loss of explosives.

6.10 RETURN TO STORAGE OF NONEXPLODED EXPLOSIVES

All explosives not used but transported via the Day Box will be returned to the explosives magazine at the end of the day.

6.11 DISPOSAL OF REMAINING EXPLOSIVES

Any excess explosives will be destroyed at the conclusion of the project.

Table 6-1 Reporting Lost or Stolen Explosives

Title	Name	Telephone Number
WESTON SUXOS	Scott Collier	256-282-2180 (cell)
WESTON UXO Safety Officer	Dan Dorrell	716-573-6780 (cell)
WESTON PM	Tony Pace	(757) 362-2461
USACE OESS	Elbert Caraballo	(410) 350-9860
Local Authorities as directed	Department of Emergency Services	911
ATF		(800) 461-8841

Notes:

ATF – Department of the Treasury – Bureau of Alcohol, Tobacco, Firearms, and Explosives
OESS – Ordnance and Explosive Safety Specialist
PM – Project Manager
SUXOS – Senior UXO Supervisor
USACE – U.S. Army Corps of Engineers
UXO – Unexploded Ordnance
WESTON – Weston Solutions, Inc.

7 EXPLOSIVES SITE PLAN

An ESP is prepared by USACE as a stand-alone document in accordance with the USACE Interim Guidance Document (IGD) 08-01, *Explosives Site Plans (ESP) for Military Munitions Response Program (MMRP) Projects* (USACE, 2008a). The approved ESP was prepared in accordance with the requirements of EM 385-1-97, Explosives Safety and Health Requirements Manual, and Errata No. 3 (USACE, 2008b). The ESP is included in **Appendix K.**

8 ENVIRONMENTAL PROTECTION PLAN

8.1 GENERAL

The Environmental Protection Plan (EPP) has been prepared in accordance with DID MR-005-12 (Environmental Protection Plan) (USACE, 2003). The objective of the EPP is to provide adequate procedures during site activities to safeguard against detrimental impacts to the surrounding environment and its natural resources, to correct any damage done to the environment as a result of site activities, and to control noise and dust on-site within reasonable limits. The EPP addresses the known environmental concerns/issues associated with the RI for the Boat Basin, Visitors Information Center. In the event that unforeseen concerns/issues arise during operations, operations in the affected area will be suspended until the full potential environmental impact is understood and appropriate safeguards can be implemented.

8.2 IDENTIFICATION OF APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

The NCP and Section 121 of CERCLA require that CERCLA remedial actions attain federal and state applicable or relevant and appropriate requirements (ARARs) unless specific waivers are granted. The ARAR analysis is directed at substantive, promulgated regulations with regard to on-site activities (CERCLA § 121(d), 42 U.S.C. § 9621(d); NCP, 40 C.F.R. § 300.5). Furthermore, CERCLA response actions, in accordance with CERCLA/NCP, are exempt from permits and similar procedural requirements with regard to on-site activities [42 U.S.C. § 9621(e)(1); 40 C.F.R. § 300.400(e)(1)]. For off-site activities (e.g., transportation and off-site disposal), compliance is required for applicable federal and state substantive and procedural requirements [NCP, 40 C.F.R. § 300.400(e)(2)]. Such off-site activities are not part of the ARAR or To Be Considered criteria (TBC) analysis; however, to the extent that they pose challenges for certain alternatives, they are discussed under the Implementability factor.

Pursuant to the NCP, 40 C.F.R. § 300.5, ARARs are defined as follows:

- **Applicable Requirements** are those cleanup standards, standards of control, and other substantive requirements, criteria, or limitations promulgated under federal environmental or state environmental or facility siting laws that specifically address a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance found at a CERCLA site. Only those state standards that are identified by a state in a timely manner and that are more stringent than federal requirements may be applicable.

- **Relevant and Appropriate Requirements** are those cleanup standards, standards of control, and other substantive requirements, criteria, or limitations promulgated under federal environmental or state environmental or facility siting laws that, while not ‘‘applicable’’ to a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance at a CERCLA site, address problems or situations sufficiently similar to those encountered at the CERCLA site that their use is well suited to the particular site. Only those state standards that are identified in a timely manner and are more stringent than federal requirements may be relevant and appropriate.

- **TBC Criteria**: In addition to ARARs, appropriate advisories, criteria, or guidance for a particular release may be identified. For example, where no specific ARAR exists for a chemical or situation, or where such an ARAR is not sufficient to be protective of human health or the environment, appropriate federal and/or state guidance or advisories may be considered in determining the necessary level of cleanup for protection of public health and the environment.

ARARs and TBCs are used to develop remedial actions, to establish preliminary remediation goals (PRGs), to scope and formulate remedial action alternatives, and to govern implementation and operation of the selected remedial alternatives. **Table 8-1** presents the initial identification and evaluation of potential ARARs that may be suited for the RI work to be performed pursuant to the Work Plan. The identification of these ARARs is consistent with the NCP in that field investigation activities should be conducted “in compliance with ARARs to the extent practicable considering the exigencies of the situation” (55 FR 8756). These potential ARARs will be reevaluated and updated, as appropriate, in the RI report. Evaluation of ARARs is an iterative process that will continue throughout the life of the project. An initial evaluation of ARARs has been performed and is presented in **Table 8-1,** which lists action-specific, location-specific, and chemical-specific ARARs. Other TBC criteria have also been evaluated and are presented in **Table 8-1**. The entries in **Table 8-1** may or may not be carried forward. A formal legal review of all ARARs will be conducted during the development of a Decision Document or Action Memorandum required for any actions to be taken at the Boat Basin, Visitors Information Center.

Table 8-1 Potential ARARs and TBCs

Standard, Requirement, Criteria, or Limitation	Citation	Description of Requirement	Comment (Applicable or Relevant and Appropriate Requirement/To Be Considered Criteria)
Action-Specific			
Department of Transportation (DOT) – shipping containers	49 CFR 178	Describes the manufacturing and testing specifications for packaging and containers used for the transportation of hazardous materials in commerce.	TBC The requirements are to be considered for the transportation of hazardous materials in the event of a discharge or release.
Dept. of Army Ammunition and Explosive Safety Standards	AR 385-64, DA PAM 385-64	Requires that safety measures be taken for the handling of explosive ordnance.	ARAR The requirements are considered substantive and applicable for the storage, handling, transportation, and disposing of munitions.
Department of Defense (DoD) Ammunition and Explosives Safety Standards	DoD 6055.09-M (DoD, 2009)	Requires that specialized personnel be employed to detect, remove, and dispose of munitions. This standard also defines the safety precautions and procedures for the detonation or disposal of munitions.	ARAR The requirements are considered substantive and applicable for DoD ammunition and explosives protocols and safety standards.
Hazardous Waste Management	40 CFR 261 and 262	Defines those solids wastes which are subject to regulation as hazardous wastes under 40 CFR Parts 261 and 262.	TBC The requirements are to be considered for the management of hazardous waste.
Military Munitions Rule	40 CFR Part 266, Subpart M	Regulates unused munitions, munitions used for intended purposes, and used or fired munitions.	ARAR The requirements are considered substantive and applicable as a result of potential munitions at the Boat Basin, Visitors Information Center.
Environment and Explosives Safety Management	DoD Directive (DoDD) 4715.11	Establishes policy for management of active and inactive military ranges. Includes guidelines for range clearance operations, hazard assessment, and recycling/ disposal.	ARAR The requirements are considered substantive and applicable because of the planned clearance, hazard assessment and recycling/disposal operations.

Table 8-1 Potential ARARs and TBCs (Continued)

Standard, Requirement, Criteria, or Limitation	Citation	Description of Requirement	Comment (Applicable or Relevant and Appropriate Requirement/To Be Considered Criteria)
Resource Conservation and Recovery Act (RCRA)	40 CFR 236 – 259 for solid waste management, 40 CFR 260, 261, 262, 263 – 279 and VAC 20-60-261 to 262, 430, and 450 to 480 for hazardous waste management, and VHWMR 9 Virginia Administrative Code (VAC) 20-80-60	As promulgated by the Virginia Waste Management Board under federal RCRA requirements, Virginia has an approved RCRA program, and Virginia Hazardous Waste Management Regulations (VHWMR) will govern instead of RCRA. However, Virginia does not yet have primacy for Land Disposal Restrictions. Disposal of the contaminated soils or treatment residuals at an off-site facility location would trigger the RCRA land disposal restrictions of 40 CFR Part 268.	ARAR The requirements of this Act are considered substantive and applicable to the Boat Basin, Visitors Information Center because of the potential for waste management and disposal associated with remedial actions (e.g., former debris landfill and MEC clearance to depth alternative).
Virginia Solid Waste Management Regulations	9 VAC 20-80-10 to 790	As promulgated by the Virginia Waste Management Board under federal RCRA requirements, this regulation will govern the generation, transport, treatment, and disposal of solid wastes.	The Solid Waste Management Regulations ARAR will be applicable if contaminated soil is excavated and removed from the site for treatment and/or disposal.
Virginia Air Pollution Control Board, Virginia Ambient Air Quality Standards, Standards of Performance for Visible Emissions and Fugitive Dust/Emissions (Rule 5-1), New and Modified Stationary Sources	9 VAC 5-30-10 to 80; 9 VAC 5-50-60 to 120; and 9 VAC 5-60-60 to 80	Promulgated by the Virginia Air Pollution Control Board under the requirements of the federal Clean Air Act, these regulations set policies and procedures to limit airborne particulate matter produced by construction activities and regulate all other types of potential air impacts.	ARAR Relevant and appropriate for all active remedies that include dust generation or the generation of any air contaminants from the remedial action alternatives considered.

Table 8-1 Potential ARARs and TBCs (Continued)

Standard, Requirement, Criteria, or Limitation	Citation	Description of Requirement	Comment (Applicable or Relevant and Appropriate Requirement/To Be Considered Criteria)
Stormwater Management Act, Stormwater Management Program Permit Regulations, Erosion and Sediment Control Law, and Erosion and Sediment Control Regulations	Va. Code Ann. §§ 10.1-603.2 to 603.15 (2001); 4 VAC 50-60-10 to 1240; Va. Code Ann. §§ 10.1-560 to 571 (2003); and 4 VAC 50-30-10 to 110.	Promulgated by the Virginia Water Control Board pursuant to the requirements of the Clean Water Act, these regulations describe the procedures and requirements to be followed in connection with the Virginia Stormwater Management Program (VSMP) permits.	ARAR Relevant and appropriate for land disturbance activities that may occur as part of investigation or remediation whose components could impact surface waters. An Erosion and Sediment Control Plan must be prepared prior to any land-disturbing activity.
Location-Specific			
Endangered Species Act of 1973	16 USC 1531 et seq. 50 CFR 402	Establishes requirements to protect species threatened by extinction and habitats critical to their survival.	TBC The requirements are considered substantive and to be considered at the Boat Basin, Visitors Information Center as a result of the potential for impacts to endangered or threatened species during remedial actions.
Fish and Wildlife Coordination Act	16 USC 661-666; 40 CFR 6.302 [g]	Require consultation when a federal department or agency proposes or authorizes any modification of any stream or other water body; requires adequate provisions for protection of fish and wildlife resources. It also establishes policy for Executive Order 11990, "Protection of Wetlands."	ARAR Potentially applicable, depending on what is found during RI removal activities and whether the removal activities may result in any modification to a water body or wetland. Compliance with this ARAR requires EPA to consult with the U.S. Fish and Wildlife Service.

Table 8-1 Potential ARARs and TBCs (Continued)

Standard, Requirement, Criteria, or Limitation	Citation	Description of Requirement	Comment (Applicable or Relevant and Appropriate Requirement/To Be Considered Criteria)
Virginia Wetlands Mitigation Compensation Policy and Virginia Wetlands Regulations	4 VAC 20-390-10 to 50) and 9 VAC 25-380-10 to 30)	The Virginia Wetlands Mitigation Compensation Policy as promulgated by the Virginia Marine Resources Commission and the Virginia Wetland Regulations as promulgated by the State Water Control Board Virginia in support of the Wetlands Act and the Federal Water Pollution Control Act in 1972 identify situations in which wetland impacts must be mitigated/compensated.	ARAR Both are applicable because of the presence of wetlands in the potential remediation area and the construction activities associated with various remedies could potentially impact the wetlands. If wetlands are impacted, the compensation policy presents specific mitigation procedures to be followed.
Virginia Water Protection Permit Regulations	9 VAC 25-210-10 to 260	Promulgated by the State Water Control Board pursuant to the requirements of the Clean Water Act (33 USC §1251 et seq.) as amended 1987, describes the procedures and requirements to be followed when an activity may impact the physical, chemical, or biological properties of surface waters.	ARAR The requirements are considered substantive and applicable at the Boat Basin, Visitors Information Center as characterization or remedial activities have the potential to alter adjacent surface waters or the elevations of wetlands and floodplains during remedial action construction activities.
Chemical-Specific			
EPA Region 3 Regional Screening Levels (RSLs)	EPA Region 3 website	Media cleanup targets based on human exposure for industrial and residential use scenarios. For a single contaminant in a single medium, under standard default exposure assumptions, the TBC corresponds to the target risk or hazard quotient. However, the RSLs for non-carcinogens are adjusted by a factor or 0.1 in order to account for the cumulative effects of multiple contaminants.	TBC The requirement, criterion, or limitation of screening levels provide health effects information and are to be considered at the Boat Basin, Visitors Information Center.

Table 8-1 Potential ARARs and TBCs (Continued)

Standard, Requirement, Criteria, or Limitation	Citation	Description of Requirement	Comment (Applicable or Relevant and Appropriate Requirement/To Be Considered Criteria)
Site Specific Reference Values	WFF	Establishes site-specific reference values that are 95% upper prediction limit of WFF background soil and groundwater data.	TBC The site-specific reference values are considered related to health effects information and are to be considered at the Boat Basin, Visitors Information Center.
EPA Ecological Soil Screening Levels	EPA website	May aid in determining soil cleanup criteria by calculating ecological receptor exposures to contaminated soil using Biological Technical Assistance Group (BTAG) screening levels (EPA, 2003).	TBC The requirement, criterion, or limitation of screening levels are considered related to health effects information and are to be considered at the Boat Basin, Visitors Information Center.
Safe Drinking Water Act, National Primary Drinking Water Regulations: Maximum Contaminant Levels and Maximum Residual Disinfectant Levels	40 CFR Part 141, Subpart G	Establishes drinking water standards for various chemicals	ARAR The requirements are considered an ARAR for groundwater at the Boat Basin, Visitors Information Center.
Other			
DoD Contractors Safety Manual for Ammunition and Explosives	DoD 4145.26M	Manual provides safety requirements for contractual work involving ammunition and explosives.	ARAR The requirements of this Act are considered substantive and applicable to the Boat Basin, Visitors Information Center because of the potential for activities involving ammunition and explosives.

ARAR – applicable or relevant and appropriate requirement
CFR – Code of Federal Regulations
EPA – U.S. Environmental Protection Agency
TBC – to be considered
WFF – Wallops Flight Facility
USC – United States Code

8.3 IDENTIFICATION OF ENVIRONMENTAL RESOURCES AND EFFECTS

8.3.1 Threatened/Endangered Species

Federal and/or state designated habitat for listed or proposed threatened or endangered (T&E) species is located within the Boat Basin, Visitors Information Center. Threatened species include the loggerhead sea turtle, northeastern beach tiger beetle, piping plover, and seabeach amaranth. Endangered species include the Delmarva Peninsula fox squirrel and roseate tern (HFA, 2012). Threatened and endangered species are noted in the Conceptual Site Model presented in **Appendix A**.

Areas of disturbance will be minimized to the extent possible and the WESTON Project Manager will coordinate with Virginia Department of Game and Inland Fisheries and/or Department of Environmental Quality, as appropriate, regarding the following tasks that could impact the site conditions and potential T&E species:

- Removal of the fence around Pyrotechnics Burn Area. Silt fencing will be installed around this area to mitigate the potential for sediment transport into the adjacent wetland areas.
- For MEC that is safe to relocate, MEC demolition activities will take place in areas of the Boat Basin, Visitors Information Center away from waterways. Silt fencing bolstered by sand bags will be used in the MEC demolition areas to reduce the potential for sediment transport to the waterways and wetland areas.
- Silt fencing will be installed in areas where significant digging is required to investigate an identified anomaly.

8.3.2 Wetlands

There are several types of wetlands present within and adjacent to the Boat Basin, Visitors Information Center as indicated on Figure 2-4 of the SI report (HFA, 2012). The Pyrotechnics Burn Area is located within an Estuarine and Marine Wetland. The South Bank Boat Basin is located in Freshwater Forested/Shrub Wetland. Gun Butt No. 1 and Gun Butt No. 2 border the Estuarine and Marine Wetlands (USFWS, 1998).

WESTON will coordinate with USACE and VDEQ, as necessary, for work within mapped wetlands. WESTON will comply with the substantive requirements of the applicable wetland regulations for any RI project activities that occur within mapped wetlands because permits are not required. Project activities will likely qualify for the substantive requirements of the Nationwide Permit (NWP) #6 for survey and MEC intrusive activities because the total disturbance of wetland areas would not exceed 25 cubic yards and all holes would be fully backfilled.

8.3.3 Surface Water Resources

The nature of the investigation activities described in the RI Work Plan is not expected to adversely impact surface water resources. Project activities will comply with stormwater best management practices (BMPs). BMPs expected will be standard engineering controls to prevent erosion and pollutant runoff, such as hay bales and/or silt fencing, if necessary, depending on the size and type of activity. These materials may not be necessary, depending on the type of activity and the weather, as in the case of temporary land disturbances on dry days, such as at a test pit that is being completed and restored. The areas of disturbance will be minimized to the extent practicable, and stormwater BMPs will be employed as necessary in a manner that prevents the discharge of pollutants into adjacent surface water resources. If project activities occur near surface waters that could potentially be impacted, WESTON will consult USACE to determine and implement appropriate measures of protection.

8.3.4 Vegetation Removal

Limited vegetation removal will be necessary in the Boat Basin, Visitors Information Center to aid survey and investigation activities. Wherever possible and where access permits, brush will be slashed so that it lies close to the ground. Additionally, the brush will be cut as low to the ground as possible. Woody plants with stems greater than 2 inches in diameter will not be treated as brush. Pruning will be considered if necessary to gain access to areas. For woody plants larger than 2 inches, coordination with USACE will be required.

8.3.5 Cultural, Archaeological, and Historical Resources

Cultural and historical resources may exist within the Boat Basin, Visitors Information Center site. There is a potential to encounter undocumented historic and prehistoric materials. An archaeologist (WESTON subcontractor John Milner and Associates) will be mobilized to the site at the onset of the intrusive investigations to provide the field team with specific training on cultural and archaeological site awareness (e.g., identification of potential cultural resources, notification procedures). Upon inadvertent discovery of archaeological artifacts, the ground-disturbing activity must immediately be halted, and the USACE PM must be contacted. It should be noted that no specific artifact recovery protocol will be undertaken by the WESTON field team.

8.4 MITIGATION PROCEDURES

General mitigation procedures are presented below. Specific mitigation requirements will be discussed and documented with USACE and NASA personnel.

8.4.1 Manifesting, Transporting, and Disposing of Wastes

8.4.1.1 Non-Hazardous Wastes

All generated waste will be properly characterized and disposed of under the direction of USACE and in accordance with Virginia Solid Waste regulations and the requirements of the approved Accomack County (or other approved county) disposal facility. It is expected that only non-hazardous material will be generated as a result of the RI for the Boat Basin, Visitors Information Center. All PPE and disposable sampling equipment are considered non-hazardous. PPE and sampling equipment will be placed in a plastic bag and disposed in an appropriate refuse container. Nonhazardous solid waste materials, such as trash and general debris from the trenches, will be removed and transported off-site for disposal, and scrap metal will be recycled through a local recycling firm.

Although MEC is potentially hazardous, once detonated in place or at the designated demolition area, the only remaining material requiring disposal will be scrap metal. WESTON intends to arrange for recycling of all scrap metal. In accordance with 40 CFR 261.6(a)(3), scrap metal, if recycled, is not subject to parts 262-266, or 268, or 270. WESTON will recycle all scrap metal generated as a result of the RI and maintain records of all recycling.

8.4.1.2 Hazardous Wastes

WESTON does not anticipate generating or encountering hazardous wastes during the RI for the Boat Basin, Visitors Information Center. If WESTON encounters any signs of hazardous materials/waste (e.g., containers of used solvents or other hazardous chemicals) other than MEC, WESTON will make appropriate attempts to avoid those areas, and the Program Health and Safety Manager and USACE PM will be notified. If an area is to be avoided based on the conditions stated above, the sample approach will be modified as necessary to meet the RI objectives.

In the unlikely event that hazardous materials and wastes are encountered, they will be stored in authorized containers chemically compatible with the waste (55-gallon or less in size) with a sealable lid; labeled in accordance with applicable regulations; appropriately manifested; and transported in accordance with applicable VDEQ (9 VAC 20-60-261 to 262, 430, and 450 to 480), DOT (49 CFR 178), and EPA regulations (40 CFR 261 and 262). Accumulation, transportation, and disposal of all hazardous waste will be coordinated with USACE. Competent and qualified individuals will be tasked with waste removal.

8.4.2 Security of Hazardous Materials

WESTON personnel will provide security to control the work area. All hazardous materials associated with the project (primarily explosives) will be secured as discussed in Section 6 Explosives Management Plan.

8.4.3 Burning Activities

Burning activities are not planned as part of the RI for the Boat Basin, Visitors Information Center. Potential ignition around the detonation of MEC will be mitigated in accordance with Section 3 and the safety measures presented in the APP. Open fires, such as campfires or fires to dispose of cut brush, will not be permitted during the performance of the RI.

Smoking will be restricted to designated areas or within closed automobiles. Smoking areas will be designated by the UXOSO. In all cases, cigarettes butts and matches must be disposed of either in an automobile ashtray or in a metal can. Cigarette butts and matches may not be tossed from car windows or discarded on the ground surface.

8.4.4 Dust and Emission Control

Project activities such as MEC demolition activities and normal vehicle use are considered minor mobile sources of air emissions and are not anticipated to have any significant effect on air quality. All vehicles and equipment will be in good working order and will meet applicable vehicle emissions requirements.

WESTON will employ procedures such as tamping explosives with earth to reduce the amount of particulates resulting from demolition activities. Although MEC detonation may result in a brief suspension of particulates, they will rapidly settle out of the air. Therefore, the activity is not expected to adversely affect air quality.

8.4.5 Noise Control and Prevention

It is expected that the RI for the Boat Basin, Visitors Information Center will generate two primary sources of noise: noise from mechanical equipment (i.e., trucks) and noise from demolition activities. WESTON will control the noise emissions from mechanical equipment by ensuring that the manufacturer's noise control equipment is in place and functioning (i.e., mufflers). To minimize nuisance noise, equipment will be powered off when not in use.

The second source of noise will be pulse noises resulting from demolition activities. Both tamping the demolition shot with earth and observing weather conditions on the day of the shot will control the pulse noise. For example, a day with a low cloud ceiling will transmit the nuisance noise more effectively than a clear day. To reduce the nuisance noise on a cloudy day, various options, including possibilities such as not conducting the demolition shot, waiting for a shift in the prevailing winds, reducing the net explosive weight of the shot, or some combination of controls, will be assessed. The SUXOS and the Demolition Supervisor will determine the applicable method of noise control.

Because noise generated by project activities will be limited to infrequent pulses that are short in duration, WESTON does not anticipate adverse impacts to resident fauna. It is expected that fauna will temporarily avoid areas where noise is being generated until the activities have ceased.

8.4.6 Spill Control and Prevention

WESTON anticipates that unleaded gasoline, diesel fuel No. 2, hydraulic fluid, motor oil, and various acidic/basic calibration solutions and preservatives will be the only substances with hazardous constituents that may be stored on-site, and will be in quantities less than 5 gallons. To decrease the amount of pollutants to be stored on-site, WESTON plans, to the greatest extent possible, to conduct all fueling and repair of vehicles off-site.

Hazardous liquids that are necessary to conduct the field activities will be stored in the smallest quantities possible. Should the storage of hazardous waste, or materials with hazardous constituents be necessary, a storage tank constructed primarily of non-earthen materials, or a stationary device designed to contain an accumulation of hazardous waste would be placed within an approved secondary containment of adequate size to contain a spill (110% of storage tank size). The tank would be managed in accordance with the APP and 40 CFR Subpart I.

Because of the nature of the operations, the potential for a spill of pollutants during operations is low. The highest probability for a spill will occur during re-fueling operations of equipment. In the event of a spill, WESTON will notify appropriate emergency responders. USACE would complete any required notifications to VDEQ. Additionally, WESTON will be equipped with spill kits on-site for immediate cleanup if a petroleum product is inadvertently spilled. Any spills originating from small containers (e.g., gasoline cans) would be contained using absorbent materials.

If fuel or oil is spilled, the following measures will be taken:

- The spill area will be isolated and contained.
- USACE, WFF Fire Department spill response team, and VDEQ Emergency Response will be notified during a spill response.
- The liquid and affected soil will be shoveled into a plastic bag and subsequently placed into a DOT-approved shipping container.
- Each container will be labeled to identify its contents.

- The container(s) will be shipped off-site and disposed of at a permitted facility in accordance with the Code of Federal Regulations 260 – 270 and 9 Virginia Administrative Code (VAC) 20-80.

8.4.7 Storage Areas and Temporary Facilities

Storage of materials will be in a designated on-site area approved by USACE and NASA. Scrap metal will be containerized and stored in roll-offs and will be disposed of off-site at the conclusion of the project. WESTON does not anticipate the construction or use of a temporary storage area for hazardous materials. Temporary storage of fuel containers will be in vehicles. Unless directed by the USACE PM to do otherwise, all temporary facilities erected by WESTON to execute the field activities will be removed during demobilization.

8.4.8 Access Routes

WESTON will use county and private community roads to gain access to various portions of the Boat Basin, Visitors Information Center. No environmental impact is anticipated from the use of existing roads because these city and private roads are used by the general public and private residents.

8.4.9 Vegetation Protection and Restoration

WESTON shall take all actions necessary to protect and prevent unnecessary damage to vegetation. WESTON personnel will disturb only the vegetation necessary for safe and effective access for investigation activities. WESTON will work in close coordination with USACE to ensure that impacts on all rare and protected floral and faunal species will be avoided to the greatest extent practicable. Because of the limited vegetation removal activities planned in the Boat Basin, Visitors Information Center, no tree or shrub restoration is planned after investigation activities are completed.

8.4.10 Site Water Run-on and Runoff

Run-on and runoff water controls are not necessary because there is no expectation that contaminated soils, water, or waste are present on-site, or that such materials will be generated while activities are conducted. Project activities will comply with stormwater management BMPs. Additionally, project activities will be conducted in a manner that prevents the discharge of pollutants into adjacent waterways; waste disposal will be at an off-site facility. WESTON will consult with USACE to determine and implement appropriate measures of protection for any areas where there are adjacent wetlands; i.e., sandbags or other barrier devices could be used to prevent the spread of potentially contaminated soil or water.

8.4.11 Decontamination Procedures

All operations for the MEC portions of the RI for the Boat Basin, Visitors Information Center will be conducted in Level D PPE. No decontamination of personnel is anticipated to be performed. All PPE are considered non-hazardous. As such, PPE will be placed in a plastic bag, disposed of in an appropriate refuse container, and transported off-site for disposal through the municipal waste system. Equipment used for MC sampling will not require decontamination in accordance with the UFP QAPP (**Appendix H**). Equipment and vehicles used for other aspects of the RI field efforts are not expected to require decontamination.

8.4.12 Minimizing Areas of Disturbance

To the greatest extent practicable, all activities associated with the project will be conducted in a manner that will avoid and minimize impacts to land resources both within and outside of the project boundaries. Impacts will be minimized by staging equipment in the parking lot area or in areas already cleared. The area of soil that will be disturbed is not anticipated to be above the threshold that requires an erosion and sediment control plan.

8.5 POST-ACTIVITY SITE RESTORATION

All wastes will be removed from the site immediately upon completion of each day’s field activities. Therefore, no post–activity cleanup should be required. A post–activity inspection will be conducted by the SUXOS and the UXOQCS to ensure the location is left clean.

Restoration activities will be approved prior to releasing WESTON from the contract. Restoration activities will include backfilling of test pits. Original topography will be restored unless otherwise instructed by USACE and NASA site representatives. Disturbed areas will not be reseeded; however, sod will be replaced where applicable. USACE PM approval will be obtained, and the restored areas will be visually inspected immediately after the site restoration is completed.

8.6 AIR MONITORING

No air monitoring will be performed for the activities planned during the RI for the Boat Basin, Visitors Information Center. WESTON does not anticipate finding HTRW-related contamination that would require air sampling. Additionally, toxic vapor screening results from previous investigations conducted at WFF FUDS do not indicate the presence of airborne contaminants above occupational exposure levels. If conditions change, the APP and associated Activity Hazard Analyses and SSHP will be amended.

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APPENDIX A

CONCEPTUAL SITE MODEL

APPENDIX A
CONCEPTUAL SITE MODEL

The Conceptual Site Model (CSM) is a description of a site and its environment that is based on existing knowledge. The CSM describes sources of environmental contaminants or munitions and explosives of concern (MEC) hazards at a site, actual or potential pathways, current or proposed use of property, and potential receptors to contaminants or hazards. The CSM, which is depicted in **Figure A-1,** provides a planning tool to integrate site information from a variety of sources, to evaluate the information with respect to project objectives and data needs, and to respond through an iterative process for further data collection or action. The CSM development should be viewed as a process that reflects the progress of activities at a site from initial assessment through site closeout. The CSM developed during the Site Inspection (SI) by Human Factors Applications, Inc. (HFA), a wholly-owned subsidiary of TerranearPMC, LLC (TPMC) (HMA/TPMC, 2012) and updated here for the Boat Basin, Visitors Information Center is described in the following sections.

A.1 AREA AND LAYOUT

The Boat Basin, Visitors Information Center is located within the Wallops Flight Facility (WFF), Virginia. WFF is located in Accomack County on the eastern shore of the Commonwealth of Virginia and consists of three separate areas: Main Base, Wallops Island, and Wallops Mainland. The Boat Basin, Visitors Information Center encompasses approximately 1.53 acres of land that includes four areas: Pyrotechnics Burn Area, Gun Butt Nos. 1 and 2, and South Bank Boat Basin.

The Pyrotechnics Burn Area is an approximately 20 foot by 25 foot fenced-in area formerly used by the Navy to dispose of parachute flares and practice bomb signals, possibly using trinitrotoluene (TNT) blocks or flammable material such as wood or coke (USACE, 2010). Gun Butt No. 1 was constructed in 1952 and used to test and perfect the use of medium-caliber (20 millimeter (mm) – 37mm) aviation guns and ammunition. Gun Butt No. 2 was constructed in 1952 and, similar to Gun Butt No. 1, was used to test and perfect the use of medium caliber (20mm and 37mm) aviation guns and ammunition.

Prior to construction of the gun butts, the marsh area in front of the cell provided an ideal unobstructed overland range. Experimental testing of aircraft gun-type weapons, associated accessories, and lot proof testing of non-explosive aircraft ammunition was performed at the Test Cell/Gun Laboratory Range Area (USACE, 2005b). By design and plan, explosive ammunition was not fired at the Test Cell/Gun Laboratory Range Area.

The South Bank Boat Basin has had no known munitions use; however, numerous munitions items have been observed in the South Bank Boat Basin area.

A.2 BOUNDARIES

The study area is situated on the Atlantic Coast of the Delmarva Peninsula, approximately 5 miles south of the Maryland/Virginia state boundary, west of Chincoteague Island. Wallops Island and Wallops Mainland are located approximately 7.5 miles south-southeast of the Main Base. The Main Base, which is approximately 2,230 acres, is bordered on the east by extensive marshland, swales, and tidal creeks, including Cedar Creek and Simoneaston Bay, which drain into Chincoteague Bay and Chincoteague Inlet. The Main Base is bordered to the north and west by Little Mosquito Creek. State Routes 175 and 798 form the southern and southeastern borders of the Main Base.

A.3 DEMOGRAPHICS AND LAND USE

According to a 2010 census estimate, Accomack County, VA, had a total population of 33,164, with 73.8 persons per square mile. The Town of Chincoteague, nearest to WFF, has a total estimated population of 2,941. The current land use in the Boat Basin, Visitors Information Center consists of recreation, education, and wildlife preservation. Accomack County is the largest county in Virginia and is comprised of 455 square miles of land and 855 square miles of water.

The Wallops Island National Wildlife Refuge (part of the WFF) is a National Wildlife Refuge located on Wallops Island, Virginia. The refuge was created on 10 July 1975, with the transfer of 373 acres of land from the National Aeronautics and Space Administration (NASA), and along with Chincoteague National Wildlife Refuge, is administered by the United States Fish and Wildlife Service. Much of the property is marshy, and there is also a sea-level fen on the island. The refuge was opened to public deer hunting in 2002 in an attempt to control local animal populations.

A.4 STRUCTURES

The Wallops Visitors Information Center has a variety of hands-on exhibits and a main structure. The Boat Basin consists of a fenced area and a boat ramp. The WFF Research Airport is located on the Main Base, west of the Boat Basin, Visitors Information Center. There are three runways (from 4,810 feet to 8,750 feet long), two taxiways, three ramps, and one hazardous cargo loading area in active service. Two ramps adjoin the two active hangars, and a third ramp adjoins the Crash, Fire and Rescue building. The primary research runway has a test section with a variety of surface textures and materials for runway research projects.

A.5 UTILITIES

Electric, water, and sewer serve the Visitors Information Center.

A.6 GEOGRAPHY

The Boat Basin, Visitors Information Center is located along the Virginia coast less than 2 miles southwest of the Chincoteague Bay within the Coastal Plain physiographic province, which is characterized by low relief and surface streams emptying to marshy inlets. There are several types of wetlands present within and adjacent to the Boat Basin, Visitors Information Center. The Pyrotechnics Burn Area is located within an Estuarine and Marine Wetland and the South Bank Boat Basin is located in Freshwater Forested/Shrub Wetland. Gun Butt No. 1 and Gun Butt No. 2 border the Estuarine and Marine Wetlands (USFWS, 1998).

A.7 PHYSICAL PROFILE

The physical profile presented below was compiled from information provided in the SI Report (HFA/TPMC, 2012).

A.7.1 Climate

The climate of the Virginia coast is moderated by the nearby ocean. The coldest month is January with a mean normal temperature of 36.3 degrees Fahrenheit (°F), and the warmest month is July with a mean normal temperature of 76.3 °F. The annual precipitation normal is 40.4 inches with precipitation occurring approximately equally per month throughout the year.

A.7.2 Geology

The Boat Basin, Visitors Information Center is located along the Virginia coast less than 2 miles southwest of the Chincoteague Bay within the Coastal Plain physiographic province, which is characterized by low relief and surface streams emptying to marshy inlets. The elevation of the Coastal Plain province is commonly less than 100 ft above mean sea level (msl) but can exceed 200 ft above msl. Beach and marsh deposits of the Quaternary Period shape the landscape underlying the WFF. Beneath the Quaternary deposits lies the 400-ft-thick Miocene age Calvert formation, which is a bluish gray sandy silt. Below that lies the green, fine to coarse, glauconitic (20 to 40% glauconite), quartz sand of the Piney Point formation and the greenish to dark gray silts and clays of the Pamunkey formation. Bedrock is located approximately 4,500 ft beneath the surface.

A.7.3 Topography

The topography of the Boat Basin, Visitors Information Center is generally low and flat with elevations ranging from 0 to 5 ft above msl. A shallow drainage swale separates the two former gun butt areas, and they are bordered by wetlands to the south and east. The South Bank Boat Basin and Pyrotechnics Burn Area are forested with deciduous or evergreen trees and also contain wetland vegetation.

A.7.4 Soil

The soil series at the Boat Basin, Visitors Information Center site include the Molena loamy sand (Gun Butt No. 1 and 2), Magotha fine sandy loam (Pyrotechnics Burn Area), and Udorthent and Udipsamment soils (South Bank Boat Basin). The Molena soil series is very deep, rarely flooded, and well drained. The Magotha soil series is very deep, frequently flooded, poorly drained, and typically found in salt marshes ranging from 0-2% slope. The Udorthent and Udipsamment soils are rarely flooded and well drained.

A.7.5 Hydrogeology

The groundwater at the Boat Basin, Visitors Information Center site generally flows to the southeast toward the nearby Mosquito Creek and wetland areas. The water table at the Main

Base ranges from depths of 0 to 30 ft below ground surface (bgs) and is generally recharged by surface waters or infiltration of precipitation.

There are four major aquifers at the eastern shore of Virginia: the Pleistocene aquifer (Columbia Group) and the three separate units (upper, middle, and lower) of Miocene aquifers in the Yorktown Formation. Wind-deposited beach sands, silts, and gravel typically overlie the unconfined Columbia aquifer, also known as the water table aquifer. The Columbia aquifer is located between 5 and 60 ft bgs. The Pleistocene aquifer is separated from the Miocene aquifer by a 20 to 30 ft confining layer (aquitard) of clay silt. The shallowest confined Miocene aquifer of the Yorktown Formation at WFF occurs at depths of approximately 100 ft bgs. The Miocene aquifers are classified as the upper, the middle, and the lower Miocene aquifers. Each Miocene aquifer is overlain by the upper, middle, and lower Miocene confining units.

A.7.6 Vegetation

The Pyrotechnics Burn Area is located within an Estuarine and Marine Wetland, and the South Bank Boat Basin is located in Freshwater Forested/Shrub Wetland. Gun Butt No. 1 and Gun Butt No. 2 border the Estuarine and Marine Wetlands (USFWS, 1998).

A.7.7 Beneficial Resources

Groundwater is the only source for drinking, agricultural, and process water within the WFF area. This is generally true for a large portion of the eastern shore of Virginia. Because of the reliance on groundwater and the coastal proximity of the area, the Commonwealth of Virginia has declared the eastern shore of Virginia a Critical Groundwater Area. The withdrawal of groundwater from the area, including Accomack County, is controlled through the issuance of withdrawal permits under the Virginia Groundwater Management Act. The State Water Control Board, in consultation with local planning commissions and the Department of Health, administers the permitting program and allocates groundwater withdrawal volumes as part of the permitting process. Groundwater withdrawal permits are required for withdrawals that equal or exceed 10,000 gallons per day (gpd) or 300,000 gallons per month (gpm). Withdrawals below the regulated amount, such as a typical single-family home withdrawal, are not permitted (TetraTech NUS, 2004b).

WFF operates and maintains its own permitted water supply system that includes five wells (WW01-WW05) actively used to withdraw water from the Yorktown Formation. The wells are approximately 0.75 mile to the west and southwest of the Boat Basin, Visitors Information Center. In addition, the Town of Chincoteague operates water supply wells located on Main Base property and eight public water supply (PWS) wells (TOC_3A, TOC_3B, TOC_3C, TOC_4, TOC_5, TOC_6, TOC_7A, and TOC_7B) located along the eastern boundary of the Main Base property. The closest PWS well to the Boat Basin, Visitors Information Center is located approximately 0.75 mile to the west. Three of the Town of Chincoteague wells are shallow wells drilled into the Columbia aquifer.

The Town of Chincoteague PWS wells are located less than 500 feet from the Boat Basin, Visitors Information Center and are monitored by NASA as part of their remediation effort at the tank farm. WFF conducts quarterly monitoring of the Town of Chincoteague (TOC) drinking water supply wells TOC 3B and TOC 3C for benzene, toluene, ethylbenzene xylenes (BETX) and lead (NASA, 2010). The remainder of the Chincoteague production wells are not monitored individually; rather, the Town monitors water withdrawn from all of the wells after it is blended at the raw water sampling point located across the causeway in Chincoteague proper. The remaining five Town of Chincoteague wells are deeper wells installed in the Yorktown aquifer (TetraTech NUS, 2004b). These five wells are sampled and monitored on a regular basis under the drinking water program.

A.7.8 Security

The Visitor Information Center is open to the general public, and several rockets are on display on the surrounding grounds. There are no access restrictions to prevent visitors from accessing Gun Butts No. 1 and 2. The South Bank Boat Basin and the Pyrotechnics Burn Area are surrounded by fences and are not easily accessible to the general public. However, the boat basin is still in use occasionally by NASA and the Marine Science Consortium.

A.8 EXPOSURE PROFILE

A.8.1 Human Receptors

Human receptors within the Boat Basin, Visitors Information Center are primarily the following:

- Recreationists (adult/child), including hunters, fishermen, cyclists, joggers, boaters, swimmers, and hikers.
- Residents (adult/child).
- Industrial and commercial users.
- Construction workers.
- Road and utility maintenance personnel.

There are no anticipated changes in future human receptors within the Boat Basin, Visitors Information Center.

A.8.2 Ecological Receptors

Table A-1 presents the ecological profile for the Boat Basin, Visitors Information Center, and includes federal and/or state listed species of concern, threatened, and/or endangered species known to occur and/or to potentially occur within the Boat Basin, Visitors Information Center. Various birds, terrestrial small mammals, invertebrates, flora, terrestrial fauna, and domestic animals also occur within the Boat Basin, Visitors Information Center.

Table A-1 Ecological Profile

<table>
<tr><th>Habitat Type</th><th>Degree of Disturbance</th><th>Ecological Receptors*</th></tr>
<tr><td>Mixed Forest</td><td rowspan="3">Limited disturbance in select areas due to maintenance of roadways, utilities, and facility structures.</td><td rowspan="3">1 Plant: Seabeach amaranth
1 Mammalia: Delmarva Peninsula Fox Squirrel
2 Birds: Piping Plover and Roseate Tern
1 Insect: Northeastern Beach Tiger Beetle
1 Marine Reptile: Loggerhead Sea Turtle</td></tr>
<tr><td>Freshwater forested/ shrub wetlands</td></tr>
<tr><td>Freshwater emergent wetland</td></tr>
</table>

* Federal and/or state listed species of concern, threatened, and/or endangered species known to occur and/or to potentially occur within the Boat Basin, Visitors Information Center.

A.9 MUNITIONS/RELEASE PROFILE

The Pyrotechnics Burn Area is an approximately 20 foot by 25 foot fenced-in area formerly used by the Navy to dispose of parachute flares and practice bomb signals, using either gasoline or TNT.

Gun Butt No. 1 was constructed in 1952 and used to test and perfect the use of medium-caliber (20 mm and 37mm) aviation guns and ammunition. The test range included a firing point and a concrete impact berm filled with sand or soil. Aircraft guns fired medium-caliber ammunition from Building (Bldg.) J-8 (firing point) into the impact berm (Bldg. J-130) located approximately 350 feet to the southeast of the firing point.

Gun Butt No. 2 was constructed in 1952 and, similar to Gun Butt No. 1, was used to test and perfect the use of medium caliber (20mm – 37mm) aviation guns and ammunition. The test range included a firing point and a concrete impact berm filled with sand or soil. Aircraft guns fired medium-caliber ammunition from Bldg. J-17 (firing point) into the impact bunker (Bldg. J-18), which was located approximately 150 feet to the south of the firing point.

Prior to construction of the gun butts, the marsh area in front of the cell provided an ideal unobstructed overland range (USACE, 2005b). Experimental testing of aircraft gun-type weapons, associated accessories, and lot proof testing of non-explosive aircraft ammunition was performed at the Test Cell/Gun Laboratory Range Area. By design and plan, explosive ammunition was not fired at the Test Cell/Gun Laboratory Range Area.

The South Bank Boat Basin has had no known munitions use; however, numerous munitions items have been observed in the South Bank Boat Basin area.

A.9.1 Associated Munitions Constituents

MC samples were collected for munitions constituents (MC) analysis during the SI (HMA/TPMC, 2012). However, no explosive constituents, perchlorate, or polynuclear aromatic hydrocarbons (PAHs) were detected at concentrations above their respective screening levels. Several metals were detected above their respective screening levels in samples, including iron in surface soil, subsurface soil, and groundwater; aluminum in subsurface soil; and antimony in groundwater. Based on the SI, suspected MC associated with the Boat Basin, Visitors Information Center may include various explosive compounds, metals, inorganic ions, and semivolatile organic compounds.

A.9.2 Transport Mechanisms/Migration Routes

The primary transport mechanisms and their viability and potential significance at the Boat Basin, Visitors Information Center include soil disturbance and infiltration.

Soil Disturbance - Surface and subsurface disturbances can lead to transport and migration of MC from one environmental medium to another (soil to surface or groundwater or both, soil to dust, soil to sediment) through surface water runoff, erosion, infiltration, excavation, and natural forces (i.e., wind). The Boat Basin, Visitors Information Center likely will not experience future soil disturbance associated with development. Although land development may occur, the region is primarily rural, and the area surrounding the Boat Basin, Visitors Information Center includes wildlife refuge.

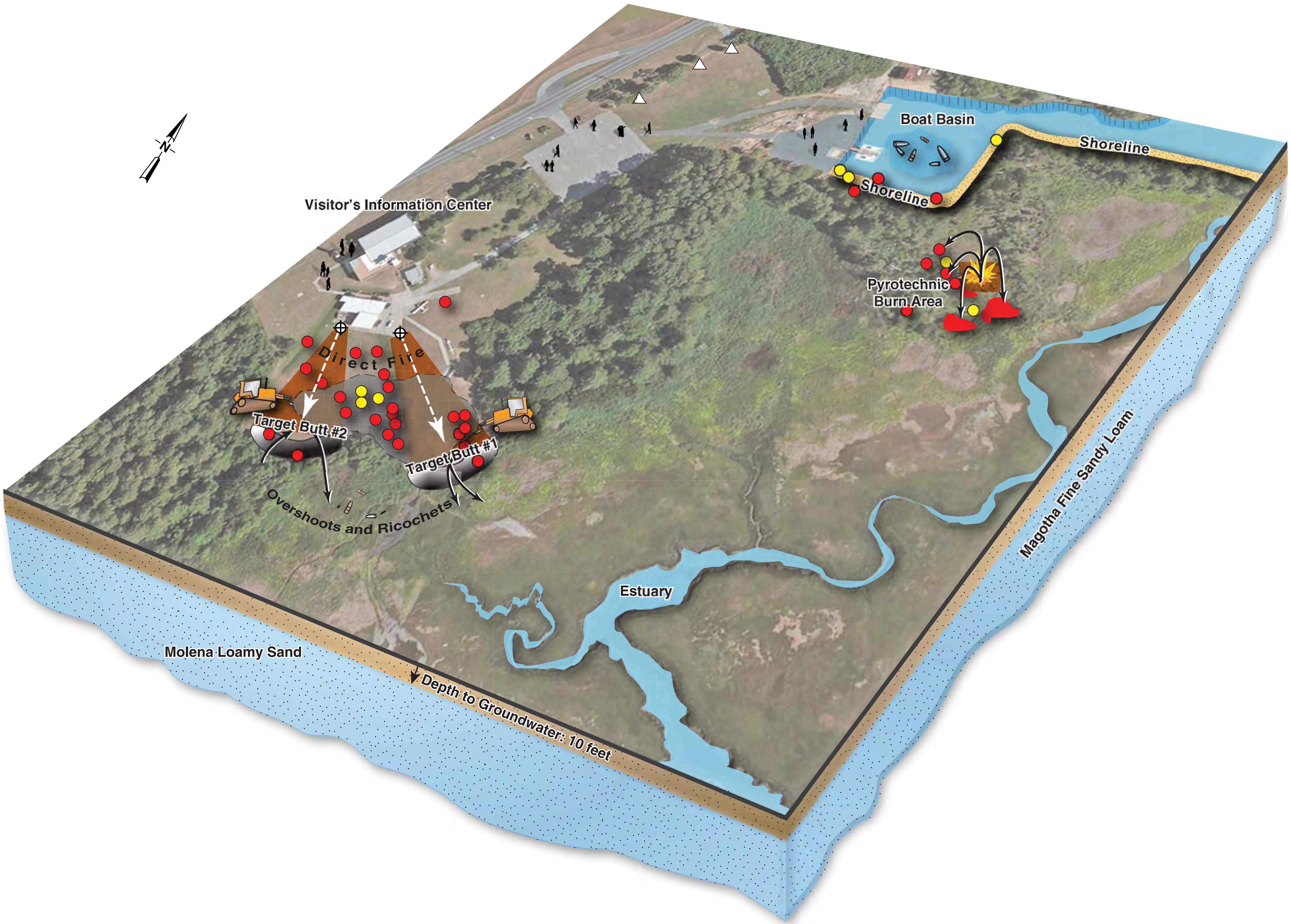
Infiltration - Based on the sandy nature of the soils underlying the WFF, particularly the Boat Basin, Visitors Information Center itself, and the shallow depth of groundwater (0 to 30 ft bgs), there is the potential for MC migration to shallow groundwater.

A.10 PATHWAY ANALYSIS

Based on MEC identified during the SI (HMA/TPMC, 2012) and current land use, there is the potential for MEC exposure at the Boat Basin, Visitors Information Center (**Figure A-2**). Potential human exposure to MEC primarily involves walking upon or collecting/handling surface MEC. Another possible MEC exposure pathway is contact with MEC during construction or underground utility activities involving excavation. When MEC is unearthed and moved, it could become more accessible to physical contact by flora and fauna and by residential, industrial, and recreational users who would not come in contact with the MEC item(s) if these items remain buried.

Insufficient sampling has been conducted within the Boat Basin, Visitors Information Center to fully evaluate the presence or absences of MC. An MC pathway analysis addresses: 1) potential human exposure to MC via the food chain, surface water/sediment, groundwater, surface and subsurface soil, and 2) biota exposure to MC.

The exposure pathway analysis is based on previous investigations (**Figure A-3**). It is subject to change and will be revised during the RI as more data become available.



Legend

Areas of Concentrated Anomalies

Subsurface Anomaly

Surface Anomaly

Concrete Target Butt

Fixed Firing Point

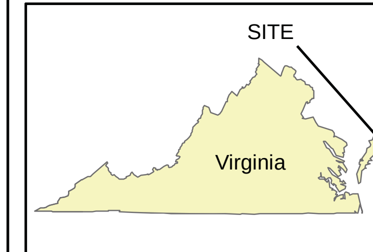
Pyrotechnic Burn Area (Potential Kickouts)

Graded Soils from Target Butts

Supply Well (Approximate Location)

Imagery Source: ESRI, Bing Mapping Service, 2011

Coordinate System: WGS 1984 UTM Zone 18 N Feet



Prepared By:

Baltimore District

Norfolk District

Figure A-1

Conceptual Site Model

Project 7 Boat Basin,

Visitors Information Center

Wallops Island, VA

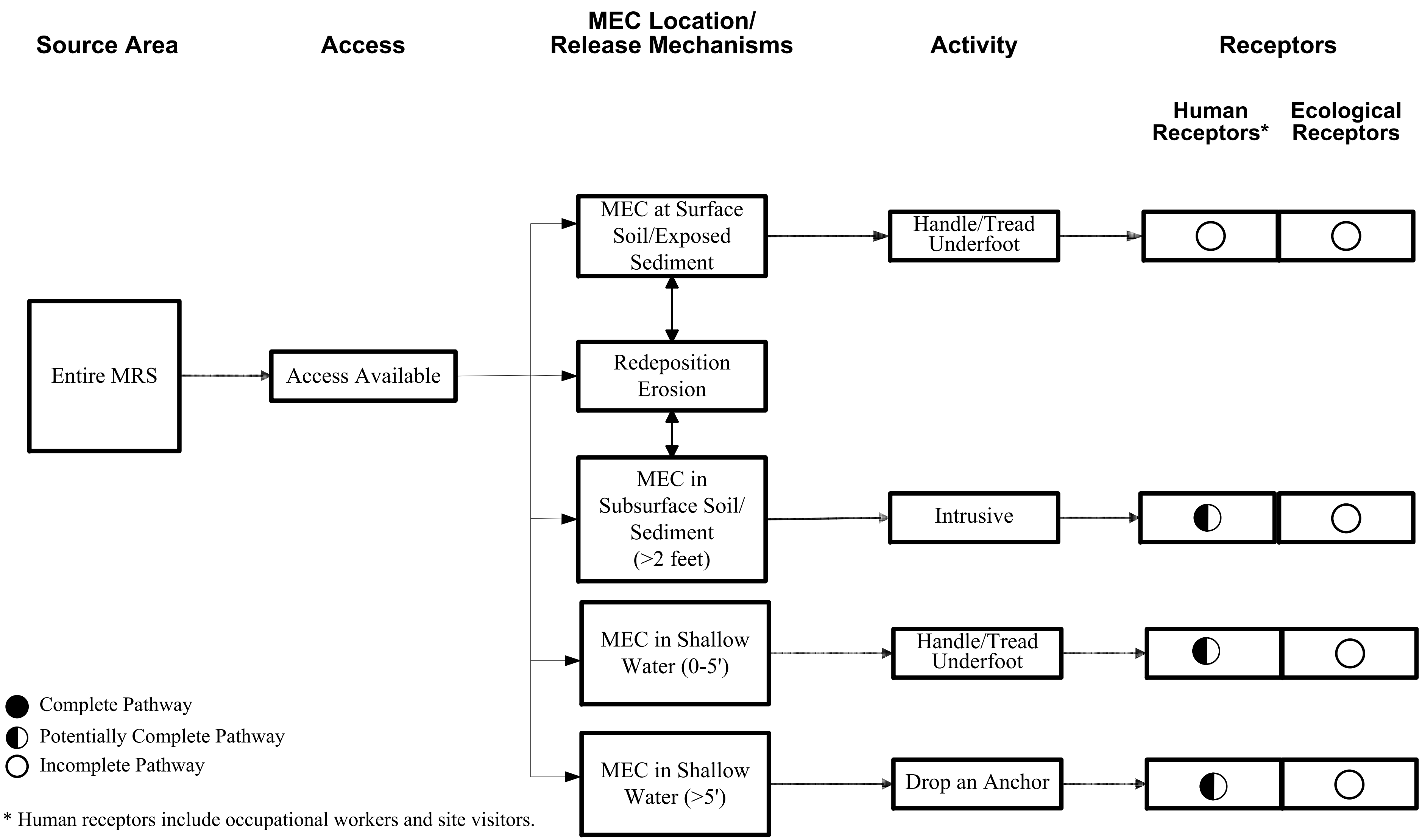
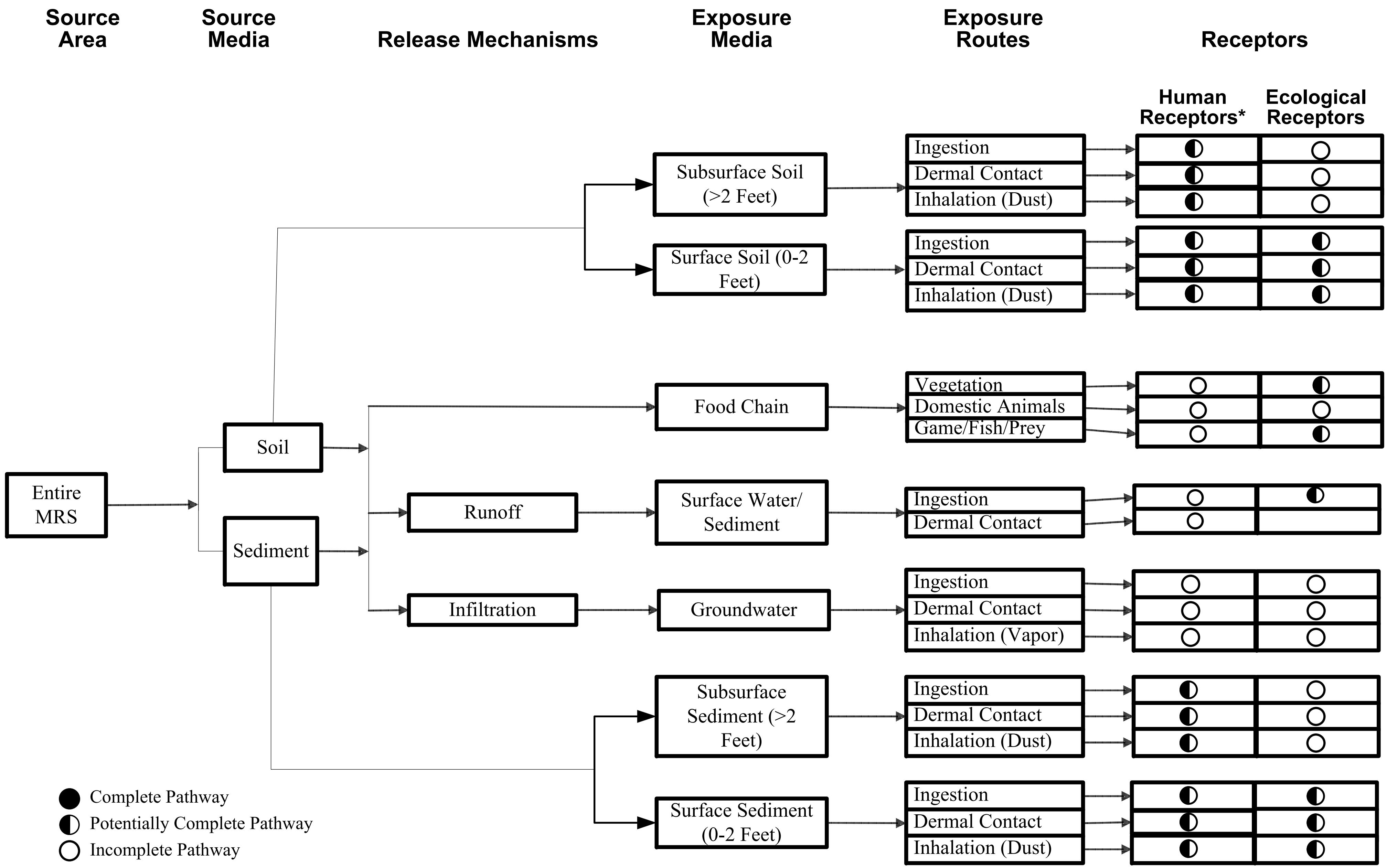


Figure A-2
MEC Exposure Pathway Analysis
Entire MRS
Project 7 Boat Basin, Visitors Information Center MRS



* Human receptors include occupational workers and site visitors.

Figure A-3
MC Exposure Pathway Analysis
Entire MRS
Project 7 Boat Basin, Visitors Information Center MRS

Boat Basin_MCExpPath_020414.vsd

APPENDIX B

PREVIOUS INVESTIGATION REPORTS

VISITOR CENTER UNEXPLODED ORDNANCE CLEARANCE REPORT, NASA WALLOPS FLIGHT FACILITY, WALLOPS ISLAND, VIRGINIA (TETRA TECH, 2006)

22.02.00.0014
0335

TETRA TECH NUS, INC.
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PHIL-20060

May 3, 2006

Project Number 00086

Ms. Carolyn Turner
NASA Goddard Space Flight Center
Wallops Flight Facility
Building F-160 Code 250.W
Wallops Island, Virginia 23337

Reference: CLEAN Contract No. N62472-03-D-0057
Contract Task Order (CTO) No. 036

Subject: Final Visitor Center Unexploded Ordnance (UXO) Clearance Report
National Aeronautics and Space Administration (NASA)
Wallops Flight Facility (WFF)
Wallops Island, Virginia

Dear Ms. Turner:

Tetra Tech NUS, Incorporated (TtNUS) is pleased to submit the enclosed final document. The report summarizes the UXO clearance project activities, details the investigation findings, and provides recommendations for future land use restrictions. I have enclosed 8 copies of the report for your use and distribution. If you have any questions or wish to discuss the enclosed, please contact me.

Respectfully,

Garth Glenn
Senior Project Manager

GG/vh

c: T.J. Meyer (NASA)
Jim Colter (Navy)
Roger Boucher (Navy w/o enclosures)
Project File

22.02.00.0014
0335

VISITOR CENTER UNEXPLODED ORDNANCE (UXO) CLEARANCE REPORT

NASA Wallops Flight Facility

Wallops Island, Virginia

National Aeronautics and Space Administration
Wallops Flight Facility
Wallops Island, Virginia

Contract Number N62472-03-D-0057
Contract Task Order 036

May 2006

TETRA TECH NUS, INC.

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Visitor Center
Unexploded Ordnance (UXO)
Clearance Report
NASA Wallops Flight Facility,
Wallops Island, Virginia

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TABLE OF CONTENTS

FIGURES

ACRONYMS

ASR	Archive Search Report
CLEAN	Comprehensive Long-Term Environmental Action Navy
CTO	Contract Task Order
CVM	Cesium Vapor Magnetometer
DOD	Department of Defense
EM-61	Geonics EM61-MK2 Time Domain Electromagnetic Metal Detector
FOL	Field Operations Leader
FURB	Facility Utilization Review Board
Geosoft	Geosoft Oasis Montaj
GPO	Geophysical Prove-out
GPS	Global Positioning System
MEC	Munitions and explosives of concerns
mm	Millimeter
MPPEH	Munitions Potentially Presenting an Explosive Hazard
NASA	National Aeronautics and Space Administration
Navy	United States Navy
POC	Point of Contact
QA	Quality Assurance
QC	Quality Control
SUXOS	Senior Unexploded Ordnance Supervisor
TtEMI	Tetra Tech EMI
TtNUS	Tetra Tech NUS, Inc.
USACE	U.S. Army Corps of Engineers
UXO	Unexploded Ordnance
WFF	Wallops Flight Facility

1.0 INTRODUCTION

This Unexploded Ordnance (UXO) Clearance Report was prepared by Tetra Tech NUS, Incorporated (TtNUS) for the National Aeronautics and Space Administration (NASA) under the Comprehensive Long-Term Environmental Action Navy (CLEAN) Contract number N62472-03-D-0057, Contract Task Order (CTO) 036. The report describes the UXO clearance activities conducted at the NASA Wallops Flight Facility (WFF) Visitor Center complex and presents conclusions and recommendations for future land use. The objective of the clearance activities was to locate, identify and remove UXO and Munitions Potentially Presenting an Explosive Hazard (MPPEH) from the top 12 inches (1 foot) of soil at the Visitor Center. The clearance activity was performed in accordance with the approved Final Work Plan and Site-Specific Safety and Health Plan (TtNUS, 2006a and TtNUS 2006b).

1.1 SITE DESCRIPTION AND BACKGROUND

1.1.1 Site Description

The NASA WFF is located in northeast Accomack County Virginia, near the Town of Chincoteague, see Figure 1-1. The NASA WFF Visitor Center complex is located east of and across Route 175 from the NASA Main Base. The Visitor Center complex consists of several buildings used for displays, educational classes and offices, outdoor displays including rockets and planes, a parking lot, picnic tables, and an open mowed lawn (see Figure 1-2). NASA obtained ownership of the property in 1959 through a property transfer from the United States Navy (Navy). NASA recently became aware of historical uses of the property that included the use of the area as a Department of Defense (DOD) munitions test range from 1948 through 1959. The area previously used for these purposes currently consists of an open mowed grass lawn to the south and southeast of the Visitor Center buildings.

1.1.2 Site Background

In 2005, NASA funded the U. S. Army Corps of Engineers St. Louis District (USACE) to conduct an Archive Search Report (ASR) to investigate and document past historical uses of the Visitor Center complex area. The USACE completed the ASR in 2005 and concluded that archival information indicated that the Visitor Center area was used as a range for munitions testing by the Navy and related DOD agencies from 1948 through 1959 (USACE, 2005). The area of concern was used during that time to ground test aircraft guns and ammunition and included two firing points and two firing butts (see Figure 1-2). The test range was also used as a Test Cell during this period to test newly produced fused munitions and machine guns. Available information indicates that 20 millimeter (mm) and 30mm rounds were tested at the facility. The archival information does not indicate if the munitions were "live" (fully charged) or armed with fuses only. An approximate 4-acre portion of the open lawn, starting about 200 feet from the building complex and extending to the east to a wetland, is the former location of the Test Cell and the firing lanes and firing-in butts. This area was inspected during the performance of a Site Assessment in 1991 and it was reported that "a large number of spent 20mm practice rounds" were found scattered in the area of one of the former firing in-butts (Metcalf & Eddy, 1991). During a subsequent visual property inspection conducted from April 4 through April 8, 2005 as part of the ASR, six spent 20mm rounds were found in the vicinity east of the display rockets, approximately 400 feet southeast of the Visitor Center (USACE, 2005).

In response to the findings in 2005, NASA erected a temporary fence to isolate and control access to the area east of the outdoor displays. The area between the temporary fence and the buildings was later walked during a site visit by TtNUS and NASA and several more 20mm projectiles were observed near the buildings. Because of this observation, NASA expanded the restricted area and erected another temporary fence to restrict access to the entire lawn area south and southeast of the Visitors Center. Based on the findings in the ASR and the site walks, NASA determined that the area potentially presented a safety hazard that could constitute an imminent and substantial endangerment to WFF personnel and others using the Visitor Center complex. To address these immediate concerns, NASA requested that TtNUS conduct a UXO sweep and clearance of the area to a depth of 12 inches.

1.2 REPORT ORGANIZATION

This report provides information on the approach used in conducting UXO removal/clearance activities at the site and presents the results and findings of those activities. The report consists of three sections. Section 1.0 provides this introduction and summary of the site background information. Section 2.0 presents a detailed discussion of the field activities and findings. Section 3.0 provides conclusions and recommendations for future site use.

2.0 CHRONOLOGY OF UXO CLEARANCE ACTIONS

UXO removal/clearance activities were conducted at the Visitor Center site from January 26, 2006 through February 23, 2006. The clearance activities were performed in the following sequence:

- Project Initiation/Site Preparation - This initial phase of the project included establishing Points-of-Contact (POC) and the chain of command for coordination and communication during the project, determination of the final clearance area, setup of the grid system, and obtaining underground utility mark-out/ clearance at the site.

- Geophysical Prove-out - Geophysical Prove-Out (GPO) area was established and "seeded" with known surrogate ordnance items to test and evaluate geophysical instrumentation and techniques to be applied to the study area. Data collected from the survey of the GPO was used to select the instrumentation and techniques most appropriate to the Visitor Center complex study area.

- Site Grid - A site grid/numbering system was established to be utilized for surface and subsurface UXO clearance operations at the site.

- Surface Clearance - The ground surface at the Visitor Center was surveyed by UXO Technicians. During this survey, UXO items and other metal debris located on or near the surface were cleared and removed from the site.

- Geophysical Survey - Following completion of the surface clearance, a geophysical survey of the site area was conducted. Data from the survey were downloaded daily, processed overnight, and presented to the site and project geophysicists for evaluation and interpretation. The results were plotted and suspect UXO targets were identified and provided to the UXO team.

- Reacquisition and Intrusive Operations - After the geophysical data were reviewed and plotted, each potential target or anomaly was assigned a unique number, reacquired in the field, and investigated through hand excavation. Items identified through this intrusive investigation were inspected, removed from the site, and stored/treated for disposal.

- Explosives Handling - Explosive materials for treating UXO cleared from the Visitor Center Site were stored, inventoried, and managed at the NASA Main Base. Materials removed from inventory for use in treating UXO were tracked and recorded.

- Material Handling - UXO items and scrap metal recovered from the site were handled, and temporarily stored at the Visitor Center. Items that were considered MPPEH were treated on site. All munitions-related debris was segregated from non-munitions-related scrap metal and all material was transferred to NASA WFF personnel for disposal.

Each of the steps or activities is discussed in detail in the following subsections.

2.1 PROJECT INITIATION AND SITE PREPARATION

On January 11, 2006, TtNUS, NASA, and NASA contractor personnel attended a meeting in Building F-160 to discuss proposed UXO clearance operations at the Visitor Center site. Items discussed at the meeting included a general site overview, project scheduling, and planned UXO clearance operations. A POC list was developed during the meeting to assist TtNUS personnel with communication and reporting procedures required by NASA for the duration of site activities. The POC list contained the names, phone numbers, and radio call-signs of NASA environmental, base security, and base fire company personnel. In addition, the list outlined the procedures to be followed for providing notification of daily start/finish times, updates of daily activities and/or notification of emergency situations at the site. A copy of the POC list was distributed to the appropriate TtNUS site personnel and was available on site during all operations. The NASA POC and fire company were notified daily of start/finish times throughout the length of the project.

On January 12, 2005, TtNUS personnel completed an excavation permit request form and submitted the form to NASA. Utility clearance/mark-out was conducted by NASA at the proposed UXO clearance grid and GPO area locations on January 27, 2006. TtNUS UXO technicians provided UXO avoidance support to NASA during utility locating/mark-out activities. An approved excavation permit was provided to TtNUS personnel prior to conducting site activities.

TtNUS personnel initiated site mobilization activities on January 27, 2006. All personnel obtained base passes at the WFF security office. Radios and keys to the Visitor Center site were obtained from the NASA environmental POC. An initial health and safety briefing was held for all site personnel and site activities, plans, and procedures were discussed. TtNUS and NASA personnel met at Building M-16 to review explosive management and storage procedures to be followed during the site investigation. TtNUS UXO technicians and NASA personnel also completed an inventory of explosives stored in Building M-15 (bunker) and a Chain-of-custody form was completed to document the amount and type of explosives stored in the bunker. Additional mobilization activities included a reconnaissance of the Visitor Center site, re-establishing the UXO clearance area temporary fencing into proper position for site activities, and placement of pin flagging along all site utility mark-outs. Site activities and procedures were also discussed with NASA Visitor Center personnel and work area and access restrictions were discussed with the staff.

2.2 SITE GRID SYSTEM

As mentioned in section 1.1, The Visitor Center complex consists of three buildings, a parking lot, walk ways, outdoor displays, and an open lawn area. The complex is surrounded by a fence on three sides and a wetland on the fourth side. Vehicle access to the area was controlled through gates. The UXO clearance area consists of an approximate 4-acre lawn (open area) located generally east and southeast of the Visitors Center building complex. The area is bordered by the Visitors Center buildings (Building J-17 and J-20) and concrete paving to the northwest, wooded land and a fence line to the west/southwest, and wooded land/wetland to the south and east. The site is generally flat with a gentle slope to the southeast.

On January 28, 2006, TtNUS personnel completed layout of the Visitor Center site grid system. A total of 16 grids were marked out over the proposed UXO investigation area (see Figure 2-1). The following grids were established at the site: 1C, 1D, 2A, 2B, 2C, 2D, 3A, 3B, 3C, 3D, 3E, 4A, 4B, 4C, 4D, and 4E. Due to the layout of the site investigation area, a total of 6 grids were marked as full grids consisting of a 100 foot by 100 foot area (grids 2A, 2B, 2C, 3B, 3C, and 3D). All remaining grids were partial areas due to the site fence along the southwest perimeter of the site and the tree line along the southern, southeastern and eastern perimeters of the site. The corner points of each grid were marked using wooden stakes. The southwest corner stake of each grid was labeled with the appropriate grid number for identification purposes.

Primary profile lines were also marked out in each of the grids to assist in planned surface sweep and geophysical survey activities on site. These profile lines were oriented in a northwest to southeast direction and were placed 25 feet apart within each grid. The profile lines were marked out using spray paint.

On February 1 and February 2, 2006, surveying activities were conducted by Baldwin and Gregg personnel at the site. The survey included all site grid corner stakes, primary profile lines, UXO area site perimeter features such as permanent and temporary fencing, tree lines, as well as the GPO area and all surrogate items placed within the prove-out area (see section 2.3 for details on the GPO area). In addition, the survey also included all major Visitor Center complex features including buildings, rocket displays, sidewalks, roadways, parking areas, drainage swales, and above ground utilities. TtNUS UXO technicians provided UXO avoidance support to Baldwin and Gregg personnel during all site survey activities. An initial Health and Safety briefing was completed with the site surveyors and tail-gate briefings were conducted on a daily basis for all personnel.

2.3 GEOPHYSICAL PROVE-OUT

The project required a site-specific GPO for the purpose of evaluating geophysical instruments and developing a standard response for the selected instruments, instrument configuration, and techniques. The purpose of the GPO was to demonstrate and document the site-specific capabilities of the proposed geophysical equipment, navigation equipment, data analysis, data management and associated equipment, and personnel to operate as an integrated system capable of meeting the project goals.

On January 29, 2006, TtNUS personnel completed the installation of the GPO grid. The grid was installed within the grassy area to the northeast of the Visitor Center parking lot (see Figure 2-1). UXO technicians conducted a preliminary sweep of the proposed GPO location (using Schondstedt® Metal detectors) in order to document that the area was free of surface/subsurface metallic debris. The GPO grid dimensions were 25 feet by 25 feet. Wooden stakes were placed at the grid corners. A grid coordinate system was established to record all findings from the GPO operation. A total of 13 seeded targets were placed within the GPO area. These items included 4 - 20mm surrogates, 4 - 30mm surrogates, and 5 non-UXO clutter items (metal pipe, clamp, rebar). As per the approved site work plan, the seed items were placed at various depths and orientations throughout the GPO area. The distance from the ground surface to the seed items was measured after burial to accurately determine and record the depth of each item. In addition, the location of each item was recorded using the grid coordinate system. As mentioned in section 2.2, the GPO grid corners and seed item locations were also surveyed by Baldwin & Gregg personnel following GPO grid setup.

On February 7, 2006 Tetra Tech EMI (TtEMI) personnel initiated GPO activities at the site. Prior to conducting GPO activities, an initial Health and Safety briefing was completed with the geophysical survey team. Quality Assurance (QA) and Quality Control (QC) tests were conducted, in accordance with the approved work plan, using two geophysical systems in order to demonstrate and document the site-specific capabilities of the geophysical equipment, navigation equipment, data analysis and management techniques, and personnel (TtNUS, 2006a). The geophysical systems included the Geonics EM61-MK2 Time Domain Electromagnetic Metal Detector (EM-61) and the Geometrics G-858 Cesium Vapor Magnetometer (CVM). The EM61 and CVM systems used for this investigation were integrated with a Trimble AG 114 Differential Global Positioning System (GPS) Receiver for real-time data positioning.

The following QA/QC tests were conducted before completing the GPO:

- Equipment/Electronics Warm-up;
- Cable Shake Test;
- Static Background and Static Standard Response Test;
- Personnel Test;
- Pull-Away Test;
- Six-Line Test;
- Octant Test;
- Height Optimization Test; and
- Azimuth Test

All QA/QC testing was conducted and evaluated in accordance with the final work plan (TtNUS).

Following completion of the QA/QC tests, the geophysical survey team conducted GPO surveys of the test grid using the EM-61 and CVM units.

For the EM-61 survey, the team surveyed the area using measuring tapes and pin flags to guide the instrument operator along 2-foot survey lines between the 25-foot markers. The EM61 data were collected at 0.1-second intervals, which when combined with the velocity of the operator, resulted in approximate 1-foot collection intervals along the survey lines. The EM61 data collected at each interval along the survey line were stored in a portable console, along with the position of the measurement as collected by the GPS receiver. The results of this survey are presented in Appendix B.

As with the EM61, the CVM system was also integrated with a GPS receiver for real-time data positioning. The geophysical survey team surveyed the area using measuring tapes and pin flags to guide the instrument operator along 2-foot survey lines between the 25-foot markers. The CVM data were collected at 0.1-second intervals, which when combined with the velocity of the operator, resulted in approximate 1-foot collection intervals along the survey lines. The CVM data collected at each interval along the survey line were stored in a portable console, along with the position of the measurement as collected by the GPS receiver. The results of this survey are contained in Appendix B.

After the GPO survey area was complete, the data were downloaded to a computer and sent to the project geophysicist for processing and analysis. The results for each instrument were compared to the known data for each seeded or surrogate target item and the data were evaluated by the project and staff geophysicists and the project manager. Based on this review, it was concluded that both the EM-61 and the CVM units were effective in locating most of the items; however, the EM61 was rated slightly better. The better performance of the EM61 and the fact that it is less affected by cultural interference such as reinforced concrete sidewalks, rocket display footers, and buildings resulted in the choice of this system for the geophysical survey at the Visitor Center site.

2.4 SURFACE CLEARANCE

On January 28, and 29, 2006, TtNUS UXO personnel completed the surface sweep/clearance of the Visitor Center site grids. The surface operation was conducted using Schondstedt® metal detectors to assist in locating surface/near-surface metallic items. The sweep was conducted using 100 foot ropes layed out along secondary grid profile lines spaced approximately 3 to 4 feet apart. The UXO technicians traversed the secondary profile lines and visually inspected the ground surface for UXO and metal debris assisted by the use of the metal detectors. The location of each item encountered during this process was marked using plastic-rod pin flags and the locations were recorded on grid reporting sheets (see Appendix A).

Each of the surface targets located was visually observed by the UXO technicians in order to determine the type and condition of the item, whether the items were MPPEH, and whether the item could safely be moved. No fuzed MPPEH Items were located during the surface sweep/clearance operation at the site and all items were determined to be safe to move.

All surface debris/items were removed and placed into 5-gallon buckets for later segregation by the UXO technicians (see Section 2.8). Some minor excavation was conducted at a number of the targets using hand shovels in order to locate or identify near-surface objects detected during the surface sweep (generally 1 inch to 4 inches below ground surface). Hand excavation was conducted by carefully digging from the side of each target until the item could be identified and removed.

A total of approximately 243 surface anomalies/targets were identified during the surface sweep operation. See Figure 2-2 for locations of identified anomalies. Based on a review of the grid reporting sheets, the following items were found within the site clearance grids:

- 162 munitions items (20mm/30mm fragments and projectiles);
- 2 munitions-related scrap debris items (empty propellant charge canisters);
- 21 identified scrap metal items (i.e. pipe, rebar, wire, nails, etc); and
- 58 unidentified scrap metal items (generally small or rusted metal fragments).

Select representative photographs of items identified during site activities are presented in Appendix C.

2.5 GEOPHYSICAL SURVEY

The geophysical survey activities at the site were conducted from February 6 through February 9, 2006. As stated in Section 2.3, the EM-61 system was chosen to conduct the survey activities on site. Prior to completing the survey activities, daily tail-gate safety briefings were held and daily QA/QC tests using the EM-61 unit were conducted. The tests conducted are outlined in Section 2.3. All site geophysical survey activities were conducted as per the approved site Work Plan (TtNUS, 2006a).

The EM-61 coil configuration used during the study area survey was a 1-meter by one-half meter rectangle. The height from the bottom coil measured 16 inches to the ground and from the top coils to the ground measured 27 inches. In addition, the EM-61 system was integrated with a GPS receiver for real-time data positioning. The geophysical survey team surveyed each of the grid areas using measuring tapes and a series of ropes to guide the instrument operator along 2-foot survey lines between the grid markers.

The EM-61 data were collected at 0.1-second intervals, which when combined with the velocity of the operator, resulted in approximate 1-foot collection intervals along the survey lines. The EM-61 data collected at each interval along the survey line were stored in a portable console, along with the position of the measurement, as collected by the GPS receiver.

In addition to the QA/QC measures noted in Section 2.3, Data Repeatability Tests were conducted daily. Two survey lines within the survey grid were repeated each day and the geophysical data were reviewed to verify the repeatability of measurement and the location of anomalies. The project and field geophysicists evaluated these data to determine if abnormalities existed that would require correction or repeat of portions of the survey. Based on these tests, no grids needed to be repeated during this survey.

Digitally recorded geophysical data collected over the study area were transferred from the data logging devices to a computer twice each day. The data from the geophysical surveys were processed daily by the project and site geophysicists and were checked for accuracy, completeness, and potential entry errors. Each data set was pre-processed using Geonics DAT61MK2 software to integrate the GPS data and then entered into Geosoft Oasis Montaj (Geosoft) data processing software to generate contour, color-fill maps that indicate the intensity of the measurements from the geophysical systems. Final data processing included correcting for any base-level (zero) errors and summation of the four time gates (Z1-Z4) to be used for final data presentation. These data were displayed using a consistent range of color for visual display.

All contour maps were oriented to a coordinate system designated by TtNUS to be consistent with existing map files for ease of interpretation.

Final geophysical contour maps were generated using a licensed Geosoft UX-Detect extension package that provides unique capabilities for locating and analyzing munitions and explosives of concerns (MEC) targets. Using the Geosoft UX-Detect software, the ground position of potential MEC targets was visually and automatically selected, and was finally narrowed down to a final target list. Individual target list/dig sheets were developed for each geophysical grid at the site (see Appendix D). A threshold value of 8 millivolts for all four time gates (Z1-Z4) was used for target selection, based largely on the results of the GPO survey.

A total of 2,153 anomalies/targets were identified during the geophysical investigation at the Visitor Center site. A composite map of the entire study area is provided as Figure 2-3. The individual grid maps and target lists associated with the individual grid map are provided in Appendix B.

2.6 INTRUSIVE INVESTIGATION

TtNUS conducted UXO excavation/removal operations at the Visitor Center site from February 10 through February 21, 2006. All activities were completed as per the approved Work Plan (TtNUS, 2006a).

The initial step in the intrusive investigation was target reacquisition. The target list/dig sheets developed during the geophysical investigation were utilized to obtain target coordinates for each anomaly identified (see Appendix D). Targets were reacquired using the local grid coordinates (X/Y coordinates) for each grid. TtNUS personnel used 100 foot measuring tapes to locate each target based on these local coordinates. Each individual target was marked out using plastic-rod pin flags. A unique target identification number was placed on each of the pin flags. Following placement of the pin flags within a specific grid, the target locations were checked by the UXO technicians using the Schondstedt® metal detectors. In addition, as a QC check on the local grid coordinates, approximately 5% of the target locations were verified using a Trimble PRO XRS GPS unit and the latitude/longitude coordinates supplied on the geophysical dig sheets. No discrepancies were noted between the originally mapped locations as listed on the grid dig sheets and the actual reacquired target locations.

Prior to conducting actual excavation at a specific target, The UXO technicians confirmed the exact location of the target with the Schondstedt® metal detector. Identified targets were then excavated utilizing suitable tools (hand shovels and trowels) to remove sufficient soil to permit identification and assessment. All excavations were started from the side of the anomaly until identification of the anomaly was made. Excavation operations employed a step-down or offset access method. No excavations were made directly over suspected munitions. All targets were initially excavated only enough to permit identification of each item uncovered. Every effort was made to identify a suspected munition. The target items were visually examined for markings and other external features such as shape and size. Prior to any action being performed on a MPPEH item, each item was observed for any possible fuzing without disturbing the item. No fuzed or live MPPEH items were excavated during the intrusive activities at the site.

Following identification of each item uncovered, the UXO personnel recorded the finding and descriptive information on the dig sheets. This information included the unique target identification number, the item type, approximate weight, depth of the item, and off-set from the original target location pin flag. The dig sheets can be found in Appendix D. Photographs were also collected of each item found. Select representative photos of items identified during site activities are presented in Appendix C.

As per the approved site work plan, excavation of targets was only completed to 1-foot below ground surface. A number of items were left in place due to their large size (large steel plates, concrete and rebar), or because they were located below 1-foot in depth.

A total of 2,150 target items were identified and excavated during intrusive activities at the site (see Figure 2-4 and Appendix D for target locations and details). As noted above, no live or fuzed MPPEH items were found during the intrusive investigation. The following provides a summary of the findings as detailed in the dig sheets and discussed in more detail below.

Items Removed From The Site:

- 1,106 munitions items (20mm/30mm fragments, projectiles, and empty cartridges).
- 7 munitions-related Debris items (grenade handle, Mortar fins, M-1 clips, and 75mm projectiles).
- 302 identified scrap metal items (pipe, rebar, nails, bolts, strapping, etc.).
- 332 unidentified scrap metal items (generally small or rusted metal fragments).

Items Left In Place:

- 3 anomalies associated with an area identified as a probable former burn pit containing slag-like melted and consolidated metal debris including 20mm/30mm fragments. This area is covered by 12 inches or more of soil.

- 10 identified scrap metal items too large to move (large metal plates, concrete and rebar).

- 328 unidentified items at depths greater than 1 foot.

Items Not Intrusively Investigated:

- 62 anomalies identified during the geophysical survey that coincided with known man-made cultural features (sidewalks, utility lines, etc).

Items Not Located:

- 3 targets identified through the geophysical survey where no contact was made using the metal detectors or through hand excavations.

As shown in Figure 2-4, munitions related debris was scattered throughout the study area. However, the major concentrations of munitions related debris were located in and around the location of the former firing-in butts. These butts were located mainly in grids 3B and 4D.

As noted above, a total of 1,106 items found during the on site investigation was scrap- 20mm and 30mm fragments, projectiles, and empty cartridges. None of these items were found to be fuzed or contained explosives. Approximately 15 of the 20mm and 30mm projectiles were segregated for later demolition activities (see section 2.7). Although these items where not fuzed or observed to contain explosives, a very slight unknown residue or discoloration was observed on the outside of these items. Therefore, the UXO team determined that treatment of these items was necessary to support certification of the debris as being explosive-free.

Seven (7) other scrap munitions debris items were also identified during site activities. These items included one grenade handle, one set of fins believed to be from a mortar, several empty M-1 rifle ammunition clips, and three 75mm projectiles. The 75mm projectiles were observed to be inert practice rounds which were partially filled with Bee's Wax. The 75mm rounds were all located in Grid 3B (see Figure 2-4 for location of all items). The 75mm rounds were also segregated for later demolition activities, as noted in section 2.7, in order to ensure "demilitarization" of the item (disfigure to ensure that the item was not later mistaken for live ordnance).

An apparent former burn-pit(s)/slag pile(s) containing a conglomerate of melted and rusted metal, including numerous 20mm and 30mm fragments, was identified at the site. This area was defined by three separate anomalies located in close proximity to each other. These locations were identified in Grids 3B and 3C as shown on Figure 2-4. Each of these locations were investigated and left in place. The tops of the piles were all located at approximately 1-foot below ground surface and the material was very hard and rusted together. The UXO technicians made every effort to dig around these locations in order to verify that no live munitions were located within the piles. No MPPEH was observed at any of these locations.

A total of 10 additional items were also uncovered and left in place at the site. These areas included large metal plates, concrete/rebar, and large pieces of angle iron that could not be manually moved (see Figure 2-4 for locations). The areas immediately around these items were investigated by the UXO personnel in order to verify that munitions-related items were not present. No munitions-related items were found at these locations.

Three hundred and twenty eight (328) other potential targets located within the study area were also left in place. Each of these locations was excavated to a total depth of 1-foot below ground surface. No contact was made at these locations above this depth. The locations were checked using the Schondstedt® metal detectors and the anomalies identified at each of these locations was found to be below the 1-foot depth.

A total of 302 target anomalies at the site were found to contain identifiable scrap metal items. These items included pipe, rebar, metal strapping, nails, bolts, nuts, angle iron, and other construction related debris.

In addition, 332 unidentifiable scrap metal items were also found during the site investigation. These items generally consisted of small rusted pieces of metal with no distinguishing characteristics allowing the material to be positively identified.

A total of 62 target locations identified from the geophysical investigation at the site were not investigated during intrusive activities. These locations were found to be marked out over or immediately adjacent to man-made cultural items. The items included sidewalks, fence-posts, rocket displays, underground utilities, and sign-posts. The areas immediately surrounding each of these locations was screened by the UXO personnel with the metal detectors and no munitions related debris was found.

Finally, 3 target areas at the site were found to contain no observable items. No contact was made at these locations. Due to the low response amplitude of the geophysical instruments at each of these locations, these areas are believed to be false-positives and do not contain any munitions related debris.

Subsurface items excavated during intrusive activities were inspected by two UXO Technicians before being transferred for handling and disposal. Items that were removed from the site were re-inspected by the Senior UXO Supervisor (SUXOS), segregated by type, and placed in 55-gallon drums for temporary storage (see Section 2.8). The 20mm/30mm items and 75mm items noted above to be held for later demolition were kept in the locked scrap munitions debris drum until later explosive treatment as noted in Sections 2.7 and 2.8.

2.7 EXPLOSIVES MANAGEMENT AND HANDLING

All explosives acquired for and used during this project were managed and handled as per the approved site Work Plan (TtNUS, 2006a). Explosive handling/management procedures utilized for site activities were agreed upon between NASA and TtNUS personnel during the initial project meeting held on January 11, 2006.

The explosives acquired for this project included 25 - 16 foot Nonel Shock Tubes with Blasting Caps, 2,500 feet of Nonel Shock Tube, and 24 Helix 1.1 pound Binary Charges.

All explosive items were delivered to NASA WFF by common carrier on January 25, 2006. Items were delivered to the designated NASA POC and were stored in the Building M-15 Bunker. TtNUS UXO personnel met with the NASA POC at Building M-16 on January 27, 2006. The NASA procedures for storage/handling of the explosives were reviewed by all personnel and an explosives health & safety briefing was also conducted. A complete inventory of the explosive items in Building M-15 was conducted and an approved NASA Explosives Inventory Form/Chain-of-Custody Form was completed for the explosives stored on site.

During the course of the Visitor Center clearance project, the TtNUS SUXOS conducted a weekly inventory of the explosives stored in Building M-15 and the explosives inventory form was also updated.

As noted in the report sections above, no fuzed/live munitions items were discovered during the investigation at the site. Therefore, no explosives were transferred, handled, or utilized at the site during intrusive activities. Following completion of the site intrusive investigation, all explosives were removed from Building M-15, transferred to the Visitor Center site, and were disposed of (detonated) within the site investigation area. The detonation activities were conducted on February 22, 2006. The procedures used for explosive demolition are as follows.

The TtNUS Field Operations Leader (FOL) phoned the NASA POC to obtain a request for explosives transfer from the M-15 area and to schedule a tentative time for demolition activities. The NASA POC subsequently contacted designated WFF parties and provided notification of demolition activities. The TtNUS FOL radioed the WFF base security duty lieutenant and requested security personnel meet TtNUS at the M-area gate and provide escort for the transfer of explosives. Security personnel then contacted the NASA POC and requested he provide access to Building M-15 for explosives pickup. The TtNUS SUXOS met with security and NASA personnel at building M-15 and the explosives were loaded into approved containers for transport to the site. The TtNUS SUXOS with security escort then proceed along the approved transfer route from the M-area to the Visitor Center site. This route was along the Taxi-ways of the WFF airfield to a gate located along the southeastern perimeter of the WFF base near the Visitor Center. Security personnel received clearance from the WFF airfield tower personnel to cross the active runways of the base, opened the locked gate, and escorted the SUXOS to the Visitor Center Site.

Prior to explosives arrival at the site, the FOL met with NASA Visitor Center personnel and requested that they leave the site until explosive demolition activities were completed. The Visitor Center personnel proceeded to the Main WFF Base area and the gate to the Visitor Center site was locked to prevent access to the site during demolition activities.

Following the arrival of the explosives at the site, the UXO personnel conducted explosive demolition preparation activities. The UXO personnel completed setup of an approved demolition area at the extreme southern perimeter of Grid 4D. A small hole was excavated for the demolition and sand bags were placed near the excavation. A recon of the entire site was conducted to verify that no unauthorized personnel were present at the Visitor Center or within the marsh to the south of the site.

The explosives were then prepared for demolition activities by dividing the material into four equal quantities. The 20mm/30mm and 75mm items noted for demolition in Section 2.6 were also divided into four equal quantities. A total of 4 demolition shots were conducted. Prior to conducting each demolition shot, the explosives and munitions debris designated for treatment in each shot were set in place within the designated area of grid 4D and covered with sand bags. The primer-cord for the detonation was placed from the Demolition area to a point north of and behind Building J-17 at the site. This location served as the position where shots were initiated and provided security for site UXO personnel. Before any of the shots were conducted, the SUXOS contacted the FOL by radio and the FOL visually checked for vehicle traffic on Route 175 from the Visitor Center gate. When notified that vehicle traffic was clear, the SUXOS then set off the demolition shot. Each of the four demolition shots was completed using this procedure. No problems or concerns were identified during any of the demolition shots and all shots were successful. The remaining primer cord and blasting caps (reserved in case of a miss-fire) were then individually set off under sand bags in the demolition area.

All explosive demolition activities conducted at the Visitor Center site were observed by the NASA POC. A copy of the Explosives Consumptive Certificate is included in Appendix F.

2.8 MATERIAL HANDLING

All surface, near-surface, and subsurface items located and removed during the site clearance were segregated by type, and placed in 55-gallon drums for temporary storage. During excavation activities, located items were initially placed into 5-gallon buckets. At the completion of each grid investigation, the 5-gallon buckets were transferred to a debris staging area located south of Building J-17. At this point, the excavated items were completely reinspected by the UXO Technicians and the SUXOS to confirm that no MPPEH items were present.

The items were then segregated into one of two scrap debris categories; Scrap munitions debris (20mm/30mm fragments, projectiles, and empty cartridges, etc.) and general scrap metal items. Each of the segregated items was then placed into separate 55-gallon drums for temporary on-site storage. Each of the drums were clearly labeled as to the type of debris contained within and were staged to the rear of Building J-17 at the site. The drum containing scrap munitions debris was kept under lock and key at all times during site activities.

Following completion of the site activities, The TtNUS SUXOS completed a certification form for all munitions debris stored in the 55-gallon drums at building J-17. The certification stated that the material contained within the munitions debris drums had been 100% inspected and to the best of TtNUS's knowledge, all items were inert and or free of explosives or related materials. A copy of this certification was supplied to NASA environmental department personnel (see Appendix E) and custody of all 55-gallon drums containing investigation derived debris was transferred to NASA. TtNUS also provided recommendations to NASA regarding disposal procedures for the munitions debris. The material was shipped off-site by NASA (Onyx Environmental Services) on February 28, 2006. The material was transported to Onyx Environmental Services in Port Arthur, Texas for incineration. The material was received at the facility on March 9, 2006. NASA is awaiting receipt of the Certificate of Destruction (COD) to be provided after incineration.

3.0 CONCLUSIONS AND RECOMMEDATIONS

3.1 CONCLUSIONS

Based on the review of all activities conducted during the Visitor Center site clearance, which included the surface sweep assisted by use of Schondstedt® metal detectors, geophysical survey with the EM-61 unit, target reacquisition activities, intrusive investigations, removal of UXO items, and post removal sweeps at each target location with the metal detectors, the clearance operation at the site was successful. The top 1-foot of ground within the site area investigated is considered clear of MPPEH. This conclusion is further based on the fact that no live/fuzed/explosive containing items were identified anywhere on-site during the investigation.

3.2 RECOMMENDATIONS

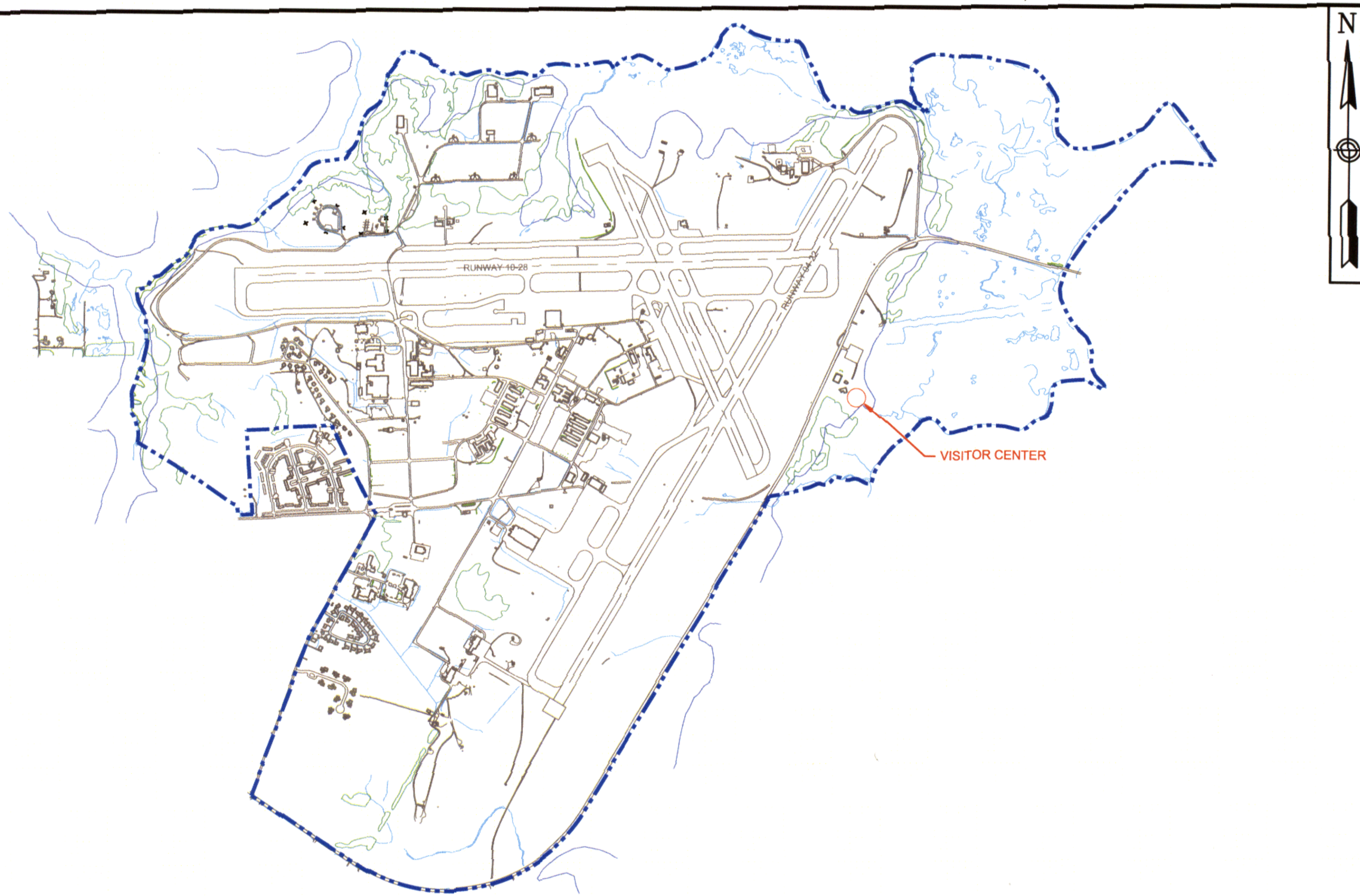
Based on the findings and conclusions of site activities, the portion of the Visitor Center site covered under this investigation should be reopened for the current non-intrusive site uses; however, a dig or excavation restriction should be placed on the area. Based on the success of the clearance operations, periodic/regular surface sweeps are not needed for current site use as long as no significant ground surface disruption occurs. It is recommended that a dig restriction be put in place for the site study area which includes the approximate 4-acre open field cleared during site activities as well as those areas immediately adjacent to the perimeter of the study area. The dig restriction should be entered into the NASA WFF Facility Management Plan and Tools and should require the following minimum requirements:

- No digging, disturbance of soils, or other intrusive activities are permitted without an approved plan. Approved plans must include the participation of qualified UXO Technicians or Specialists and must include UXO avoidance or clearance activities. Plans must be submitted to and approved by the Facility Utilization Review Board (FURB) and/or the WFF Environmental and/or the WFF Safety Office.

These restrictions should remain in place until further response activities are completed at the Visitor Center. Further response actions, if deemed necessary, are the responsibility of the USACE who should coordinate such actions with NASA.

FIGURES

112G00086/0540/112G00086GM05.DWG 03/24/06 MKB

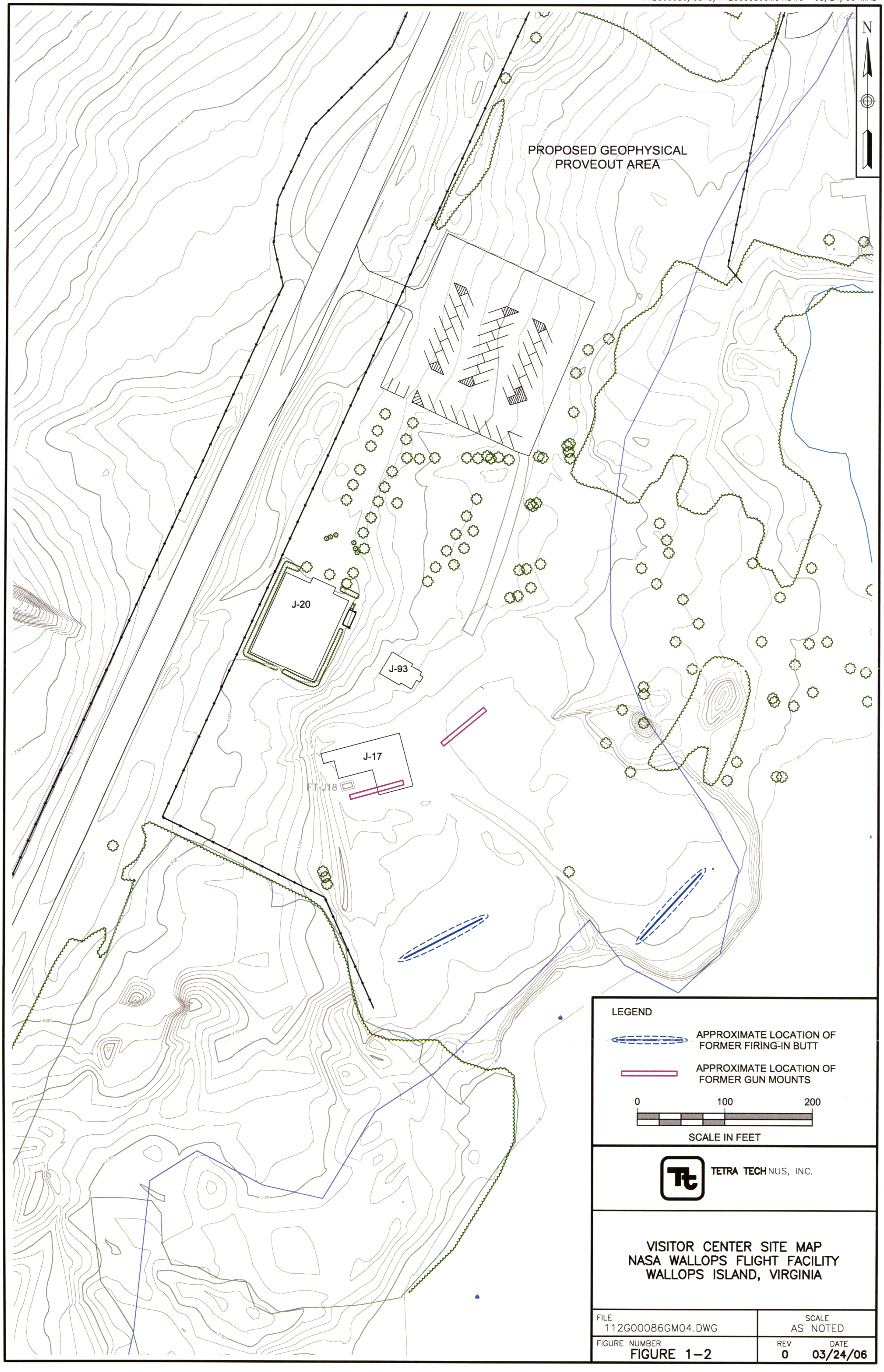


TETRA TECHNUS, INC.

VISITOR CENTER LOCATION MAP
NASA WALLOPS FLIGHT FACILITY
WALLOPS ISLAND, VIRGINIA

SCALE	AS NOTED
FILE	112G00086GM05
REV	0
DATE	03/24/06
FIGURE NUMBER	FIGURE 1-1

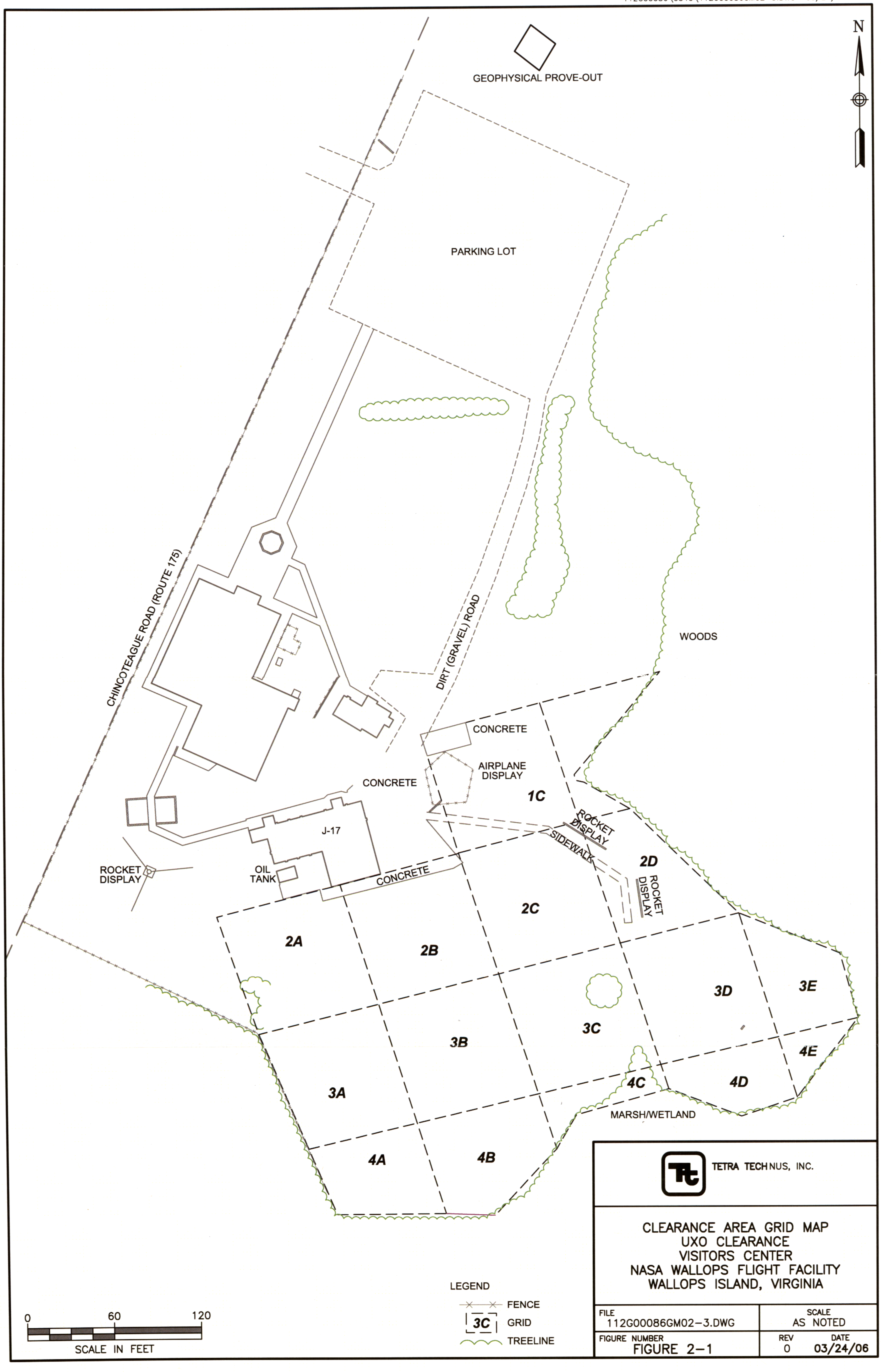
03335AB1X



TETRA TECH NUS, INC.

VISITOR CENTER SITE MAP
NASA WALLOPS FLIGHT FACILITY
WALLOPS ISLAND, VIRGINIA

FILE	SCALE	
112G00086GM04.DWG	AS NOTED	
FIGURE NUMBER	REV	DATE
FIGURE 1–2	0	03/24/06



TETRA TECH NUS, INC.

CLEARANCE AREA GRID MAP
UXO CLEARANCE
VISITORS CENTER
NASA WALLOPS FLIGHT FACILITY
WALLOPS ISLAND, VIRGINIA

FILE	SCALE
112G00086GM02-3.DWG	AS NOTED

FIGURE NUMBER	REV	DATE
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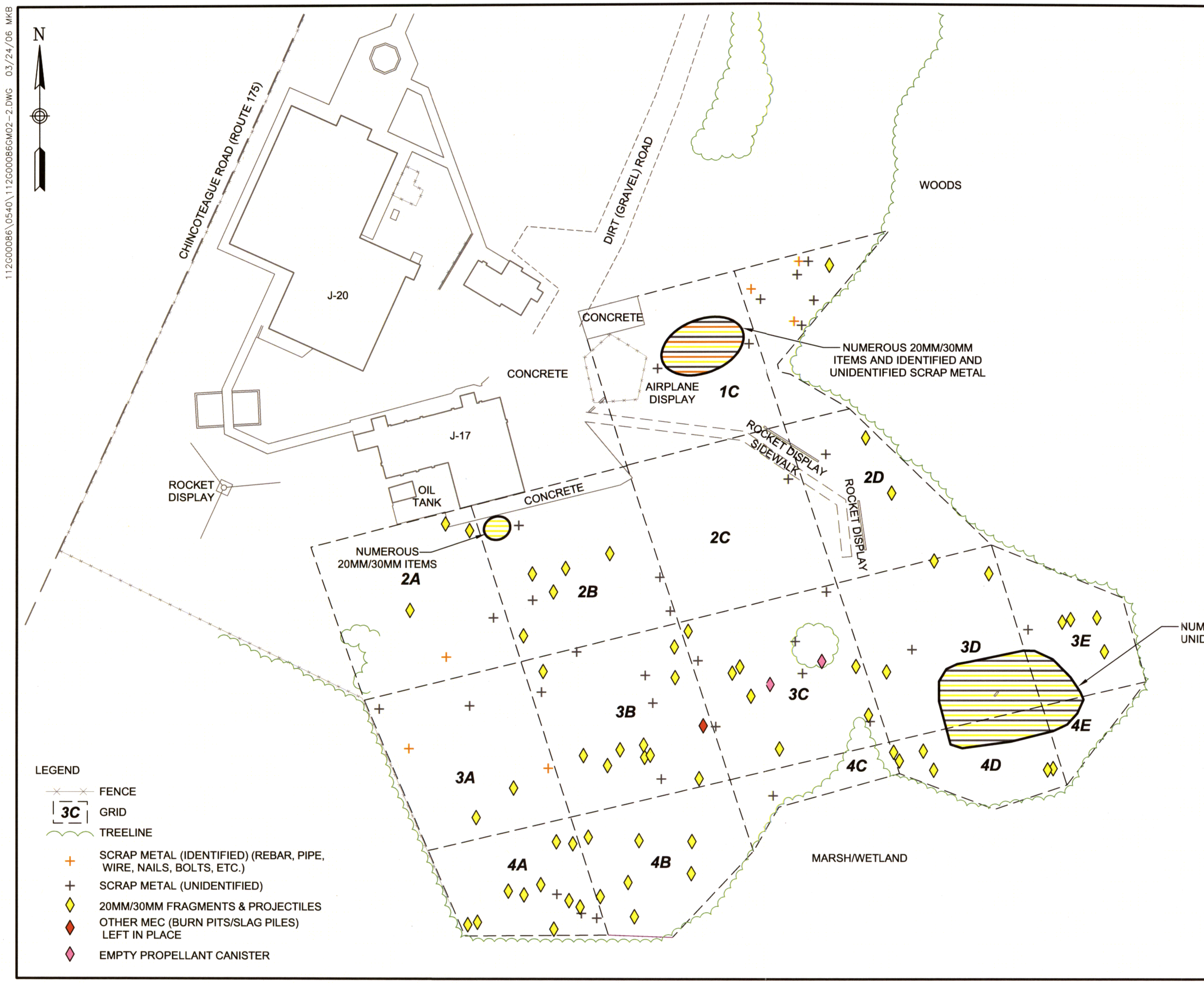
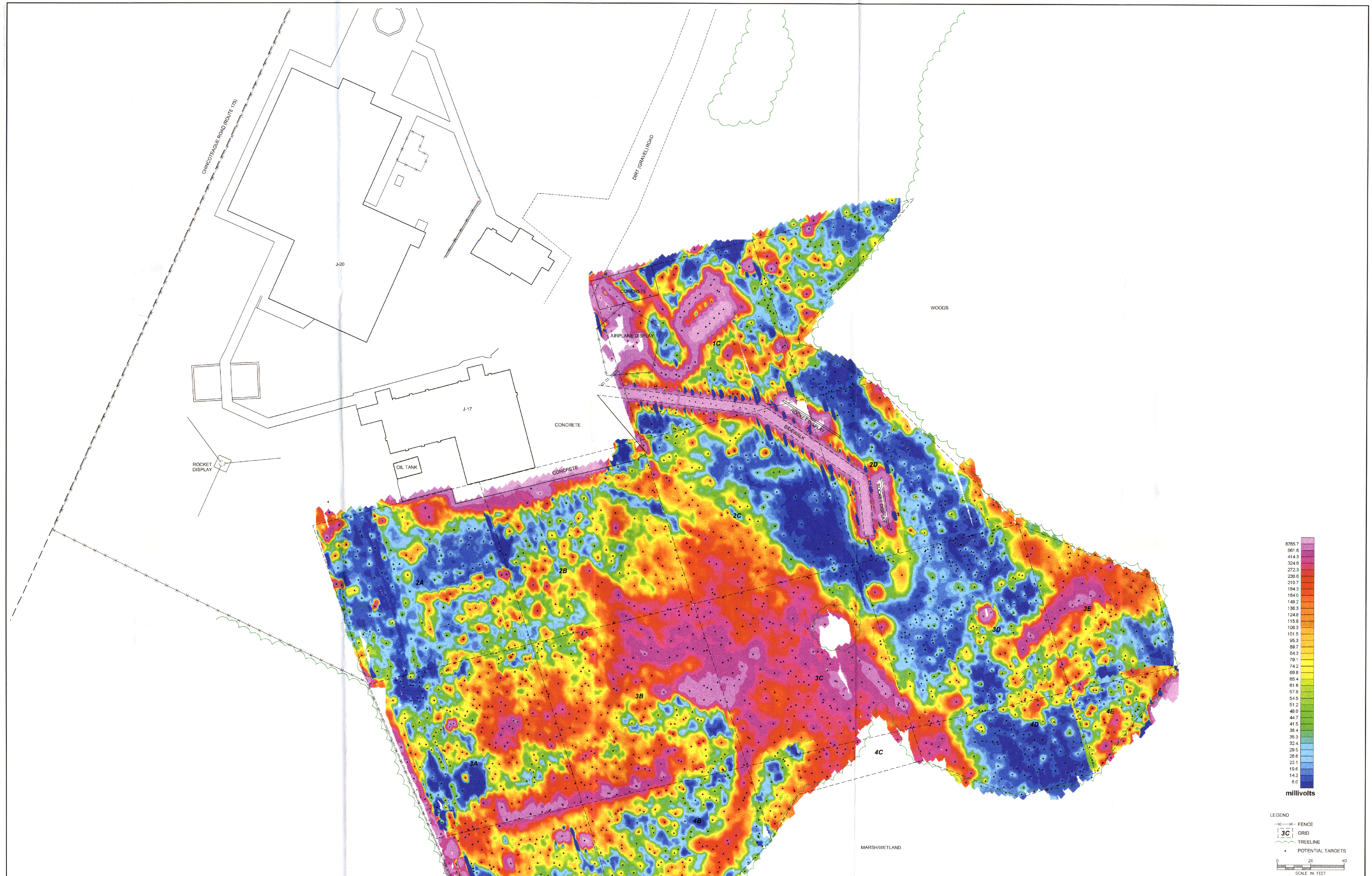


TETRA TECH NUS, INC.

SURFACE CLEARANCE FINDINGS
UXO CLEARANCE
VISITORS CENTER
NASA WALLOPS FLIGHT FACILITY
WALLOPS ISLAND, VIRGINIA

FILE	SCALE
112G00086GM02-2.DWG	AS NOTED

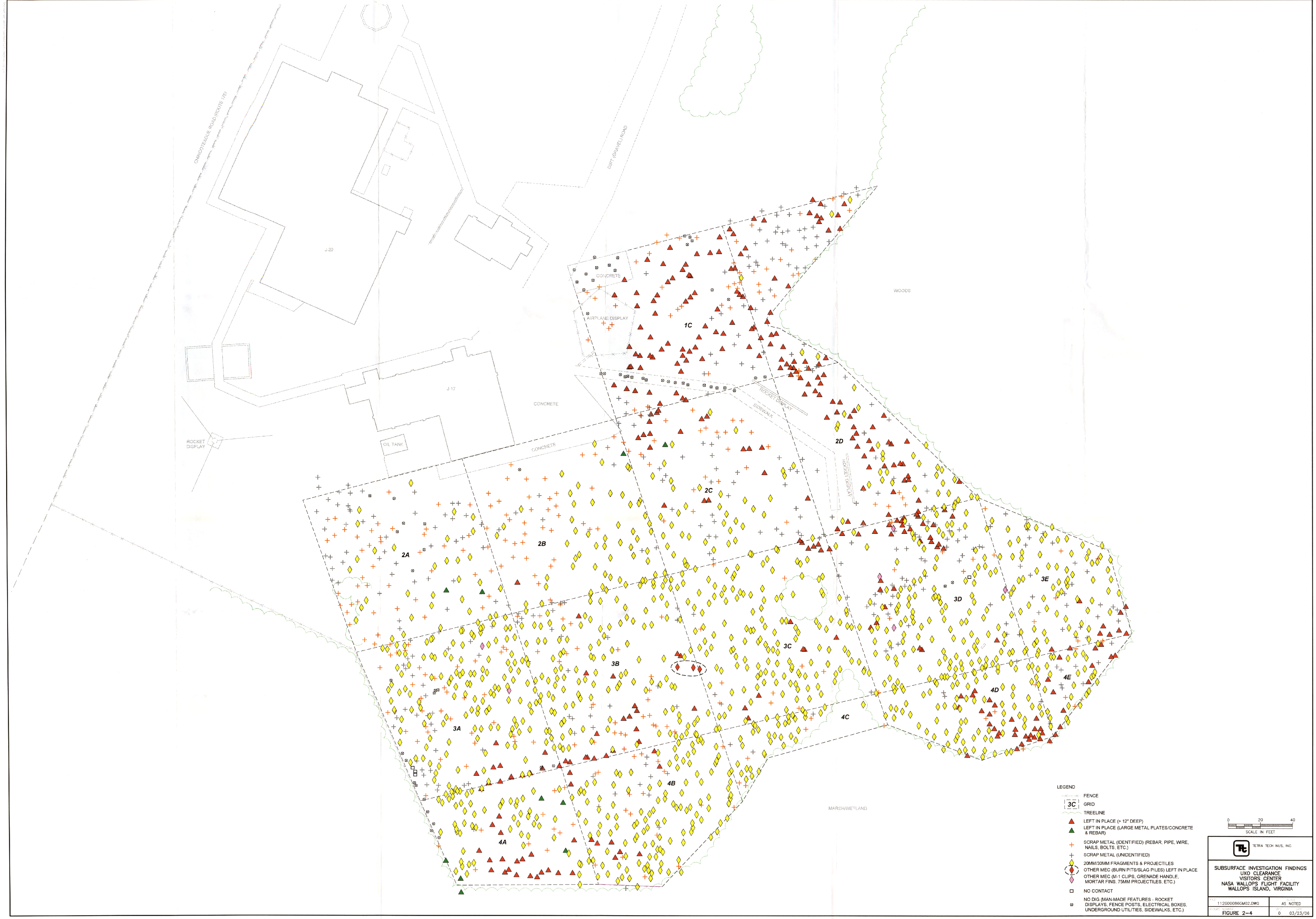
FIGURE NUMBER	REV	DATE
FIGURE 2-2	0	03/23/06



TETRA TECH NUS, INC.

GEOPHYSICAL SURVEY RESULTS
UXO CLEARANCE
VISITORS CENTER
NASA WALLOPS FLIGHT FACILITY
WALLOPS ISLAND, VIRGINIA

112G00086GM03.DWG	AS NOTED
FIGURE 2–3	0 03/24/06



TETRA TECH NUS, INC.

SUBSURFACE INVESTIGATION FINDINGS
UXO CLEARANCE
VISITORS CENTER
NASA WALLOPS FLIGHT FACILITY
WALLOPS ISLAND, VIRGINIA

112G00086GM02.DWG	AS NOTED
FIGURE 2-4	0 03/23/06

APPENDIX A

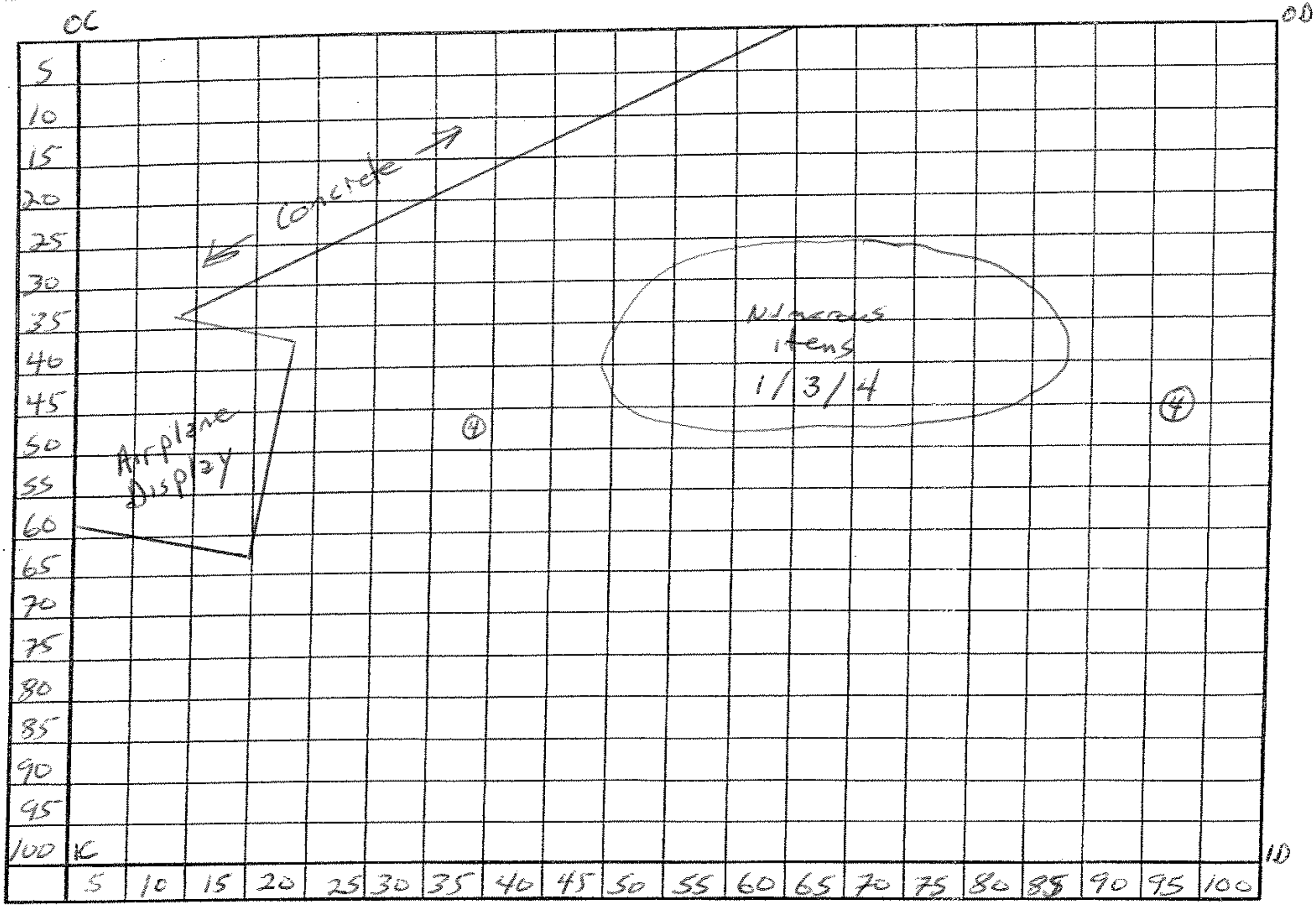
SURFACE GRID REPORTING SHEETS

(ON CD)

GRID REPORTING SHEET

Address NASA WFF Visitor Center Site

Grid # 1C   Sheet ___ of ___ Date ________



Date	Digs	MEC Items	MEC Scrap	Non Mec Scrap	Sq Ft Today	% Done

Significant items Recovered (use back for additional) Anything on back? Yes/No

1. MEC Frag   4. Scrap Metal
2.
3. Concrete/rebar

*The undersigned certifies that all identified anomalies have been investigated or excavated

*Team leader E. G. Deilent 2/2/06

*Contractor QC Vince Shickora 2-2-06

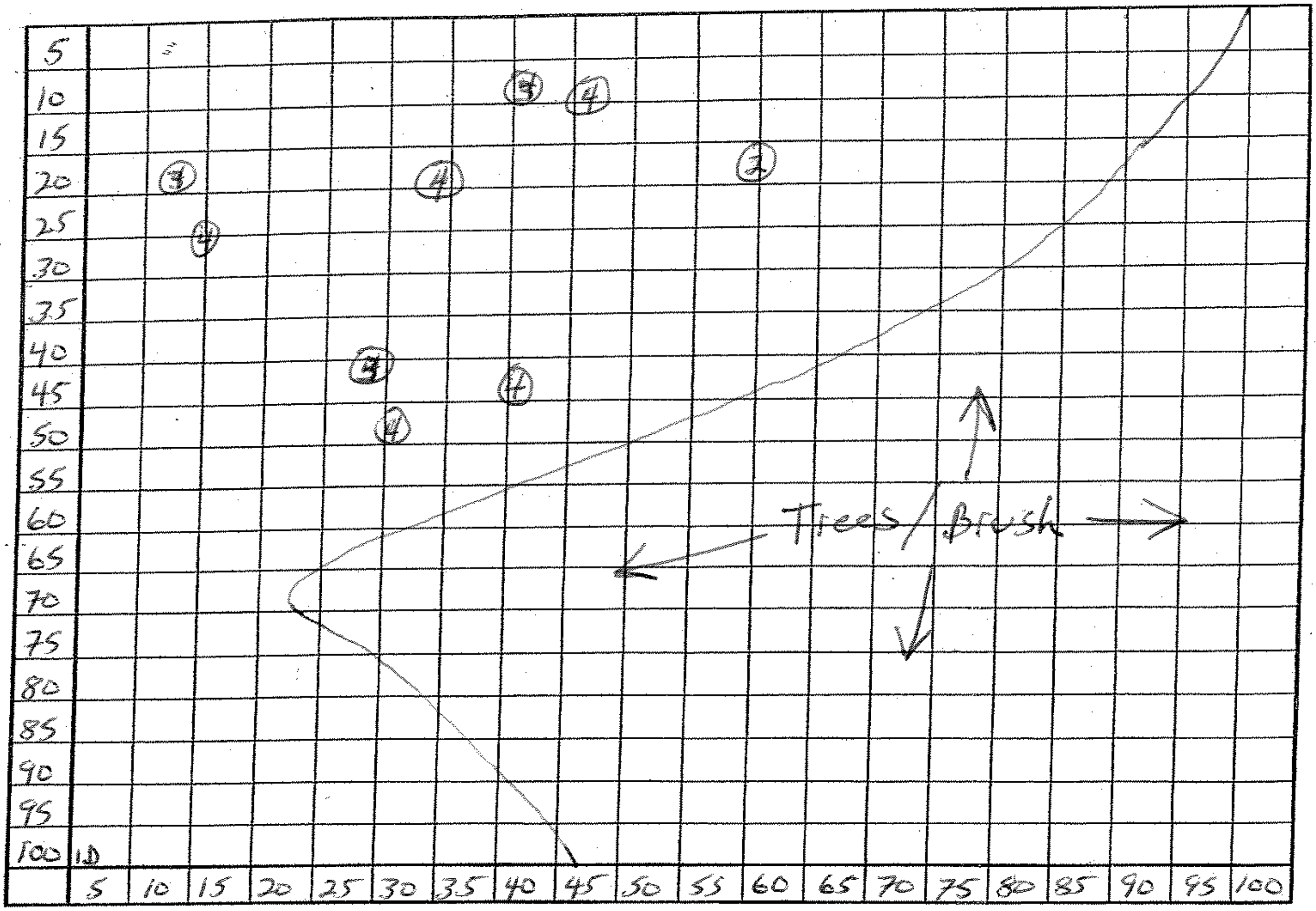
QA inspection on this grid is complete. All identified anomalies have been excavated per the above criteria.

USACE Site Representative ________

GRID REPORTING SHEET

Address NASA WFF Visitor Center Site

Grid # 1D Sheet ___ of ___ Date ________



Date	Digs	MEC Items	MEC Scrap	Non Mec Scrap	Sq Ft Today	% Done

Significant items Recovered (use back for additional) Anything on back? Yes/No

1. 4. Scrap Metal
2. MEC Scrap (20mm/30mm)
3. Concrete/rebar

*The undersigned certifies that all identified anomalies have been investigated or excavated

*Team leader Ed Deibert 2/2/06

*Contractor QC Vince Shickora 2-2-06

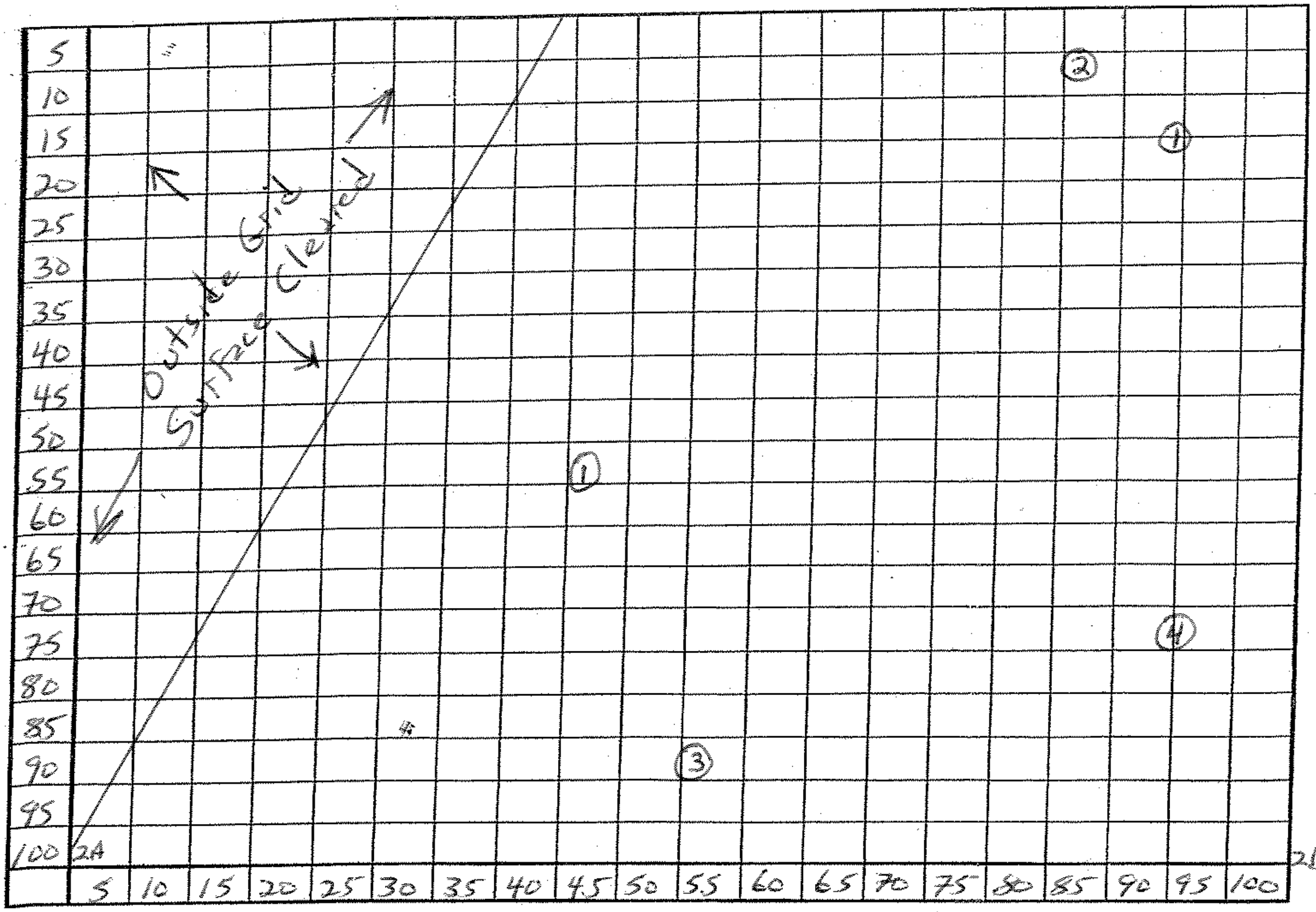
QA inspection on this grid is complete. All identified anomalies have been excavated per the above criteria.

USACE Site Representative ________________

GRID REPORTING SHEET

Address NASA WFF Visitor Center Site

Grid # 2A Sheet ___ of ___ Date ________



Date	Digs	MEC Items	MEC Scrap	Non Mec Scrap	Sq Ft Today	% Done

Significant items Recovered (use back for additional) Anything on back? Yes/No

1. MEC Frags
2. MEC Scrap 20mm/30mm projectiles
3. Concrete Chunk (with rebar)
4. Scrap Metal (pipe)

*The undersigned certifies that all identified anomalies have been investigated or excavated

*Team leader [signature] 2/2/06

*Contractor QC Vince Shickora [signature] 2-2-06

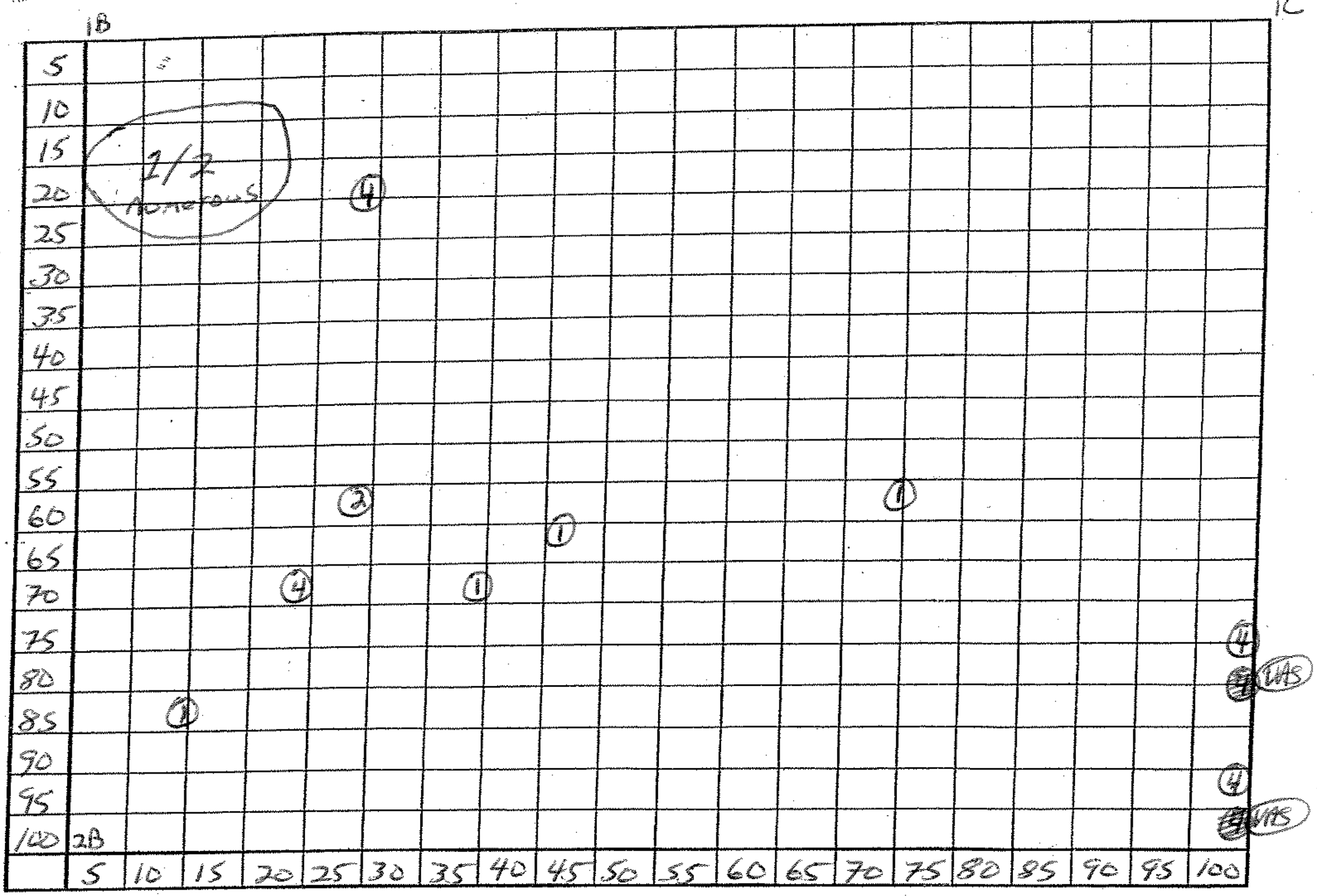
QA inspection on this grid is complete. All identified anomalies have been excavated per the above criteria.

USACE Site Representative ________

GRID REPORTING SHEET

Address NASA WFF Visitor Center Site

Grid # 2B Sheet ___ of ___ Date __________



Date	Digs	MEC Items	MEC Scrap	Non Mec Scrap	Sq Ft Today	% Done

Significant items Recovered (use back for additional) Anything on back? Yes/No

1. MEC Frags   4. Scrap Metal
2. MEC Scrap 20mm/30mm projectiles
3.

*The undersigned certifies that all identified anomalies have been investigated or excavated

*Team leader [signature] 8/2/06

*Contractor QC Vince Shickock [signature] 2-2-06

QA inspection on this grid is complete. All identified anomalies have been excavated per the above criteria.

USACE Site Representative __________

GRID REPORTING SHEET

Address NASA WFF Visitor Center Site

Grid # 2C   Sheet ___ of ___ Date ________

1C   1D

5																				
10																				
15																				
20																				
25																				
30																				
35																			4	
40																				
45																				
50																				
55																				
60																				
65																				
70																				
75																				
80																				
85																				
90																				
95																				
100	2C																			
	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100

2D

Date	Digs	MEC Items	MEC Scrap	Non Mec Scrap	Sq Ft Today	% Done

Significant items Recovered (use back for additional) Anything on back? Yes/No

1. 4. Scrap Metal
2.
3.

*The undersigned certifies that all identified anomalies have been investigated or excavated

*Team leader [signature] 2/2/06

*Contractor QC Vince Shickora [signature] 2-2-06

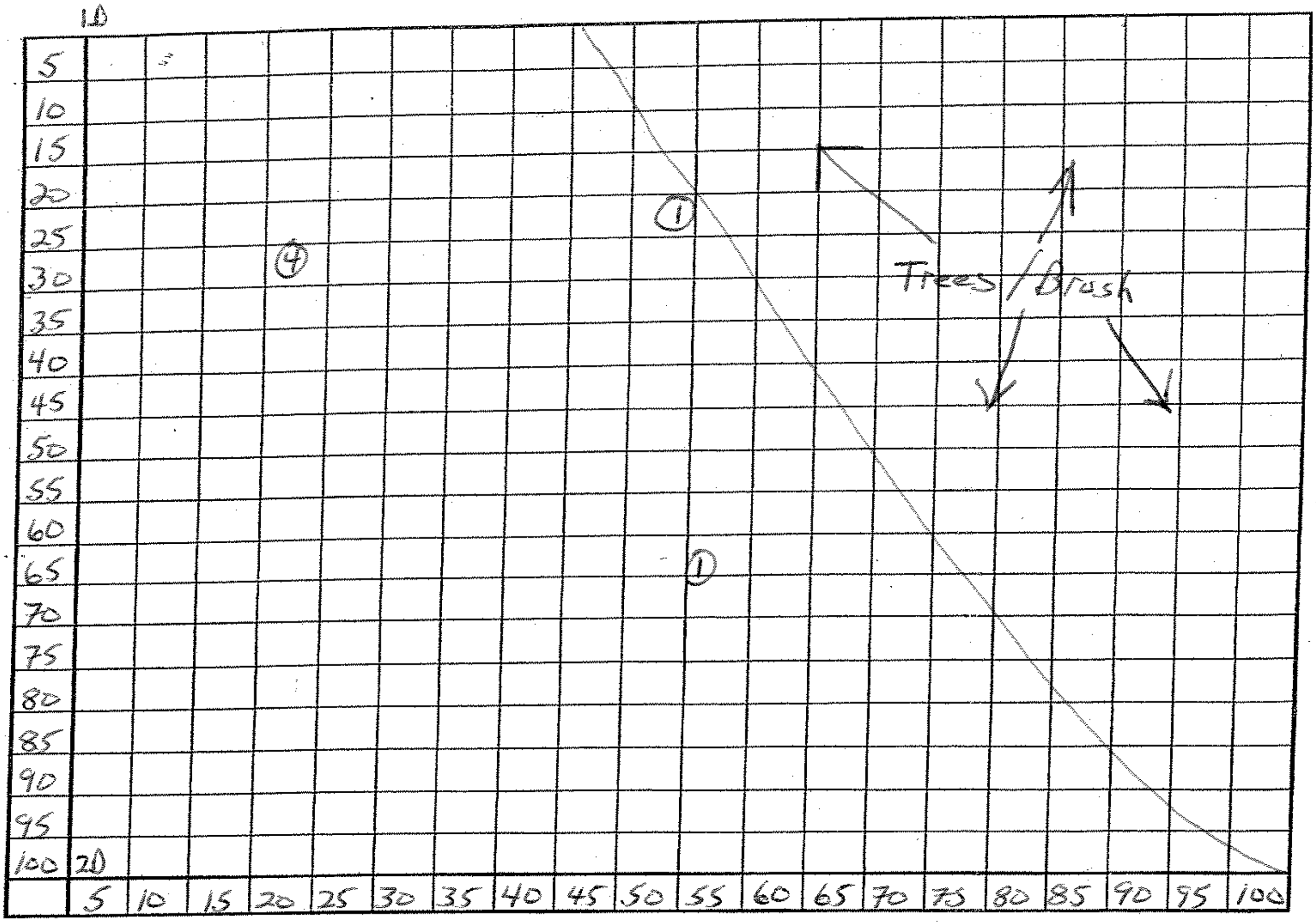
QA inspection on this grid is complete. All identified anomalies have been excavated per the above criteria.

USACE Site Representative ________

GRID REPORTING SHEET

Address NASA WFF Visitor Center Site

Grid # 20 Sheet ___ of ___ Date ___



Date	Digs	MEC Items	MEC Scrap	Non Mec Scrap	Sq Ft Today	% Done

Significant items Recovered (use back for additional) Anything on back? Yes/No

1. MEC Frags (20 mm) 4. Scrap Metal (pipe)
2.
3.

*The undersigned certifies that all identified anomalies have been investigated or excavated

*Team leader Ed Deibert 2/2/06

*Contractor QC Vince Shickora [signature] 2-2-06

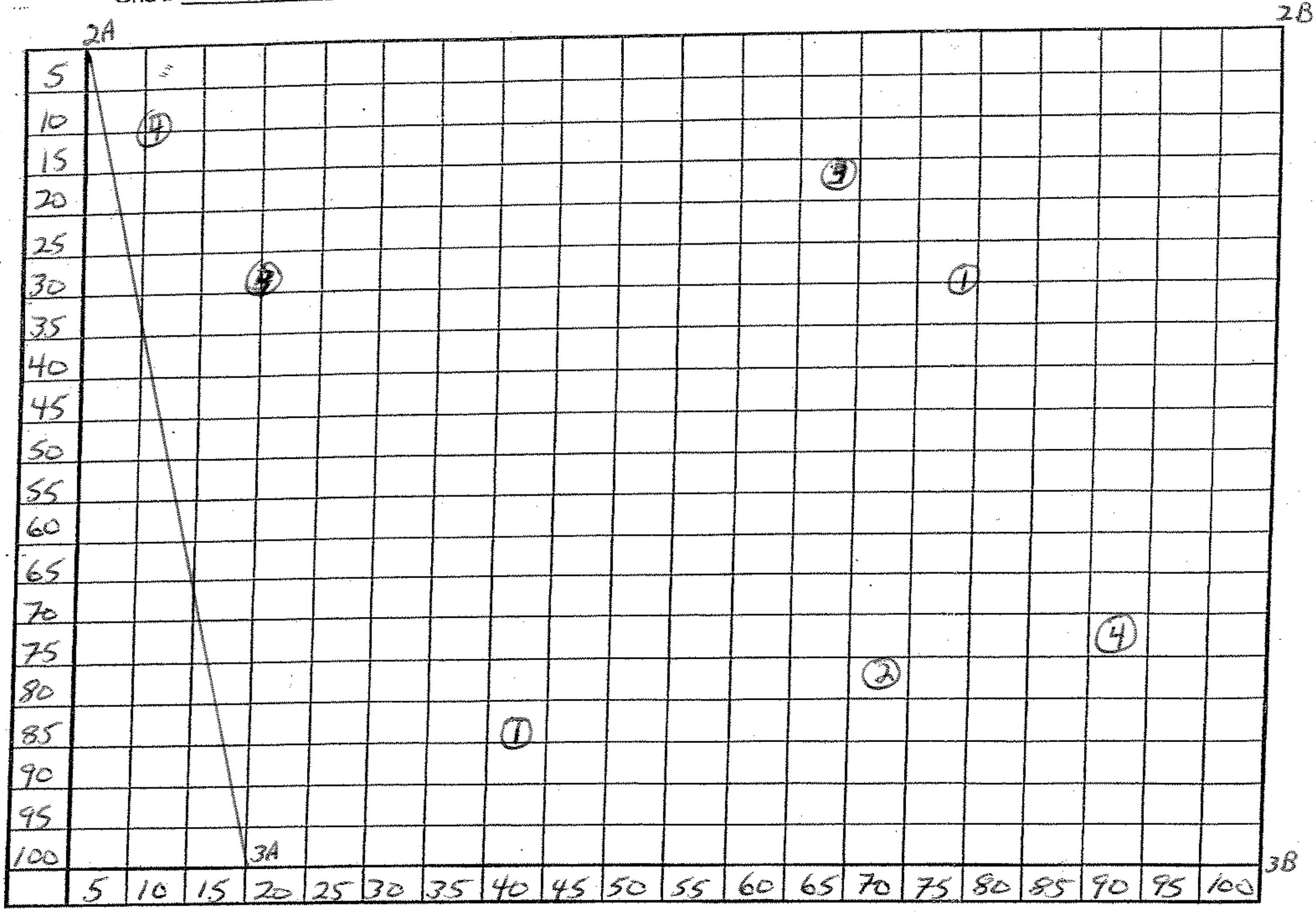
QA inspection on this grid is complete. All identified anomalies have been excavated per the above criteria.

USACE Site Representative ___

GRID REPORTING SHEET

Address NASA WFF Visitor Center Site

Grid # 3A Sheet ___ of ___ Date ___________



Date	Digs	MEC Items	MEC Scrap	Non Mec Scrap	Sq Ft Today	% Done

Significant items Recovered (use back for additional) Anything on back? Yes/No

1. MEC ~~Frags~~ Frags 4. Scrap Metal
2. MEC Scrap 20mm/30mm projectiles
3. ______________________________

*The undersigned certifies that all identified anomalies have been investigated or excavated

*Team leader Ed [illegible] 2/2/06

*Contractor QC Vince Shickola [illegible] 2-2-06

QA inspection on this grid is complete. All identified anomalies have been excavated per the above criteria.

USACE Site Representative ______________________________

GRID REPORTING SHEET

Address NASA WFF Visitor Center Site

Grid # 3B   Sheet ___ of ___ Date ________

2B   2C

	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100
5						4														
10			1																	
15																		1		
20																				
25																				
30		4												4				2		
35																				
40																				
45														4						
50																				
55																				
60																				
65				2							1								5	
70								1												
75											1 1									
80							1													
85																				
90												4								
95																1				
100 3B																				3C

Date	Digs	MEC Items	MEC Scrap	Non Mec Scrap	Sq Ft Today	% Done

Significant items Recovered (use back for additional) Anything on back? Yes/No

1. MEC Frags   4. Scrap Metal
2. MEC Scrap 20mm/30mm projectiles   5. Prep Charge Cannister
3. ________

*The undersigned certifies that all identified anomalies have been investigated or excavated

*Team leader Ed Dieckert 2/2/06

*Contractor QC Vince Shickora [signature] 2-2-06

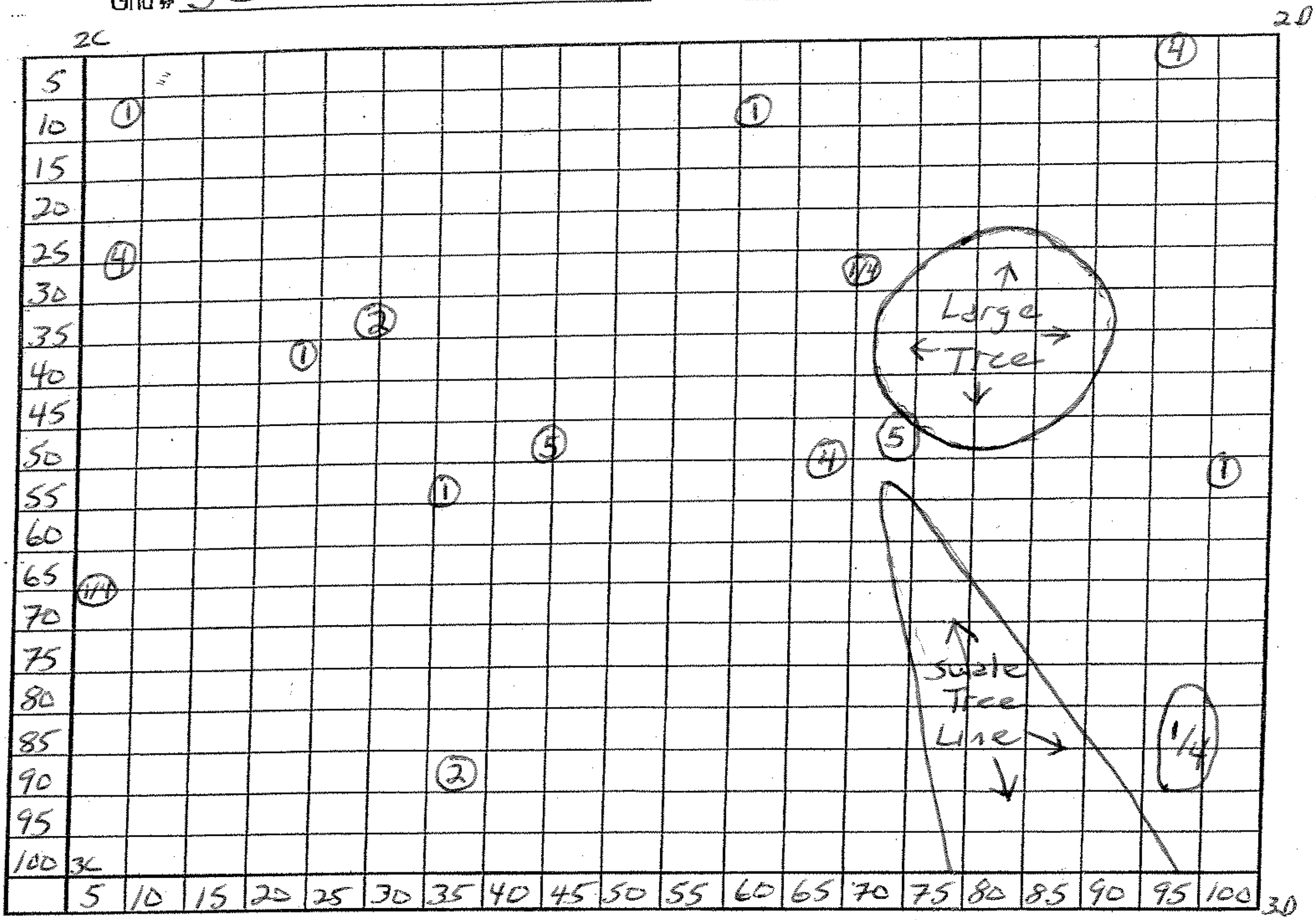
QA inspection on this grid is complete. All identified anomalies have been excavated per the above criteria.

USACE Site Representative ________

GRID REPORTING SHEET

Address NASA WFF Visitor Center Site

Grid # 3C Sheet ___ of ___ Date ______



Date	Digs	MEC Items	MEC Scrap	Non Mec Scrap	Sq Ft Today	% Done

Significant items Recovered (use back for additional) Anything on back? Yes/No

1. MEC Frags 4. Scrap Metal
2. MEC Scrap 20mm/30mm projectiles 5. Prop Charge Cannister
3.

*The undersigned certifies that all identified anomalies have been investigated or excavated

*Team leader E M [illegible] 2/2/06

*Contractor QC Vince Shackford [illegible] 2-2-06

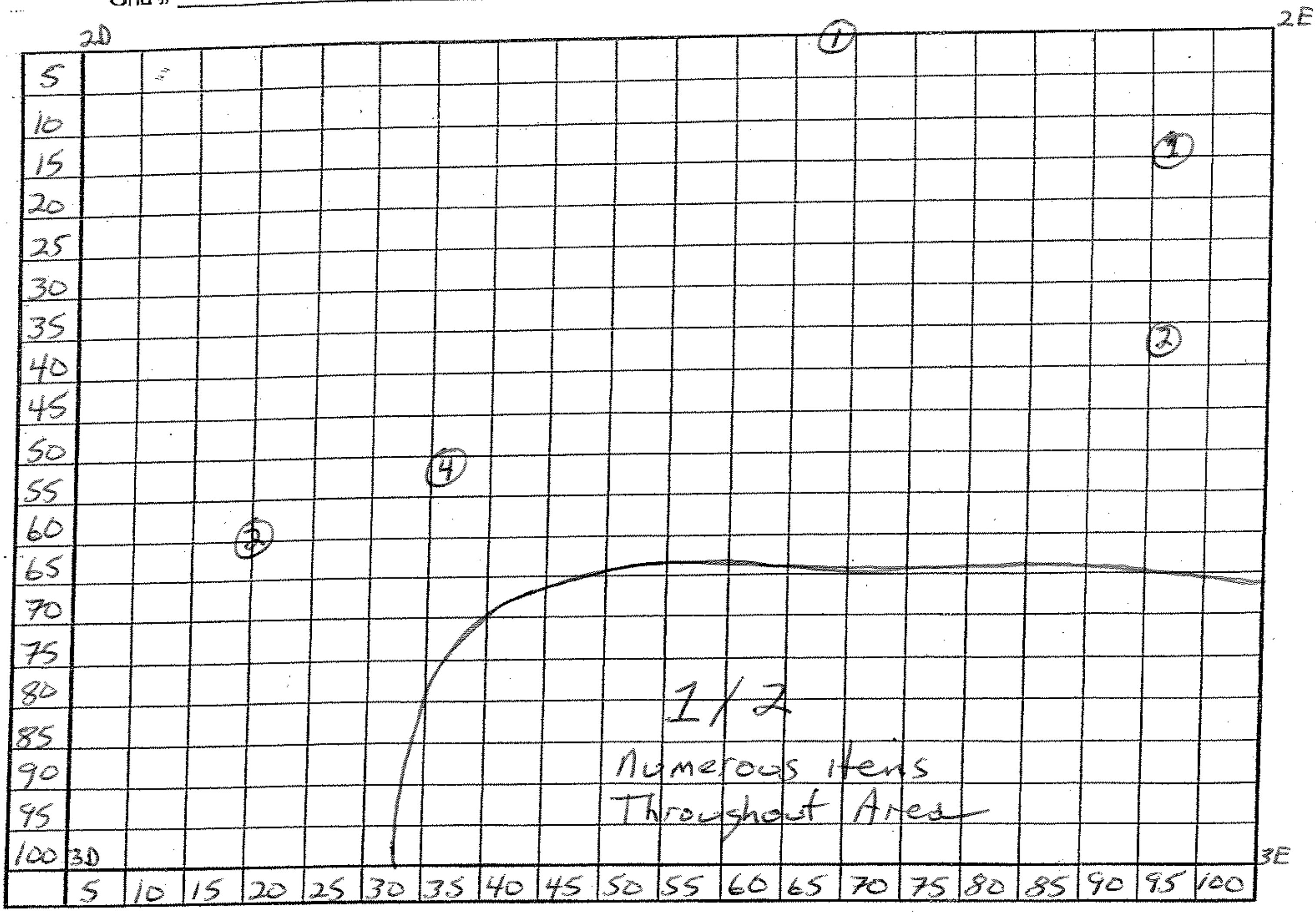
QA inspection on this grid is complete. All identified anomalies have been excavated per the above criteria.

USACE Site Representative ______

GRID REPORTING SHEET

Address NASA WFF Visitor Center Site

Grid # 3D Sheet ___of___ Date ________



Date	Digs	MEC Items	MEC Scrap	Non Mec Scrap	Sq Ft Today	% Done

Significant items Recovered (use back for additional) Anything on back? Yes/No

1. MEC Frags 4. Scrap Metal
2. MEC Scrap 20mm/30mm Projectiles
3.

*The undersigned certifies that all identified anomalies have been investigated or excavated

*Team leader E M Deibert 2/2/06

*Contractor QC Vince Shickora [signature] 2-2-06

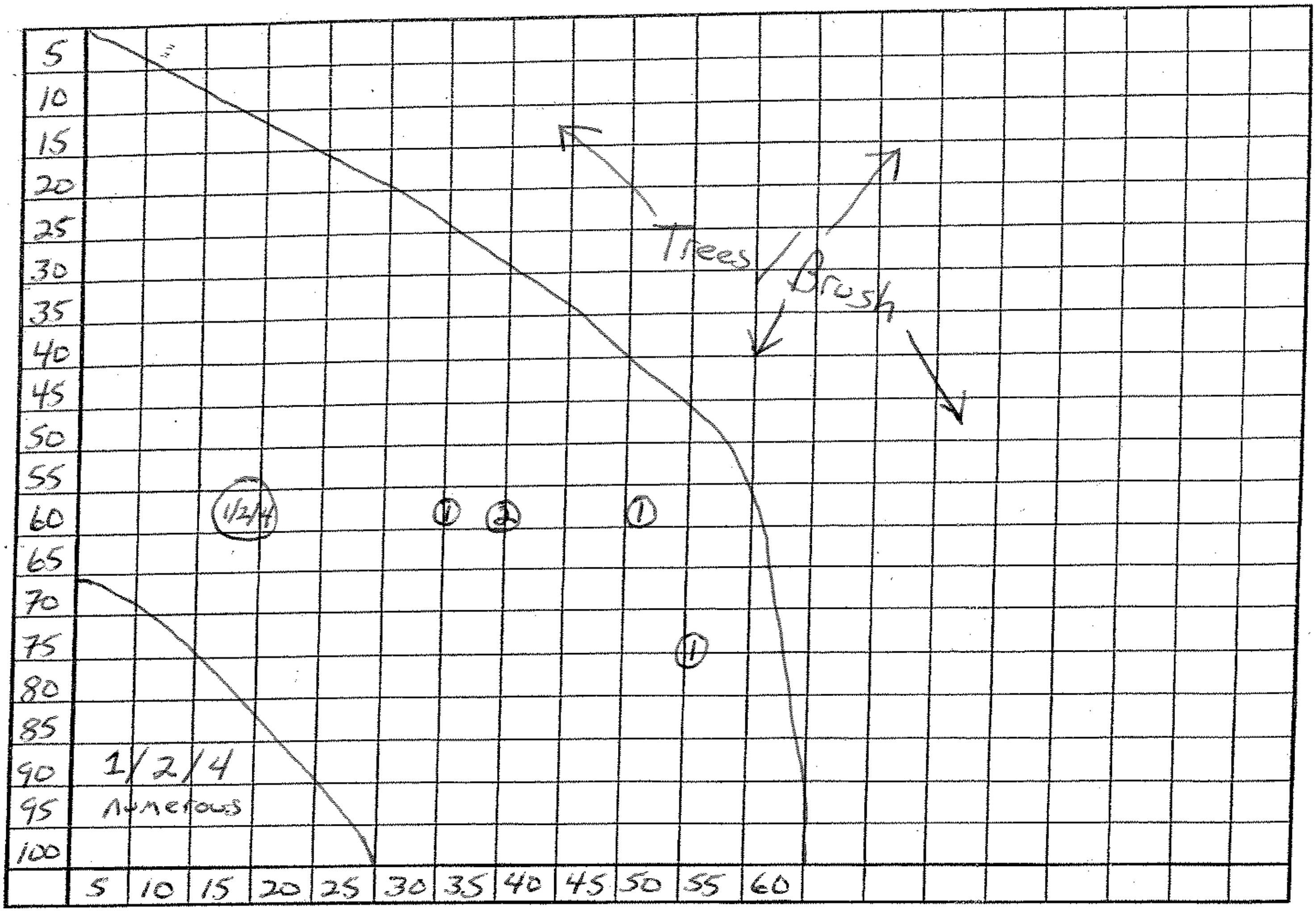
QA inspection on this grid is complete. All identified anomalies have been excavated per the above criteria.

USACE Site Representative________

GRID REPORTING SHEET

Address NASA WFF Visitor Center Site

Grid # 3E   Sheet ___of___ Date __________



Date	Digs	MEC Items	MEC Scrap	Non Mec Scrap	Sq Ft Today	% Done

Significant items Recovered (use back for additional) Anything on back? Yes/No

1. MEC Frags   4. Scrap Metal
2. MEC Scrap 20mm/30mm projectiles
3. __________

*The undersigned certifies that all identified anomalies have been investigated or excavated

*Team leader E. Deichert 2/2/06

*Contractor QC Vince Shickora 2-2-06

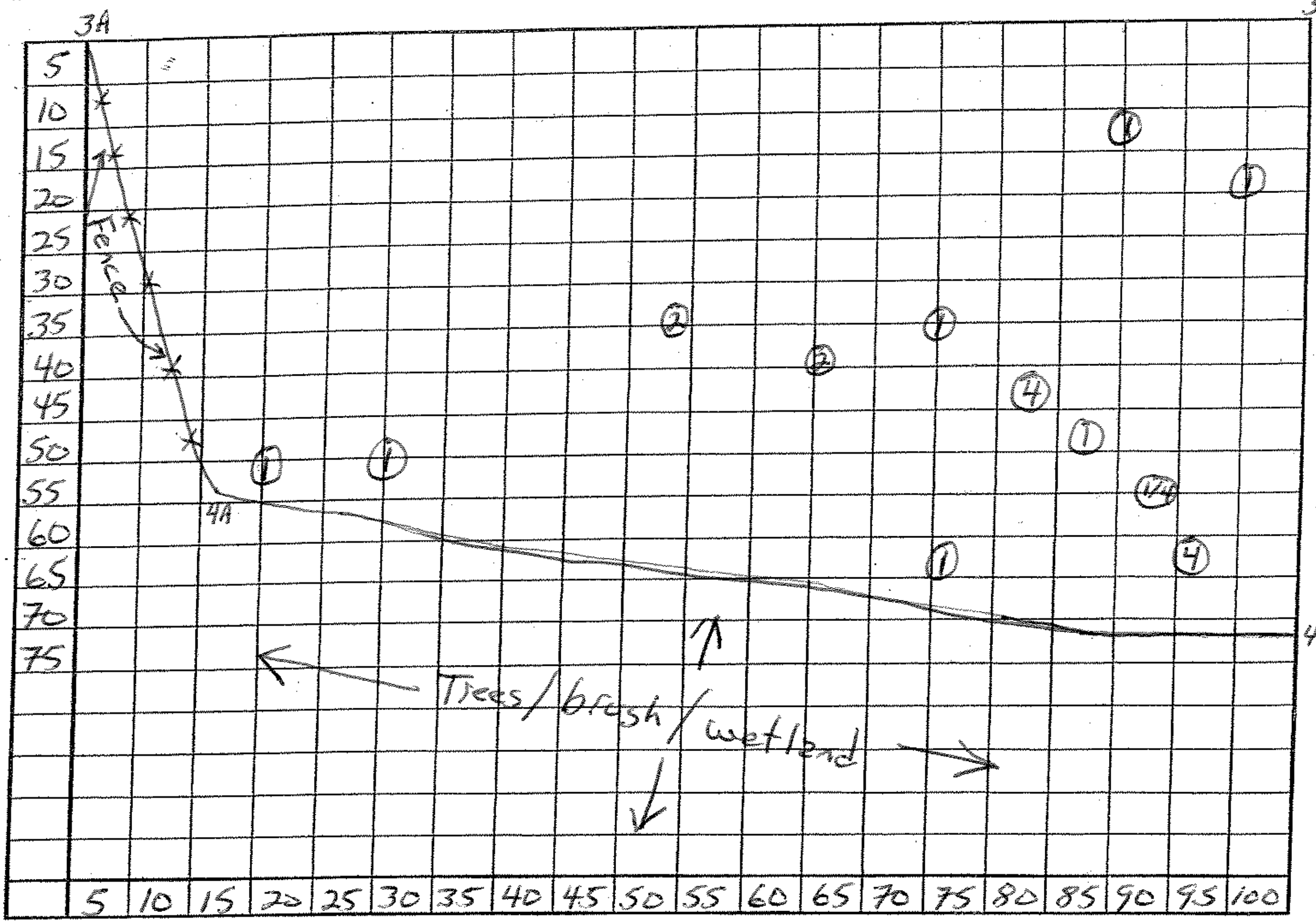
QA inspection on this grid is complete. All identified anomalies have been excavated per the above criteria.

USACE Site Representative__________

GRID REPORTING SHEET

Address NASA WFF Visitor Center Site

Grid # 4A Sheet ___ of ___ Date ________



Date	Digs	MEC Items	MEC Scrap	Non Mec Scrap	Sq Ft Today	% Done

Significant items Recovered (use back for additional) Anything on back? Yes/No

1. MEC Frags 4. Scrap Metal
2. MEC Scrap 20mm/30mm Projectiles
3.

*The undersigned certifies that all identified anomalies have been investigated or excavated

*Team leader E M Deihert 2/2/06

*Contractor QC Vince Shickort [signature] 2-2-06

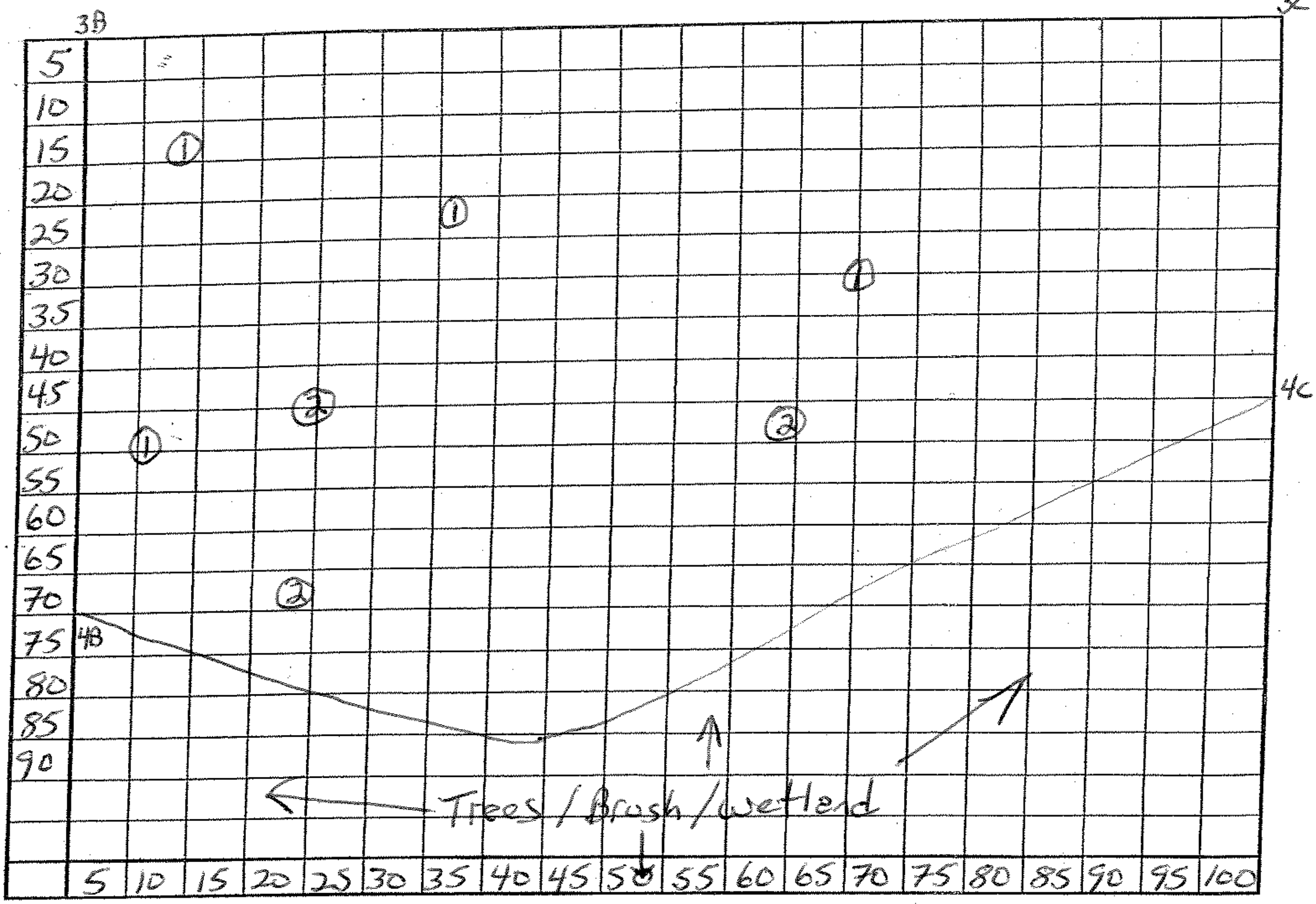
QA inspection on this grid is complete. All identified anomalies have been excavated per the above criteria.

USACE Site Representative ________

GRID REPORTING SHEET

Address NASA WFF Visitor Center Site

Grid # 4B Sheet ___ of ___ Date ___



Date	Digs	MEC Items	MEC Scrap	Non Mec Scrap	Sq Ft Today	% Done

Significant items Recovered (use back for additional) Anything on back? Yes/No

1. MEC Frags
2. MEC Scrap 20mm/30mm projectiles
3.

*The undersigned certifies that all identified anomalies have been investigated or excavated

*Team leader E M Dailert 2/2/06

*Contractor QC Vince Shickora 2-2-06

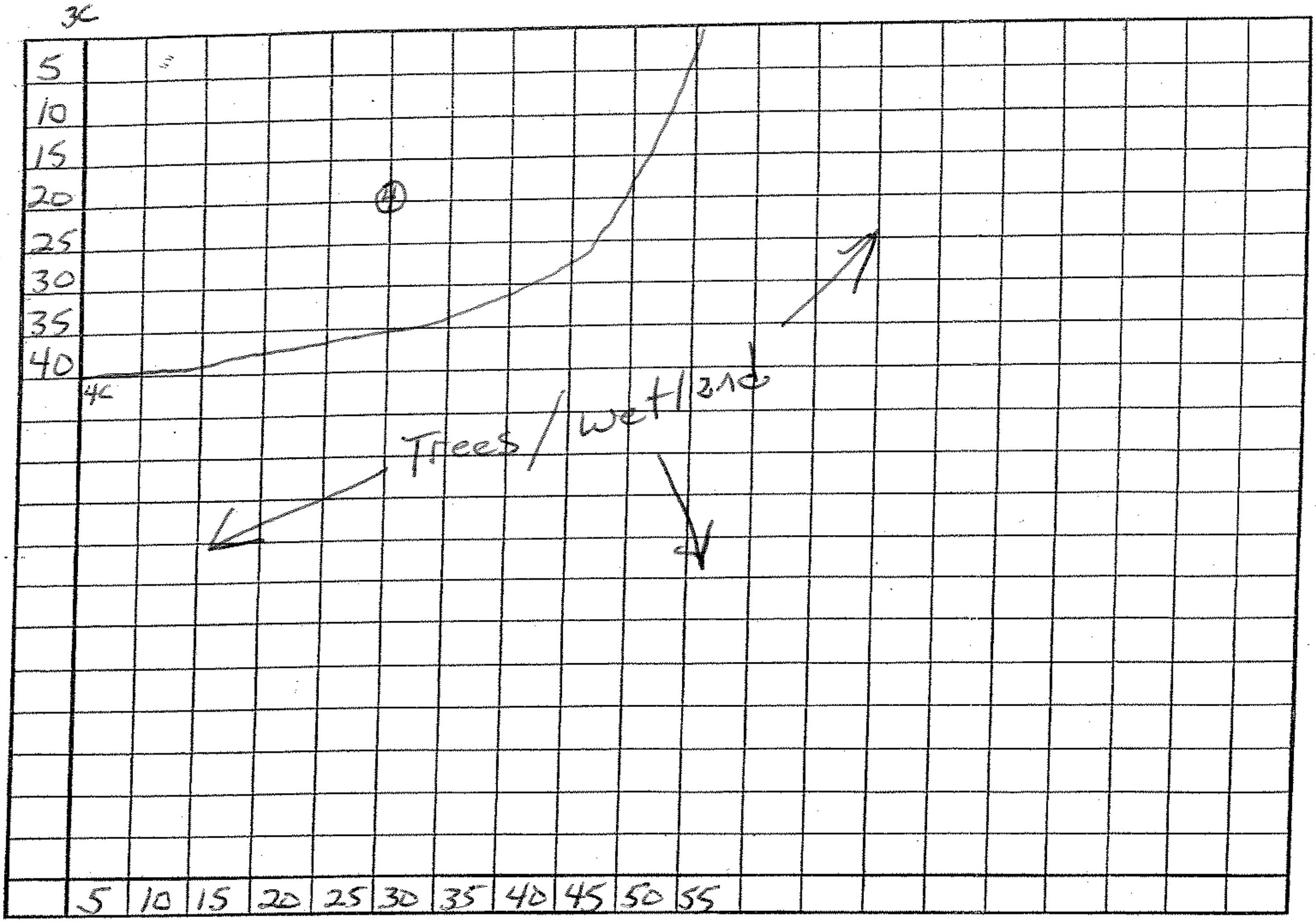
QA inspection on this grid is complete. All identified anomalies have been excavated per the above criteria.

USACE Site Representative ___

GRID REPORTING SHEET

Address NASA WFF Visitor Center

Grid # 4C Sheet ___ of ___ Date ___



Date	Digs	MEC Items	MEC Scrap	Non Mec Scrap	Sq Ft Today	% Done

Significant items Recovered (use back for additional) Anything on back? Yes/No

1. 4 Scrap Metal
2.
3.

*The undersigned certifies that all identified anomalies have been investigated or excavated

*Team leader [signature] 2/2/06

*Contractor QC Vince Shickora [signature] 2-2-06

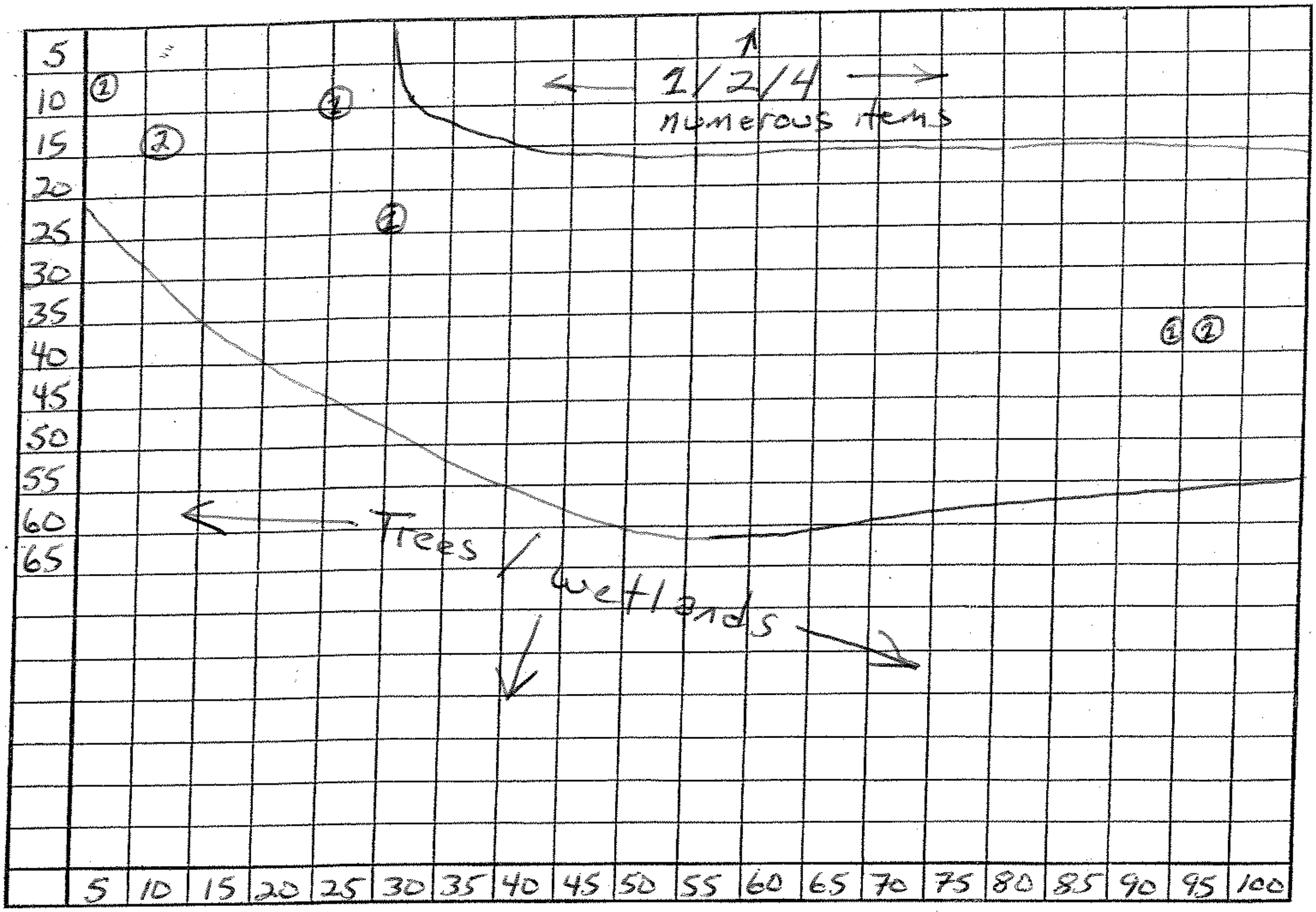
QA inspection on this grid is complete. All identified anomalies have been excavated per the above criteria.

USACE Site Representative ___

GRID REPORTING SHEET

Address NASA WFF Visitor Center Site

Grid # 4D   Sheet ___ of ___   Date ________



Date	Digs	MEC Items	MEC Scrap	Non Mec Scrap	Sq Ft Today	% Done

Significant items Recovered (use back for additional) Anything on back? Yes/No

1. MEC Frags   4. Scrap Metal
2. MEC Scrap 20 mm / 30 mm projectiles
3. ________

*The undersigned certifies that all identified anomalies have been investigated or excavated

*Team leader E M Dailut 2/2/06

*Contractor QC Vince Shickora [signature] 2-2-06

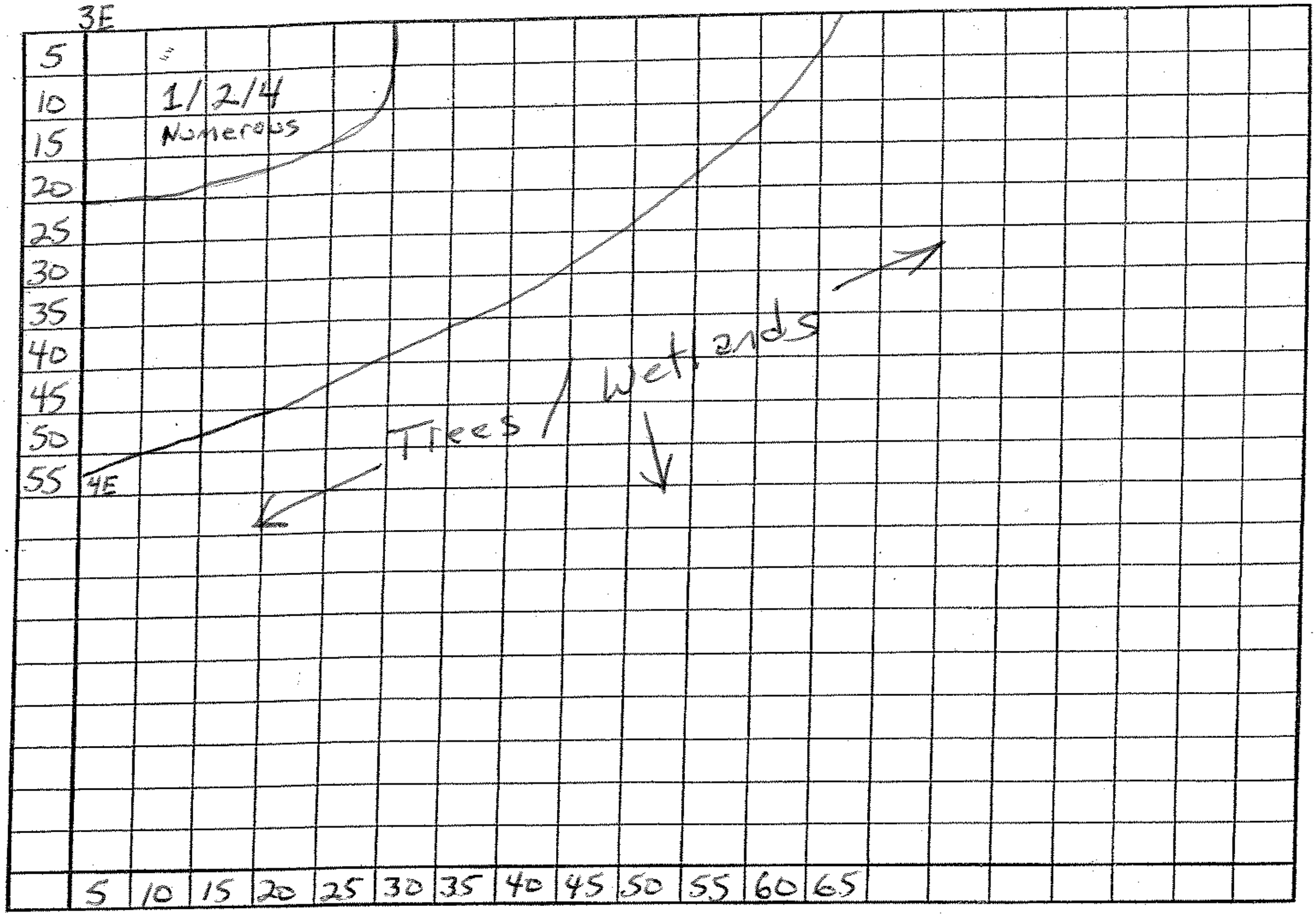
QA inspection on this grid is complete. All identified anomalies have been excavated per the above criteria.

USACE Site Representative ________

GRID REPORTING SHEET

Address NASA WFF Visitor Center Site

Grid # 4E Sheet ___of___ Date ________



Date	Digs	MEC Items	MEC Scrap	Non Mec Scrap	Sq Ft Today	% Done

Significant items Recovered (use back for additional) Anything on back? Yes/No

1. MEC Frags 4. Scrap Metal
2. MEC Scrap 20mm/30mm Projectiles
3.

*The undersigned certifies that all identified anomalies have been investigated or excavated

*Team leader E M Deulunt 2/2/06

*Contractor QC Vince Shickora [signature] 2-2-06

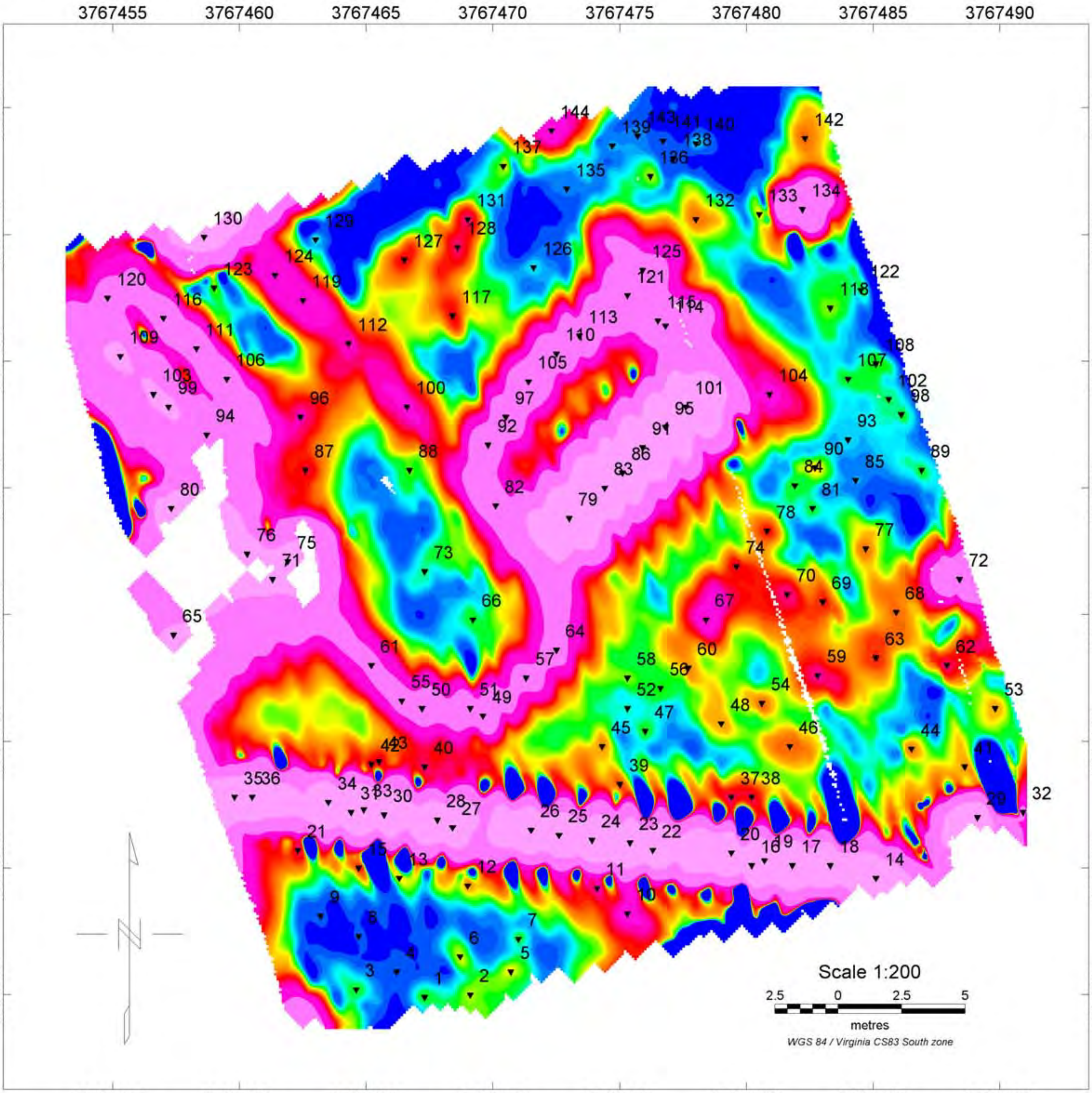
QA inspection on this grid is complete. All identified anomalies have been excavated per the above criteria.

USACE Site Representative________

APPENDIX B

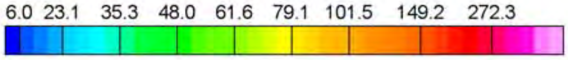
GEOPHYSICAL PROVE-OUT MAPS AND TARGET LISTS

(ON CD)



millivolts

6.0 23.1 35.3 48.0 61.6 79.1 101.5 149.2 272.3

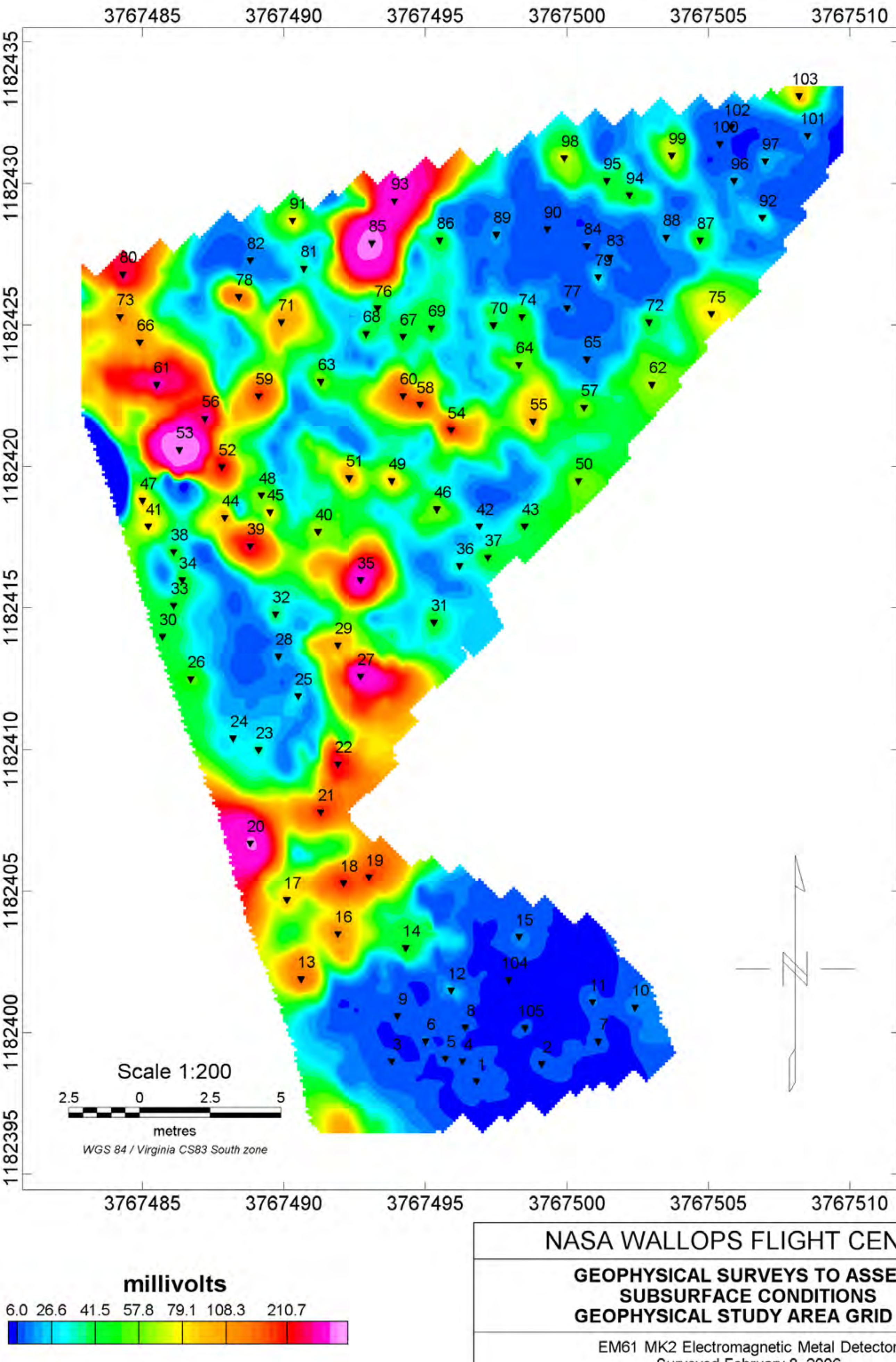


NASA WALLOPS FLIGHT CENTER

GEOPHYSICAL SURVEYS TO ASSESS SUBSURFACE CONDITIONS GEOPHYSICAL STUDY AREA GRID 1C

EM61 MK2 Electromagnetic Metal Detector
Surveyed February 8, 2006

Tetra Tech EM Inc.

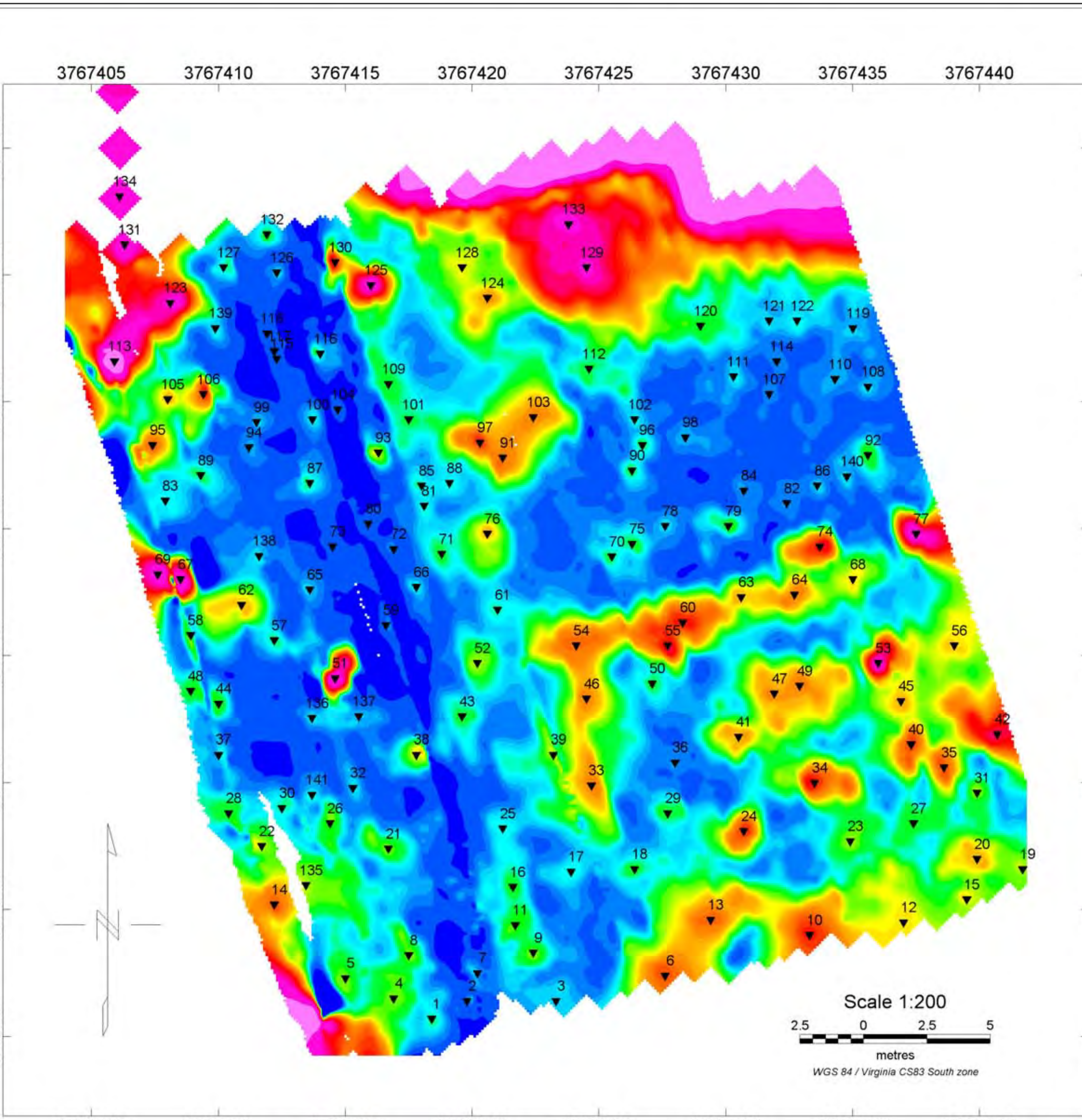


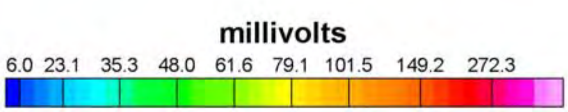
NASA WALLOPS FLIGHT CENTER

GEOPHYSICAL SURVEYS TO ASSESS SUBSURFACE CONDITIONS GEOPHYSICAL STUDY AREA GRID 1D

EM61 MK2 Electromagnetic Metal Detector
Surveyed February 8, 2006

Tetra Tech EM Inc.



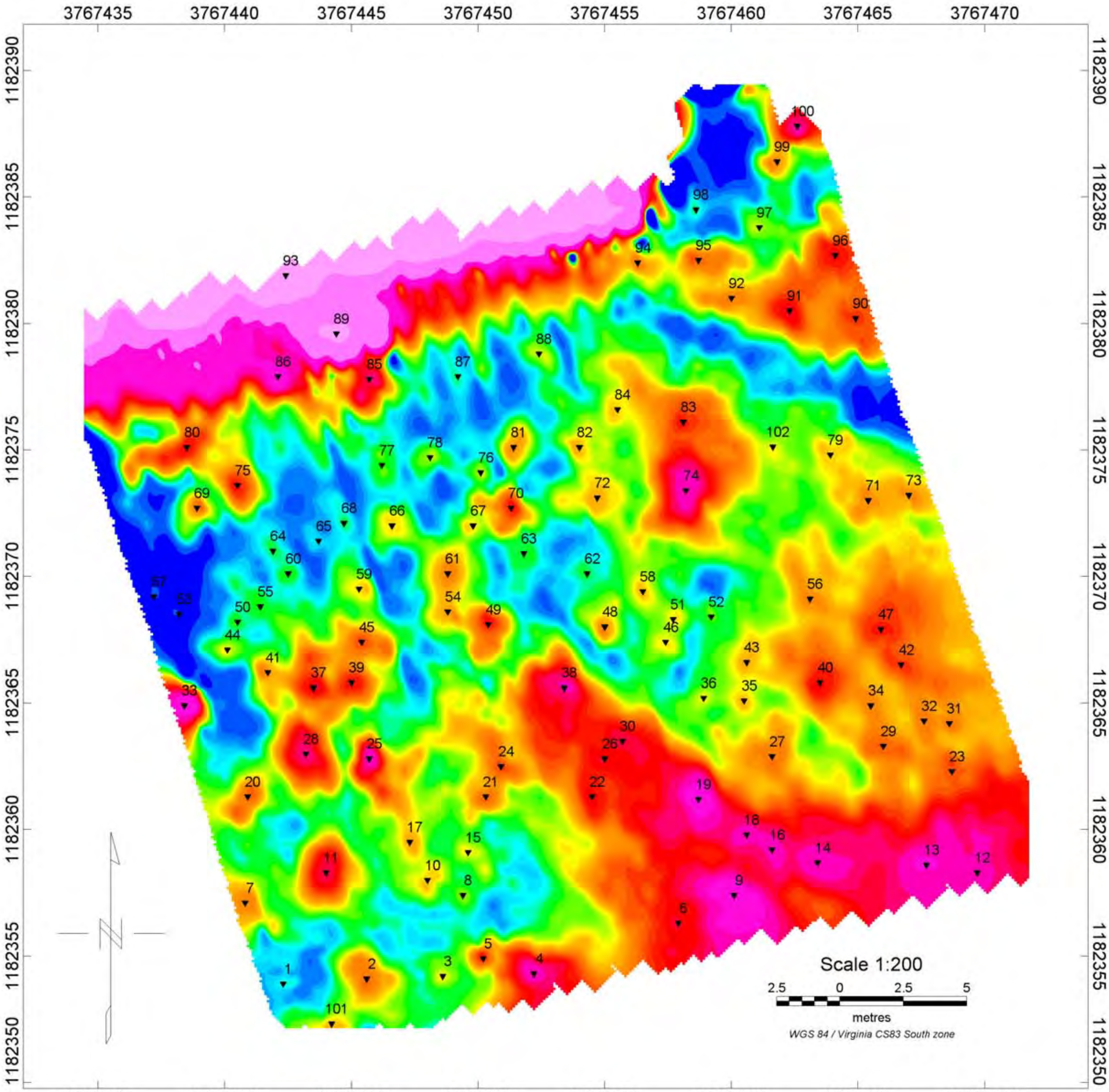


NASA WALLOPS FLIGHT CENTER

GEOPHYSICAL SURVEYS TO ASSESS SUBSURFACE CONDITIONS GEOPHYSICAL STUDY AREA GRID 2A

EM61 MK2 Electromagnetic Metal Detector
Surveyed February 8, 2006

Tetra Tech EM Inc.



millivolts

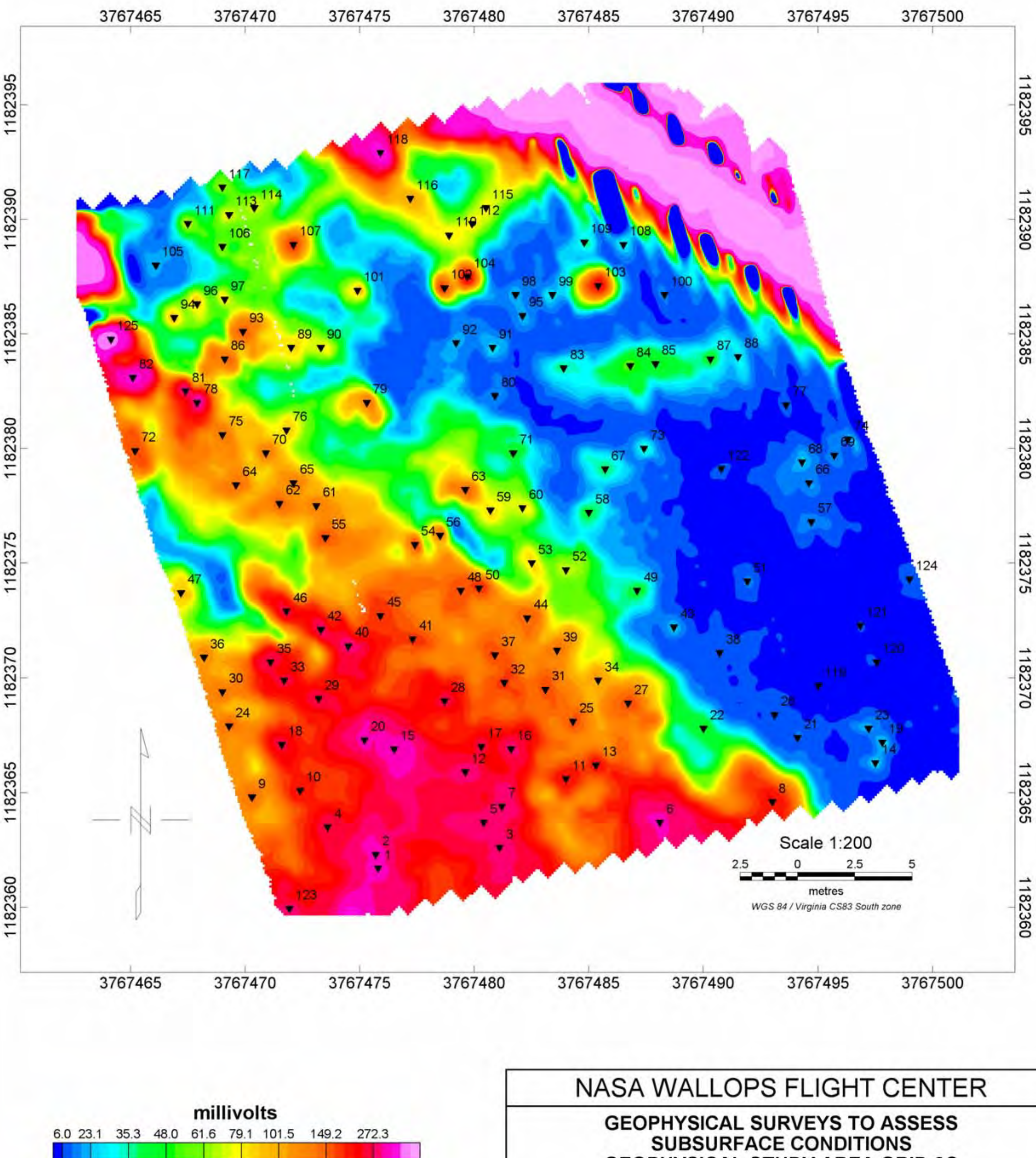
6.0 26.6 41.5 57.8 79.1 108.3 210.7

NASA WALLOPS FLIGHT CENTER

GEOPHYSICAL SURVEYS TO ASSESS SUBSURFACE CONDITIONS GEOPHYSICAL STUDY AREA GRID 2B

EM61 MK2 Electromagnetic Metal Detector
Surveyed February 8, 2006

Tetra Tech EM Inc.

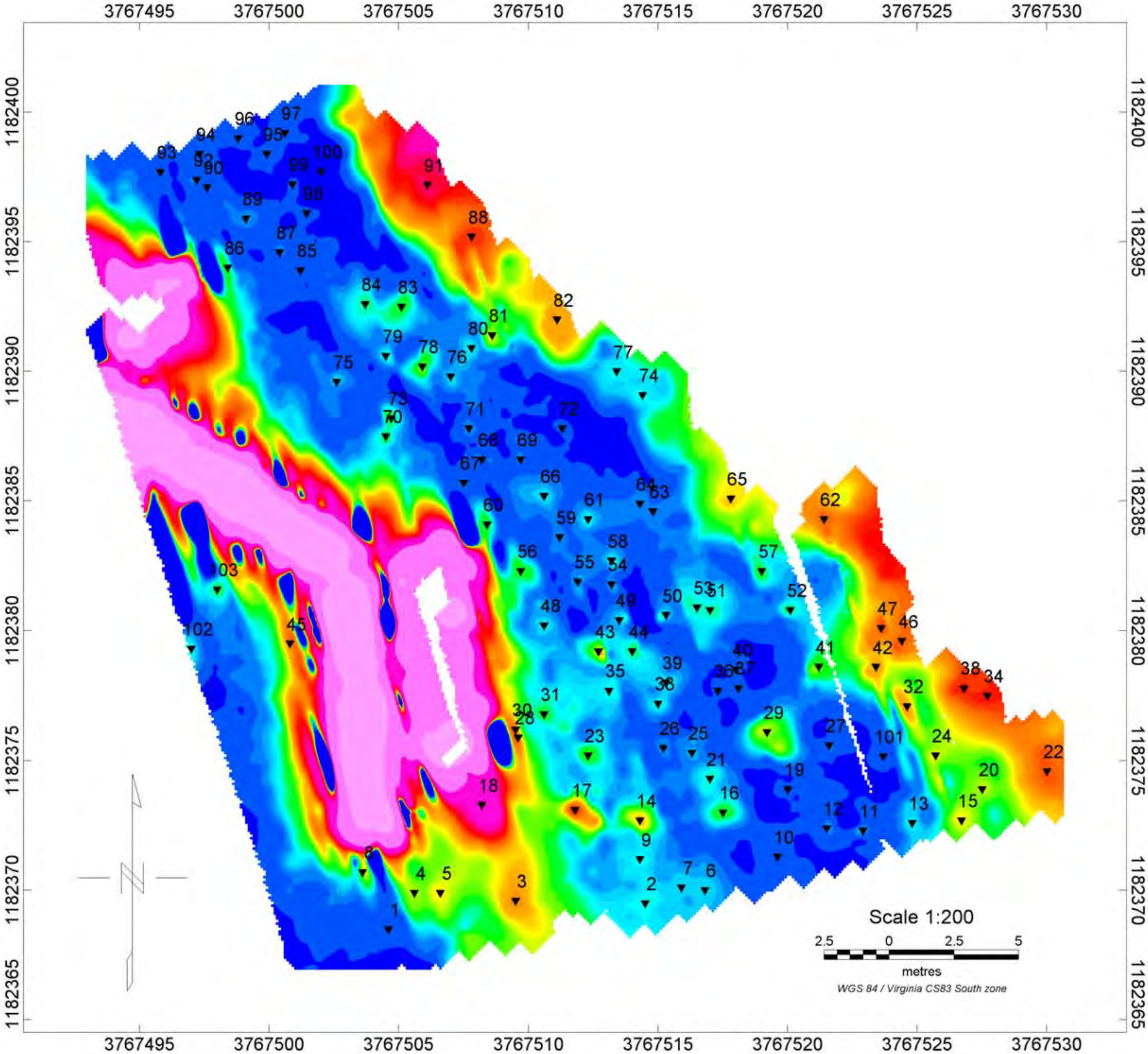


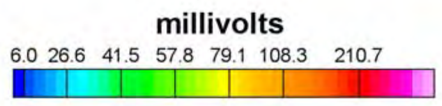
NASA WALLOPS FLIGHT CENTER

GEOPHYSICAL SURVEYS TO ASSESS SUBSURFACE CONDITIONS GEOPHYSICAL STUDY AREA GRID 2C

EM61 MK2 Electromagnetic Metal Detector
Surveyed February 8, 2006

Tetra Tech EM Inc.



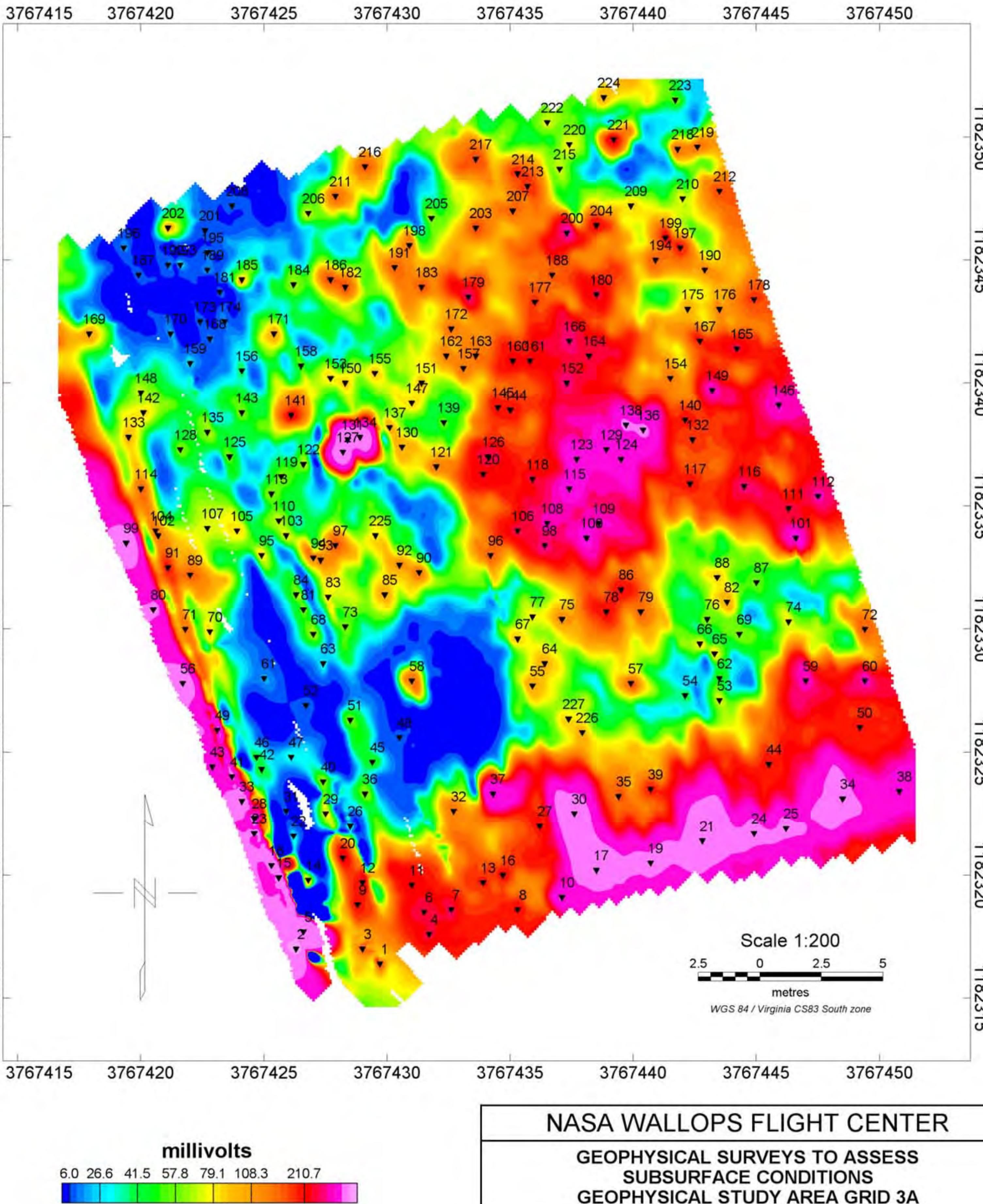


NASA WALLOPS FLIGHT CENTER

GEOPHYSICAL SURVEYS TO ASSESS SUBSURFACE CONDITIONS GEOPHYSICAL STUDY AREA GRID 2D

EM61 MK2 Electromagnetic Metal Detector
Surveyed February 8, 2006

Tetra Tech EM Inc.

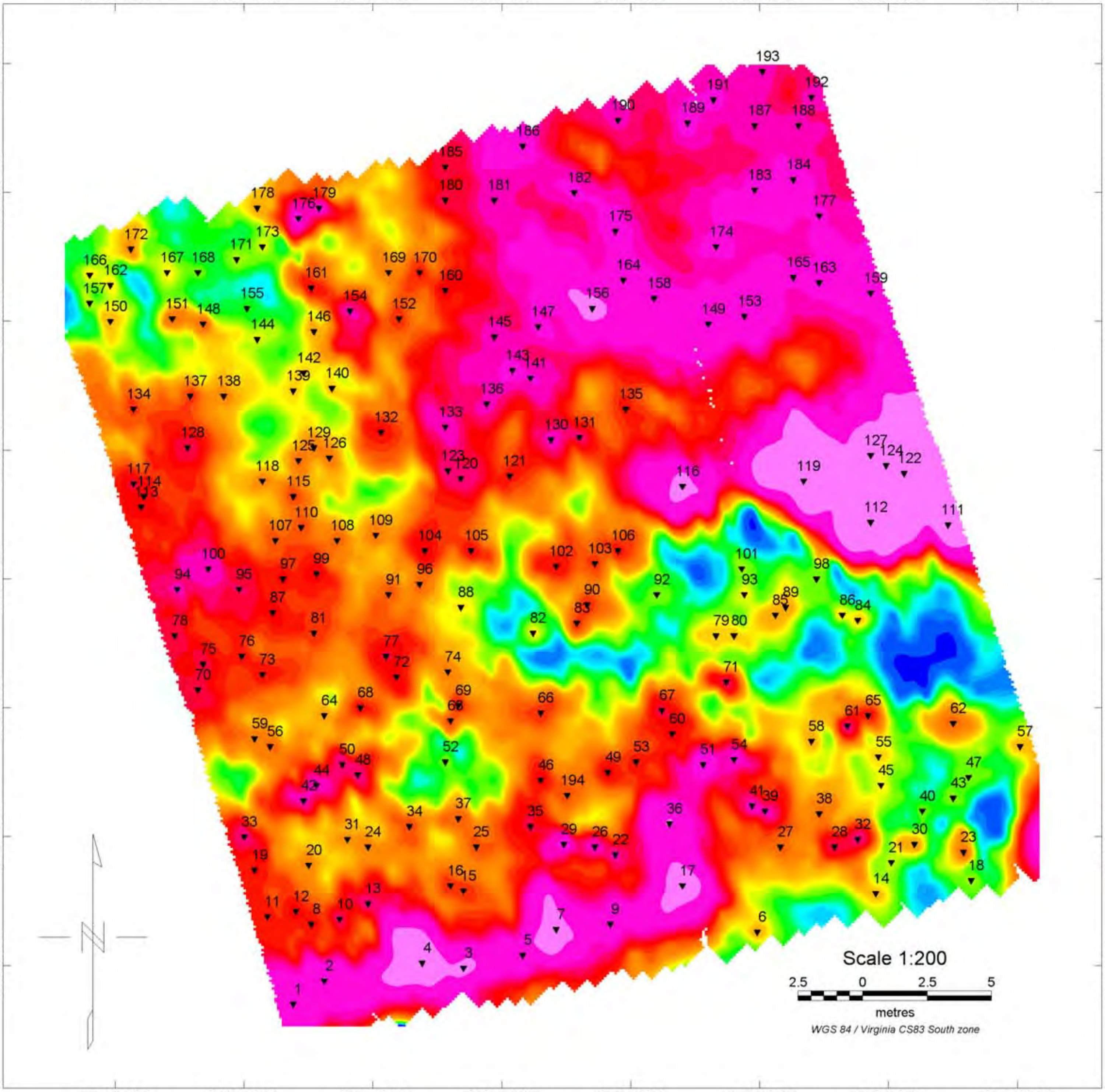


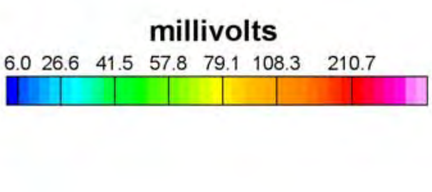
NASA WALLOPS FLIGHT CENTER

GEOPHYSICAL SURVEYS TO ASSESS SUBSURFACE CONDITIONS GEOPHYSICAL STUDY AREA GRID 3A

EM61 MK2 Electromagnetic Metal Detector
Surveyed February 9, 2006

Tetra Tech EM Inc.



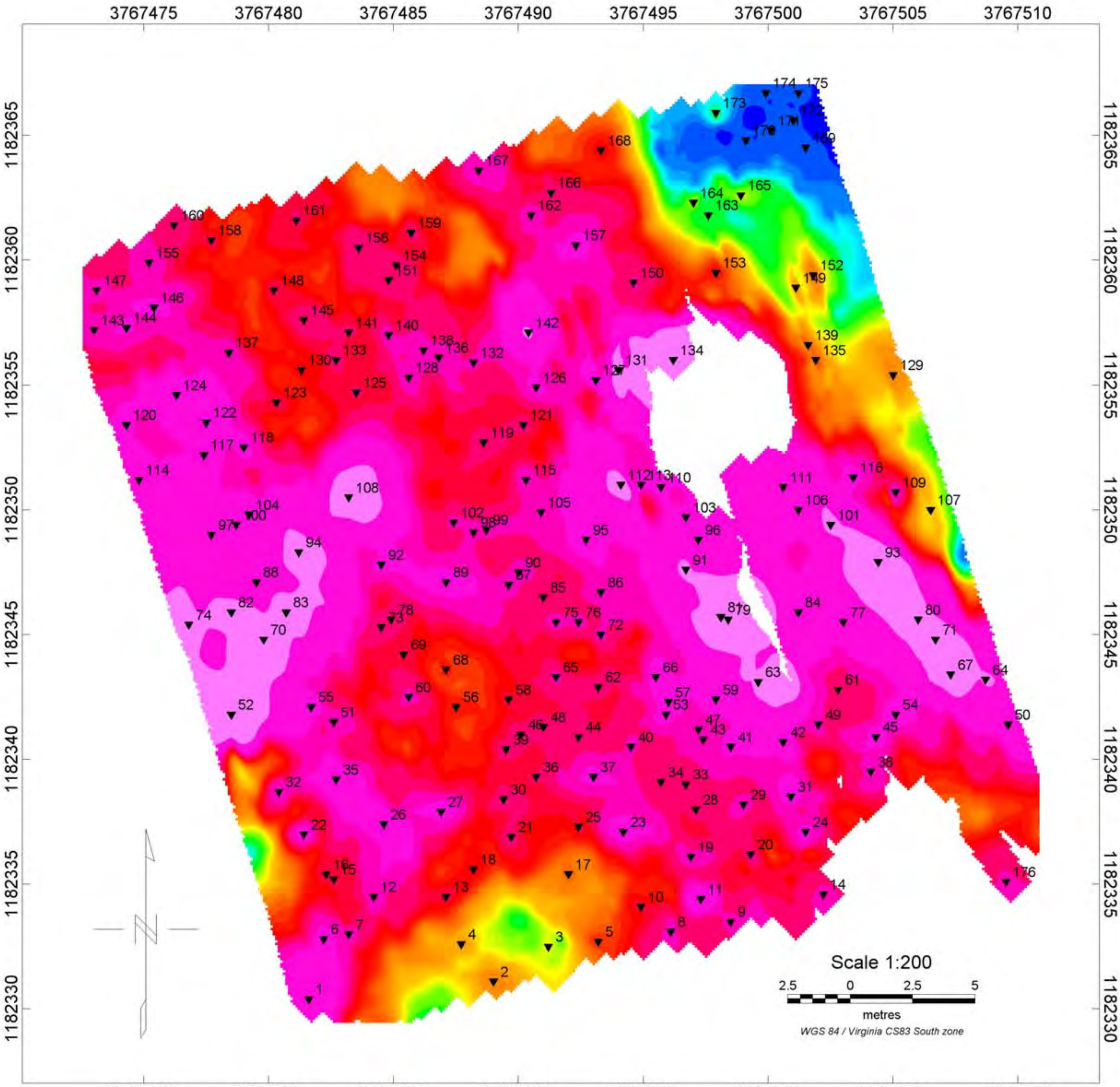


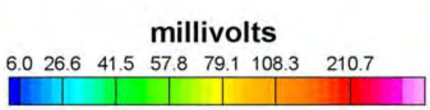
NASA WALLOPS FLIGHT CENTER

GEOPHYSICAL SURVEYS TO ASSESS SUBSURFACE CONDITIONS GEOPHYSICAL STUDY AREA GRID 3B

EM61 MK2 Electromagnetic Metal Detector
Surveyed February 9, 2006

Tetra Tech EM Inc.



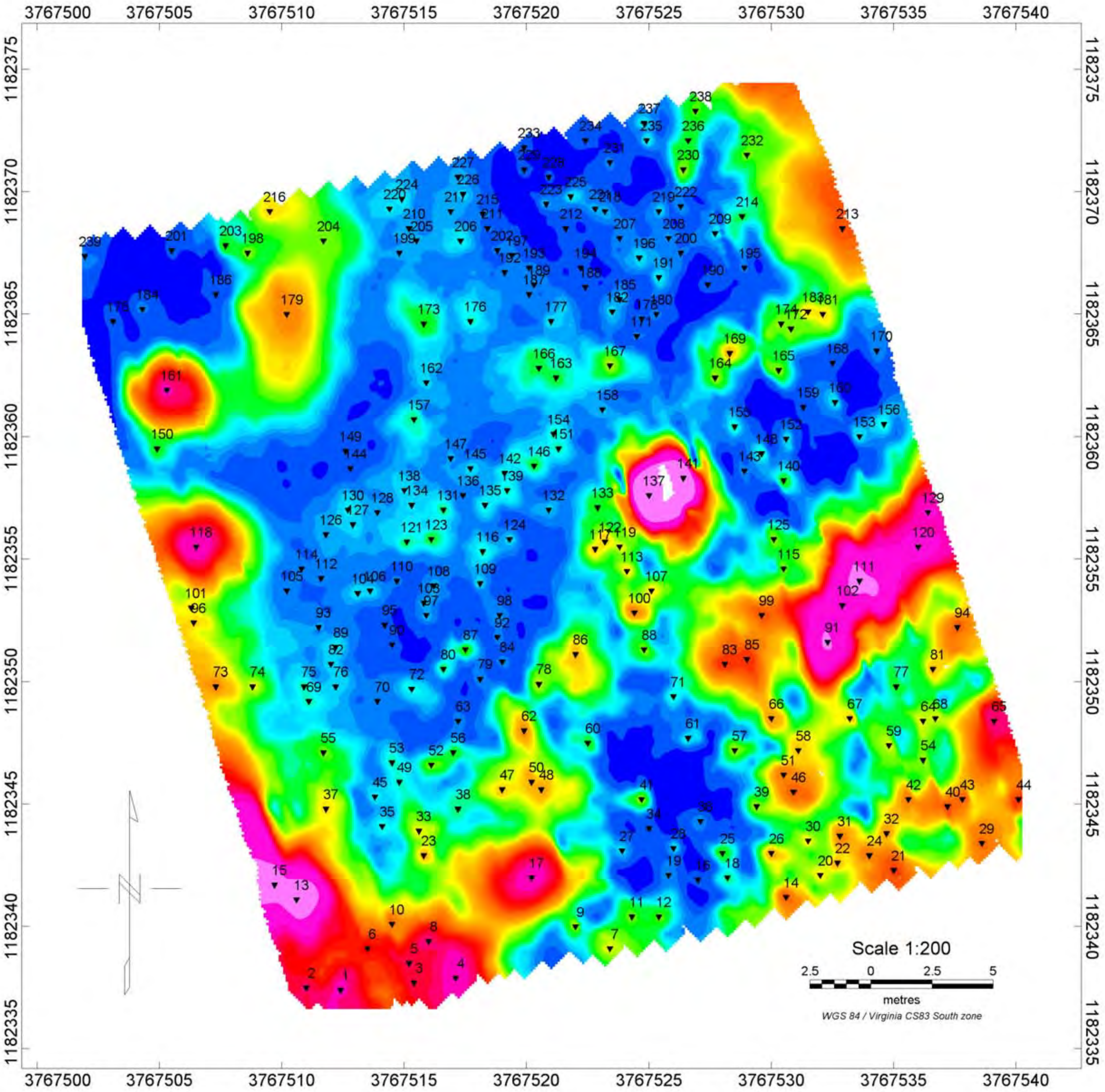


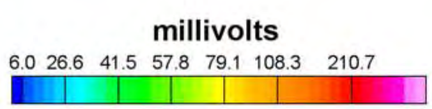
NASA WALLOPS FLIGHT CENTER

GEOPHYSICAL SURVEYS TO ASSESS SUBSURFACE CONDITIONS GEOPHYSICAL STUDY AREA GRID 3C

EM61 MK2 Electromagnetic Metal Detector
Surveyed February 9, 2006

Tetra Tech EM Inc.



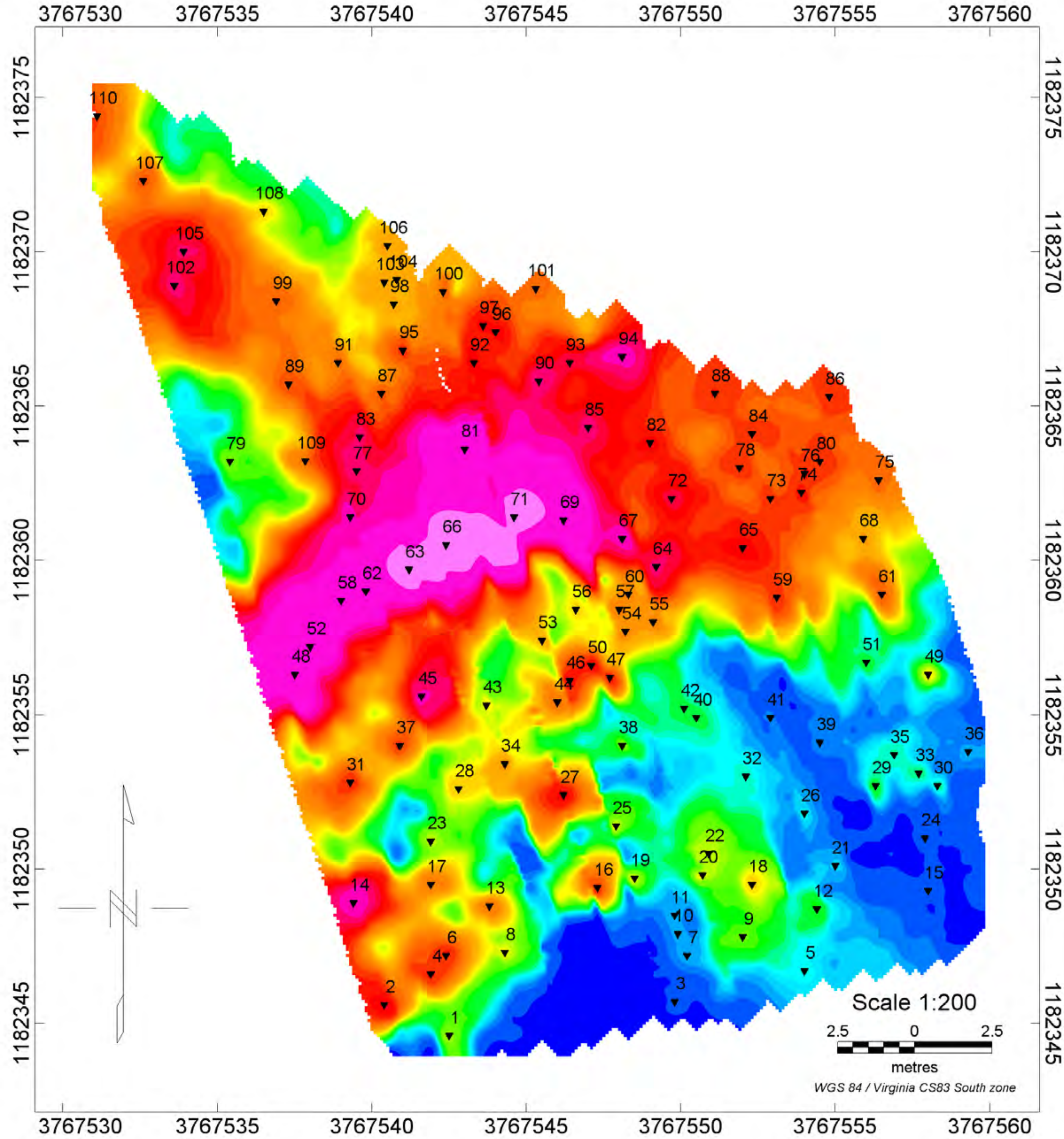


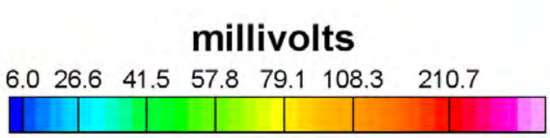
NASA WALLOPS FLIGHT CENTER

GEOPHYSICAL SURVEYS TO ASSESS SUBSURFACE CONDITIONS GEOPHYSICAL STUDY AREA GRID 3D

EM61 MK2 Electromagnetic Metal Detector
Surveyed February 9, 2006

Tetra Tech EM Inc.



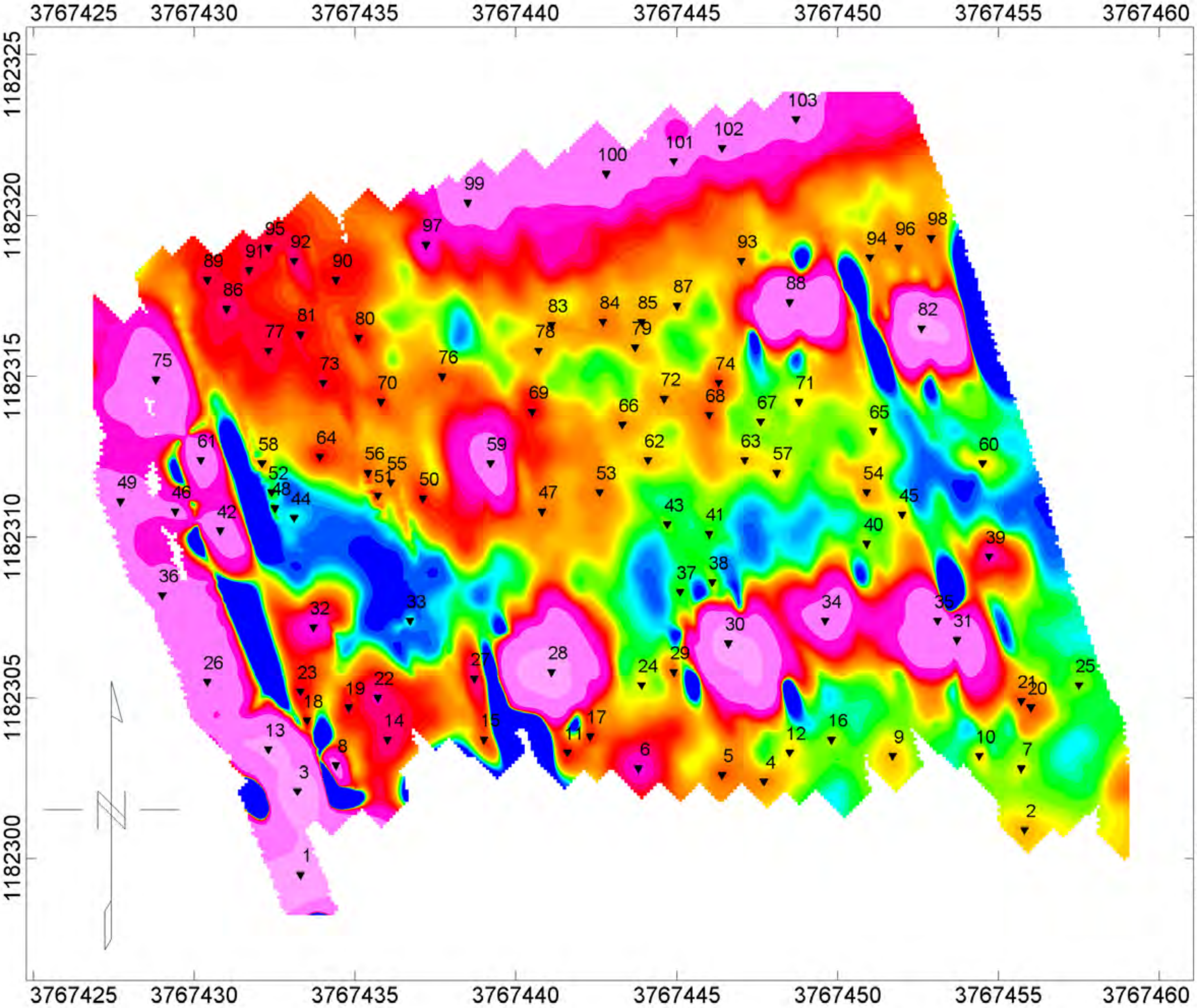


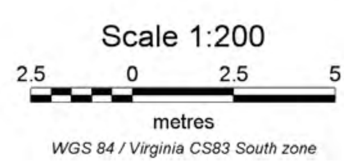
NASA WALLOPS FLIGHT CENTER

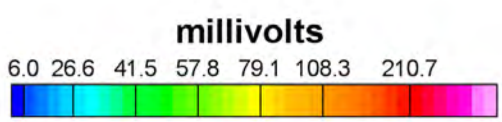
GEOPHYSICAL SURVEYS TO ASSESS SUBSURFACE CONDITIONS GEOPHYSICAL STUDY AREA GRID 3E

EM61 MK2 Electromagnetic Metal Detector
Surveyed February 9, 2006

Tetra Tech EM Inc.





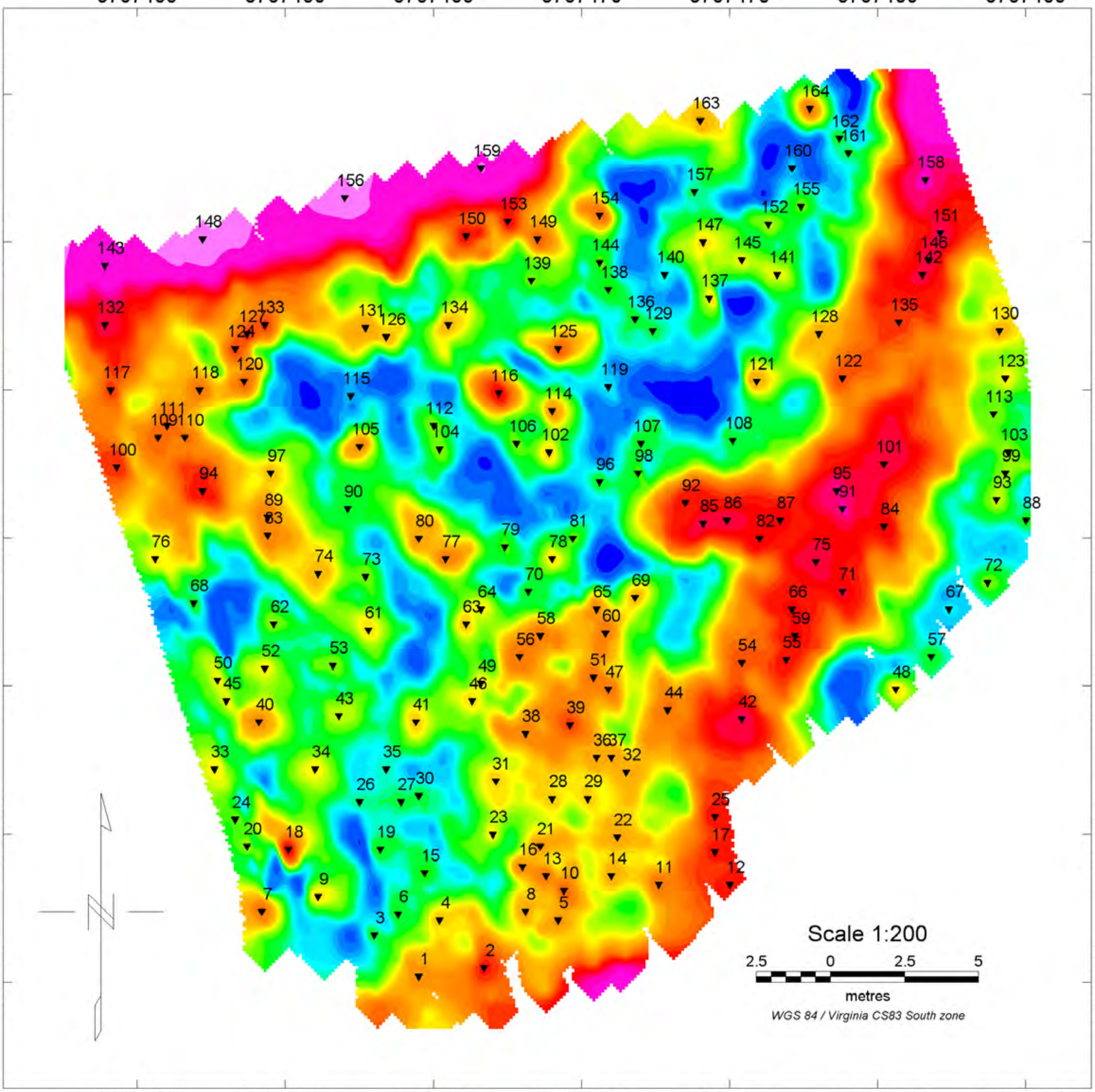


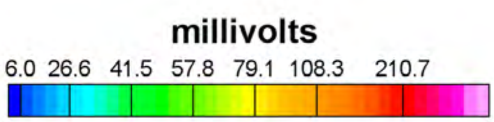
NASA WALLOPS FLIGHT CENTER

GEOPHYSICAL SURVEYS TO ASSESS SUBSURFACE CONDITIONS GEOPHYSICAL STUDY AREA GRID 4A

EM61 MK2 Electromagnetic Metal Detector
Surveyed February 9, 2006

Tetra Tech EM Inc.



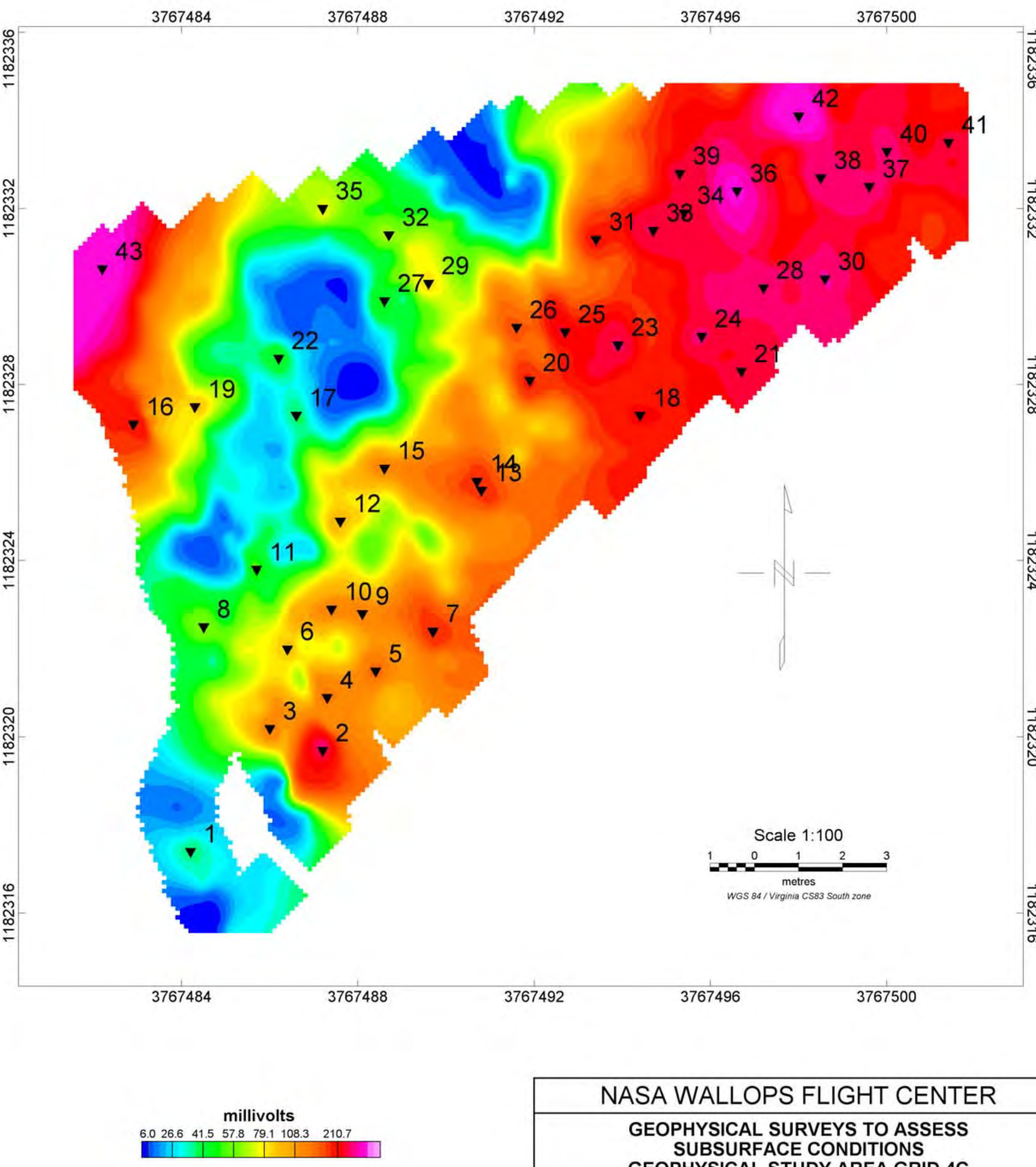


NASA WALLOPS FLIGHT CENTER

GEOPHYSICAL SURVEYS TO ASSESS SUBSURFACE CONDITIONS GEOPHYSICAL STUDY AREA GRID 4B

EM61 MK2 Electromagnetic Metal Detector
Surveyed February 9, 2006

Tetra Tech EM Inc.

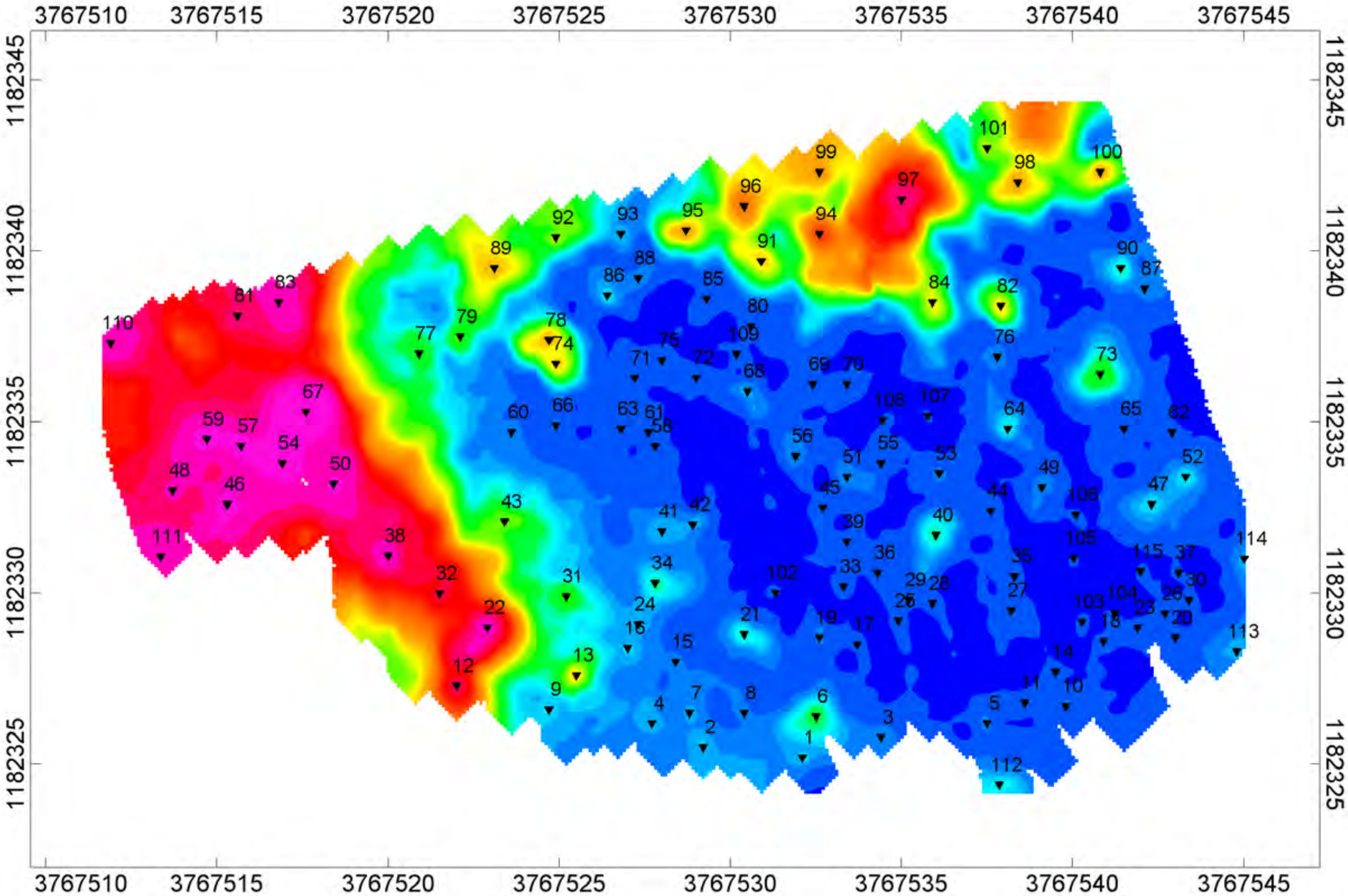


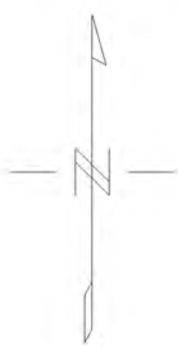
NASA WALLOPS FLIGHT CENTER

GEOPHYSICAL SURVEYS TO ASSESS SUBSURFACE CONDITIONS GEOPHYSICAL STUDY AREA GRID 4C

EM61 MK2 Electromagnetic Metal Detector
Surveyed February 9, 2006

Tetra Tech EM Inc.





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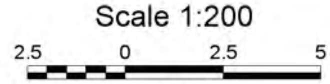
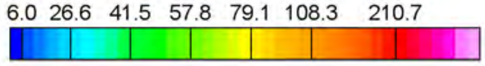


WGS 84 / Virginia CS83 South zone

millivolts

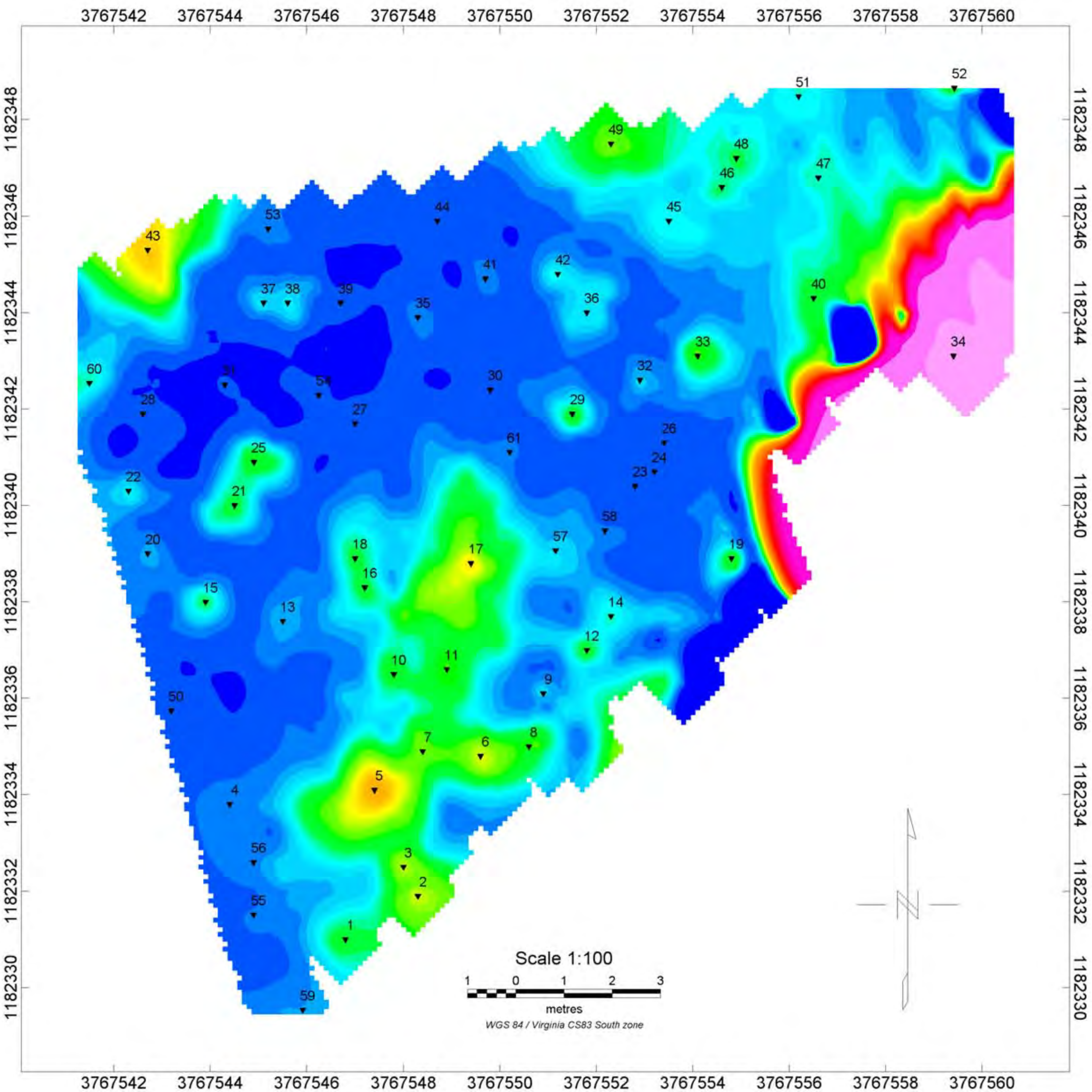


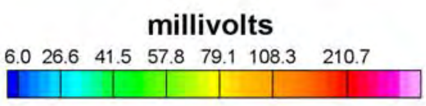
NASA WALLOPS FLIGHT CENTER

GEOPHYSICAL SURVEYS TO ASSESS SUBSURFACE CONDITIONS GEOPHYSICAL STUDY AREA GRID 4D

EM61 MK2 Electromagnetic Metal Detector
Surveyed February 9, 2006

Tetra Tech EM Inc.





NASA WALLOPS FLIGHT CENTER

GEOPHYSICAL SURVEYS TO ASSESS SUBSURFACE CONDITIONS GEOPHYSICAL STUDY AREA GRID 4E

EM61 MK2 Electromagnetic Metal Detector
Surveyed February 9, 2006

Tetra Tech EM Inc.

APPENDIX C

SELECT REPRESENTATIVE PHOTOS OF SITE ACTIVITIES

Surface Clearance – Angle Iron – Left in place Grid 2B

Surface Clearance – Steel Plate – Left in place Grid 4A

Surface Clearance – Typical 20mm/30mm items found

Surface Clearance – Scrap Metal Items Found

0335AB24

Geophysical Prove-Out using EM-61

Geophysical Survey of Visitor Center Site with EM-61

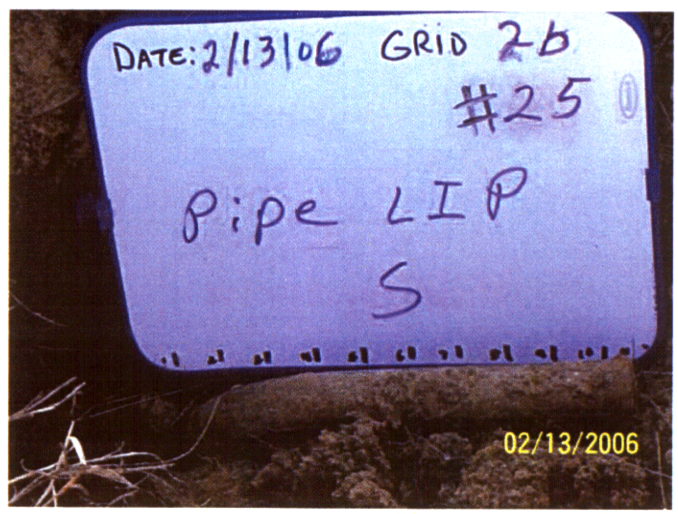
Geophysical Survey Targets Flagged in Grid 2C and 2D

Geophysical Survey Targets Flagged in Grids 2A and 2B

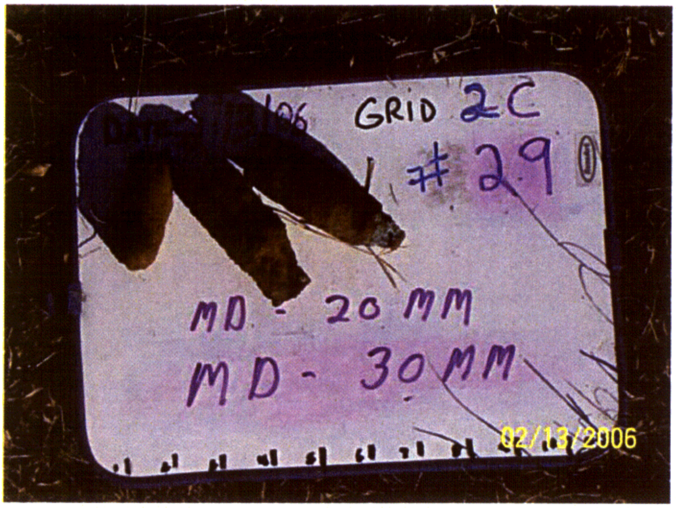
Intrusive Activities - Typical 20mm Munitions Items

Intrusive Activities – Scrap Metal (Bolt)

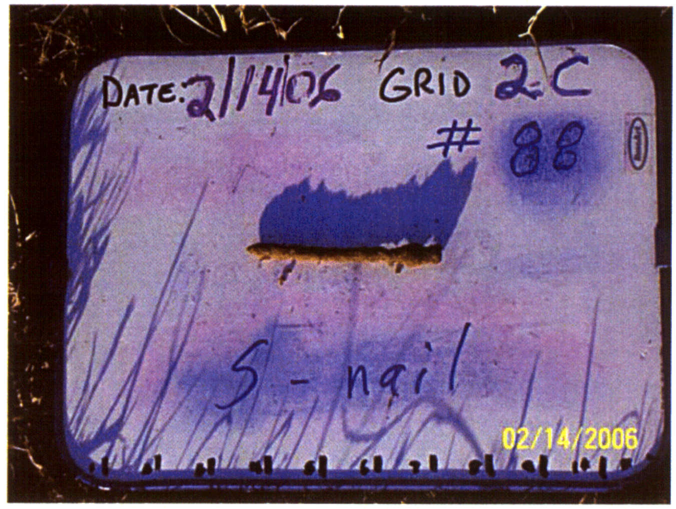
Intrusive Activities – Typical 20mm/30mm items



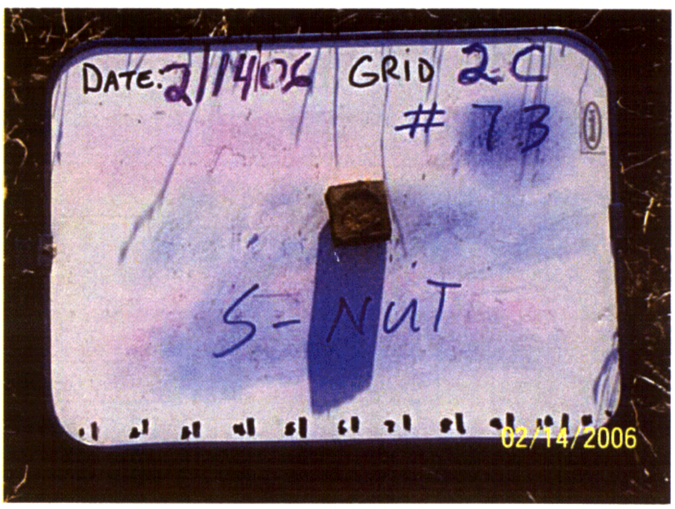
Intrusive Activities – Pipe - Left in Place



Intrusive Activities – Typical 20mm/30mm items

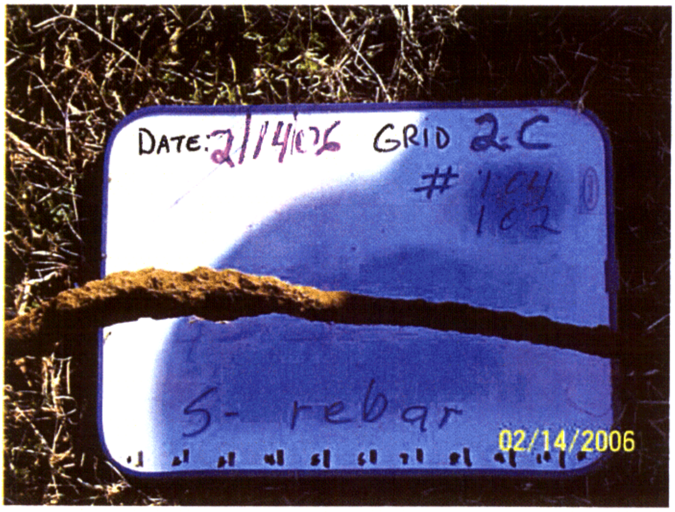


Intrusive Activities – Scrap Metal (Nail)

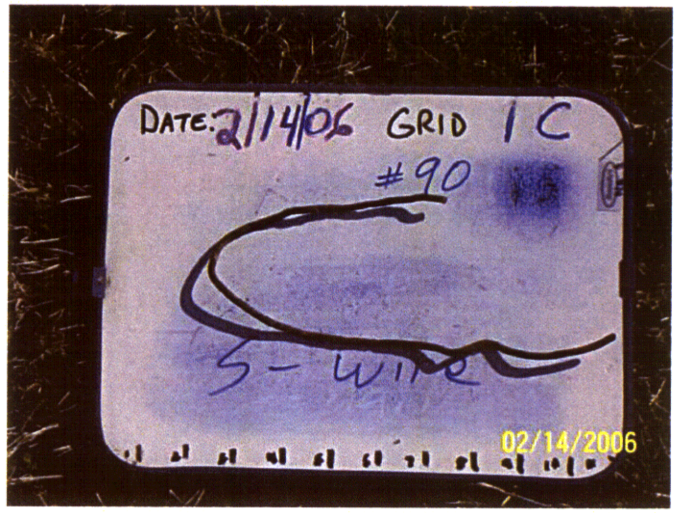


Intrusive Activities – Scrap Metal (Nut)

Intrusive Activities – Wood and Nails



Intrusive Activities – Scrap Metal (Rebar)

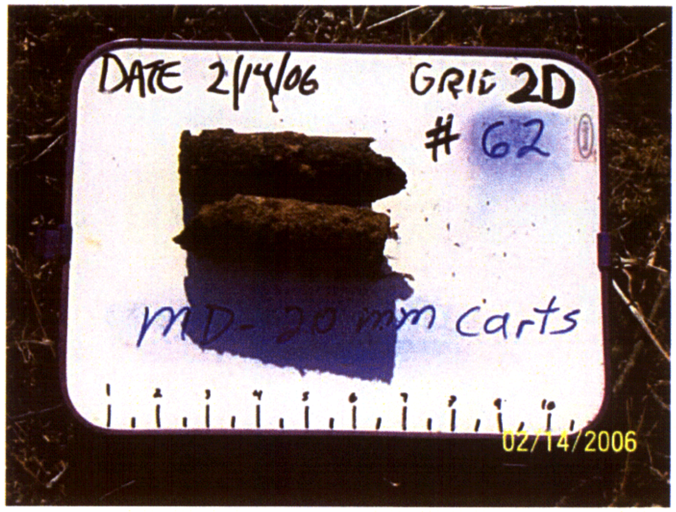


Intrusive Activities – Scrap Metal (Wire)

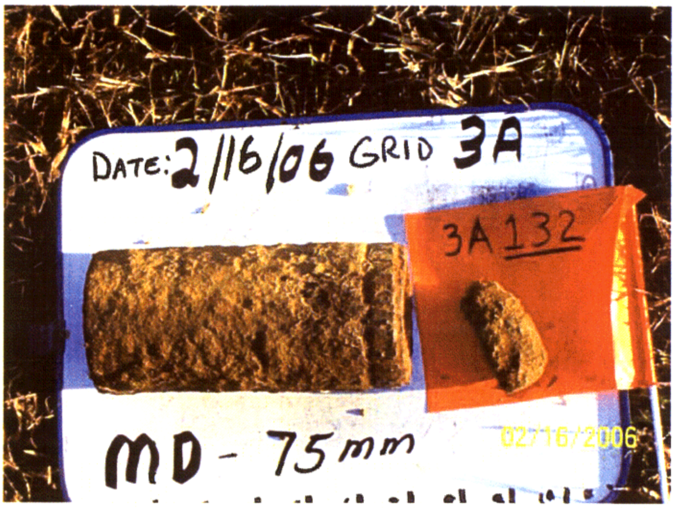
Intrusive Activities – Scrap Metal (Bracket)

Intrusive Activities – Typical 30mm projectile

Intrusive Activities – Concrete and Rebar



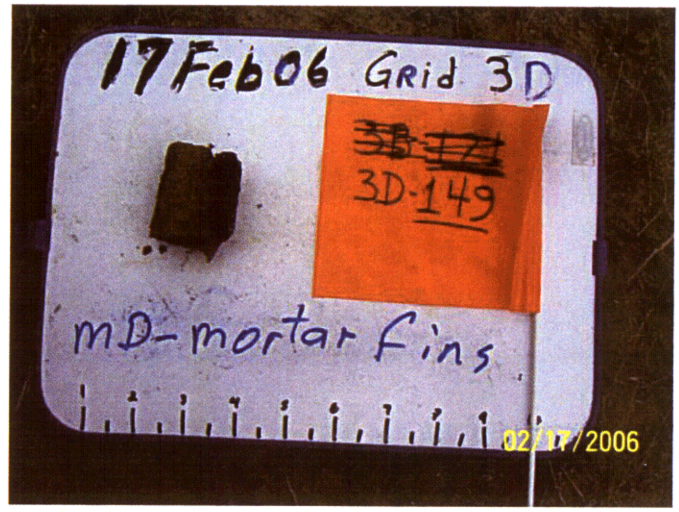
Intrusive Activities – 20mm cartridges (empty)



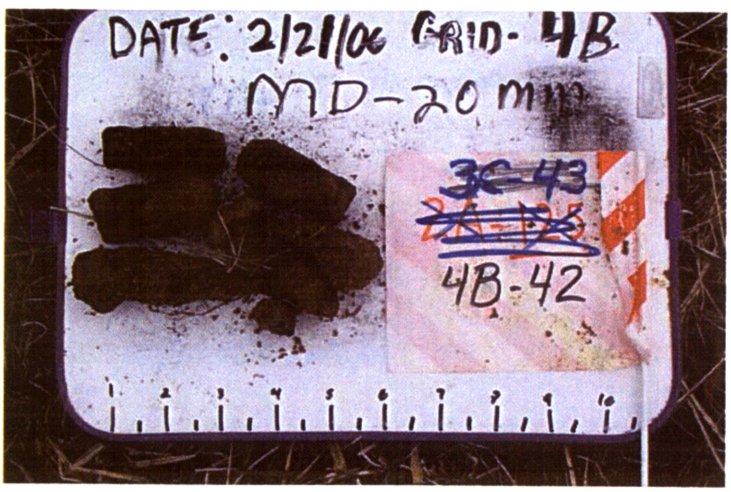
Intrusive Activities – 75mm and 30mm projectiles

Intrusive Activities – 20mm Projectiles and Fragments

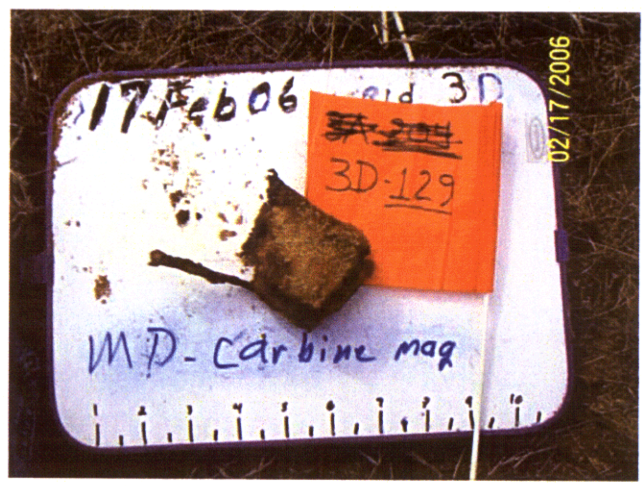
Intrusive Activities – Scrap Metal (Pipe or Rod)



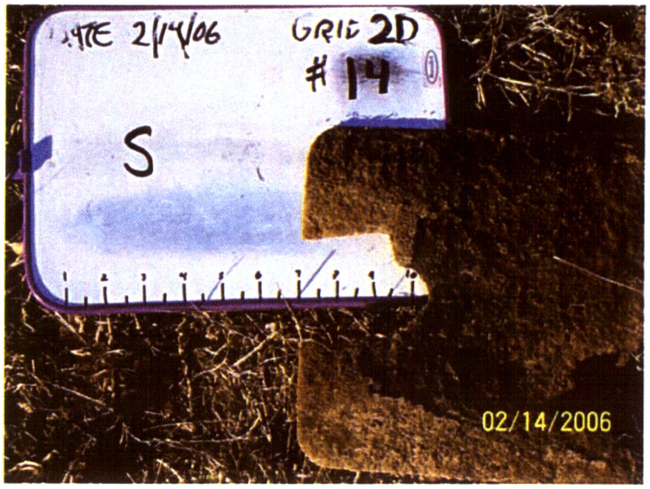
Intrusive Activities – Mortar Fins



Intrusive Activities – Typical 20mm Projectiles



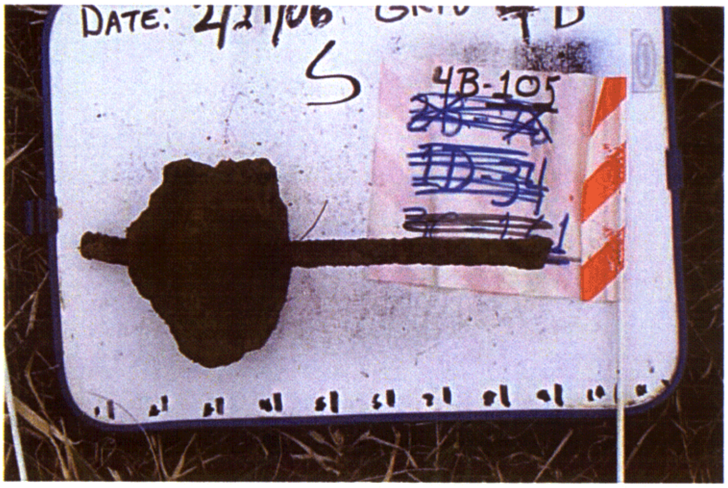
Intrusive Activities – M-1 Carbine Magazine



Intrusive Activities – Scrap Metal (Plate)

Intrusive Activities – 20mm Fragments and Projectiles

Intrusive Activities – 20mm Fragments and Projectiles



Intrusive Activities – Concrete and Rebar

Intrusive Activities – Burn Pit/Slag Pile Left in Place

Demolition Activities – 75mm items treated during Demolition

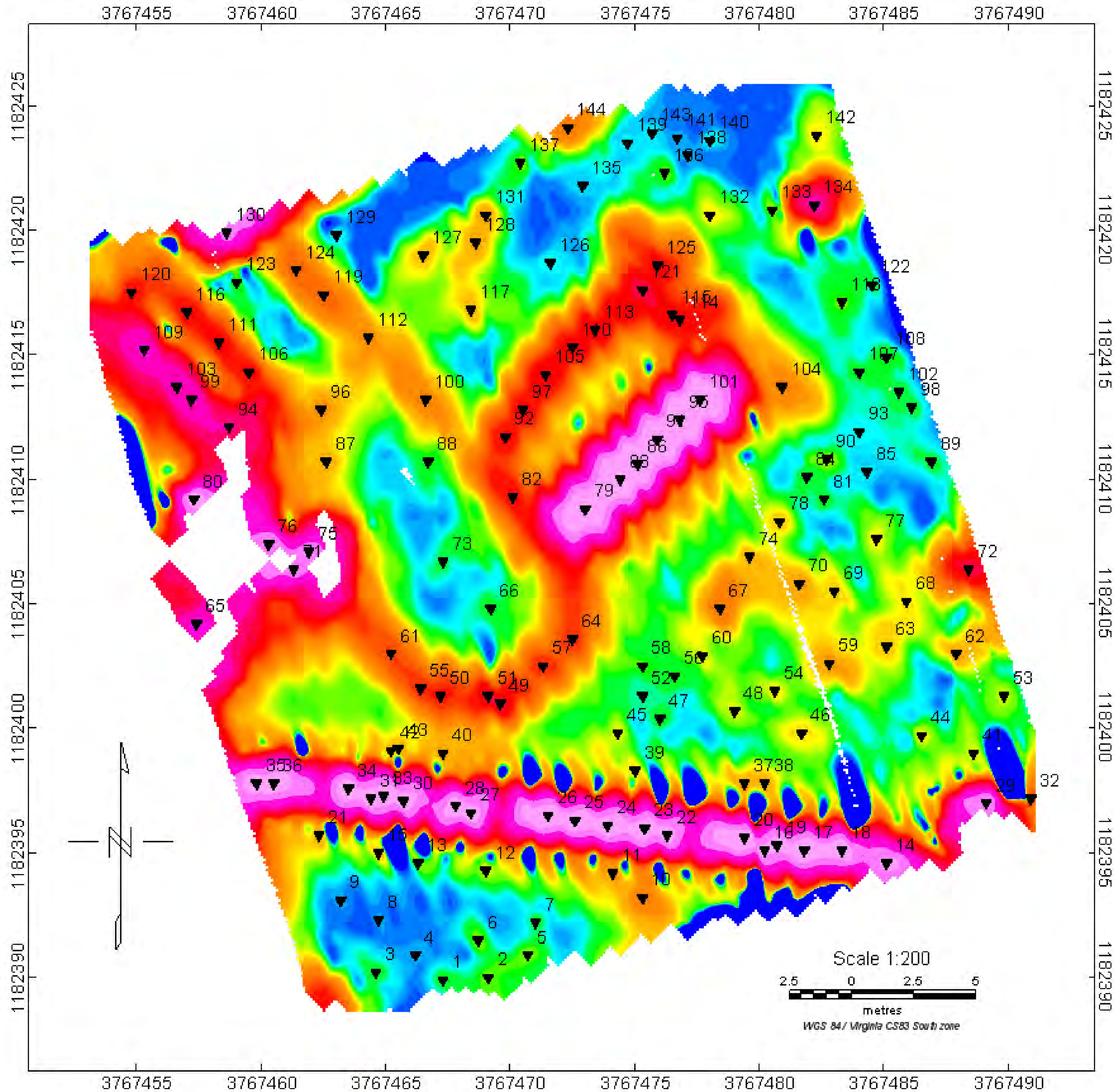
All 20mm/30mm/75mm Munitions Debris found on site
(items placed on ground for final sorting)

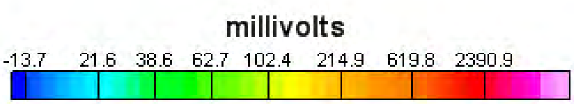
20mm/30mm items treated during Demolition

APPENDIX D

GEOPHYSICAL SURVEY DIG SHEETS

(ON CD)





NASA

Wallops Flight Center
EM61 MK2 Data
Grid 1C

February 8, 2006

Tetra Tech EM Inc.

Geophysical Dig Sheet and Target History

GRID 1C Unique Target ID	ORIGINAL SURVEY									
	Easting Coord. (m)	Northing Coord. (m)	Lat. Coord.	Long. Coord.	X - Local (Grid) Coord. (ft)	Y - Local (Grid) Coord. (ft)	Channel ID (i.e. C1, top senor, gradient)	Response Amplitude (mV)	Dig Priority	Date
1	3767467.3	1182389.9	37.56.16.63	-75.27.24.55	14.91	-1.94	Z(1-4)	45.7		2/8/2006
2	3767469.1	1182390	37.56.16.63	-75.27.24.48	20.55	-3.09	Z(1-4)	68.6		2/8/2006
3	3767464.6	1182390.2	37.56.16.64	-75.27.24.66	6.89	1.24	Z(1-4)	42.7		2/8/2006
4	3767466.2	1182390.9	37.56.16.66	-75.27.24.60	12.5	2.16	Z(1-4)	13.9		2/8/2006
5	3767470.7	1182390.9	37.56.16.66	-75.27.24.41	26.35	-1.53	Z(1-4)	80.7		2/8/2006
6	3767468.7	1182391.5	37.56.16.68	-75.27.24.49	20.78	2.03	Z(1-4)	71.9		2/8/2006
7	3767471	1182392.2	37.56.16.70	-75.27.24.40	28.54	2.38	Z(1-4)	43		2/8/2006
8	3767464.7	1182392.3	37.56.16.71	-75.27.24.66	9.25	7.86	Z(1-4)	10.5		2/8/2006
9	3767463.2	1182393.1	37.56.16.74	-75.27.24.72	5.41	11.65	Z(1-4)	9.6		2/8/2006
10	3767475.3	1182393.2	37.56.16.73	-75.27.24.22	42.75	2.04	Z(1-4)	532.3		2/8/2006
11	3767474.1	1182394.2	37.56.16.76	-75.27.24.27	40.04	6.22	Z(1-4)	359.3		2/8/2006
12	3767469	1182394.3	37.56.16.77	-75.27.24.48	24.44	10.73	Z(1-4)	117.5		2/8/2006
13	3767466.3	1182394.6	37.56.16.78	-75.27.24.59	16.42	13.9	Z(1-4)	86.3		2/8/2006
14	3767485.1	1182394.6	37.56.16.76	-75.27.23.82	74.27	-1.52	Z(1-4)	30973		2/8/2006
15	3767464.7	1182395	37.56.16.80	-75.27.24.65	11.88	16.49	Z(1-4)	190		2/8/2006

Geophysical Dig Sheet and Target History

GRID 1C Unique Target ID	ORIGINAL SURVEY Easting Coord. (m)	Northing Coord. (m)	Lat. Coord.	Long. Coord.	X - Local (Grid) Coord. (ft)	Y - Local (Grid) Coord. (ft)	Channel ID (i.e. C1, top senor, gradient)	Response Amplitude (mV)	Dig Priority	Date
16	3767480.2	1182395.1	37.56.16.79	-75.27.24.02	59.69	4.1	Z(1-4)	30514		2/8/2006
17	3767481.8	1182395.1	37.56.16.78	-75.27.23.95	64.61	2.78	Z(1-4)	35515		2/8/2006
18	3767483.3	1182395.1	37.56.16.78	-75.27.23.89	69.23	1.55	Z(1-4)	34147		2/8/2006
19	3767480.7	1182395.3	37.56.16.79	-75.27.24.00	61.43	4.32	Z(1-4)	31732		2/8/2006
20	3767479.4	1182395.6	37.56.16.80	-75.27.24.05	57.72	6.35	Z(1-4)	35840		2/8/2006
21	3767462.3	1182395.7	37.56.16.82	-75.27.24.75	5.17	20.7	Z(1-4)	290		2/8/2006
22	3767476.3	1182395.7	37.56.16.81	-75.27.24.18	48.28	9.21	Z(1-4)	32469		2/8/2006
23	3767475.4	1182396	37.56.16.82	-75.27.24.21	45.81	10.91	Z(1-4)	34245		2/8/2006
24	3767473.9	1182396.1	37.56.16.82	-75.27.24.28	41.29	12.46	Z(1-4)	33634		2/8/2006
25	3767472.6	1182396.3	37.56.16.83	-75.27.24.33	37.48	14.16	Z(1-4)	34944		2/8/2006
26	3767471.5	1182396.5	37.56.16.84	-75.27.24.37	34.29	15.7	Z(1-4)	35254		2/8/2006
27	3767468.4	1182396.6	37.56.16.85	-75.27.24.50	24.84	18.56	Z(1-4)	31756		2/8/2006
28	3767467.8	1182396.9	37.56.16.86	-75.27.24.52	23.29	20.02	Z(1-4)	33478		2/8/2006
29	3767489.1	1182397	37.56.16.84	-75.27.23.65	88.93	2.87	Z(1-4)	27403		2/8/2006
30	3767465.7	1182397.1	37.56.16.87	-75.27.24.61	17.01	22.38	Z(1-4)	32450		2/8/2006

Geophysical Dig Sheet and Target History

GRID 1C Unique Target ID	ORIGINAL SURVEY									
	Easting Coord. (m)	Northing Coord. (m)	Lat. Coord.	Long. Coord.	X - Local (Grid) Coord. (ft)	Y - Local (Grid) Coord. (ft)	Channel ID (i.e. C1, top senor, gradient)	Response Amplitude (mV)	Dig Priority	Date
31	3767464.4	1182397.2	37.56.16.87	-75.27.24.66	13.11	23.76	Z(1-4)	33389		2/8/2006
32	3767490.9	1182397.2	37.56.16.84	-75.27.23.58	94.66	2.03	Z(1-4)	1397.1		2/8/2006
33	3767464.9	1182397.3	37.56.16.87	-75.27.24.64	14.74	23.67	Z(1-4)	33157		2/8/2006
34	3767463.5	1182397.6	37.56.16.88	-75.27.24.70	10.72	25.78	Z(1-4)	34304		2/8/2006
35	3767459.8	1182397.8	37.56.16.89	-75.27.24.85	-0.49	29.46	Z(1-4)	33548		2/8/2006
36	3767460.5	1182397.8	37.56.16.89	-75.27.24.82	1.67	28.88	Z(1-4)	33100		2/8/2006
37	3767479.4	1182397.8	37.56.16.87	-75.27.24.05	59.89	13.37	Z(1-4)	280.8		2/8/2006
38	3767480.2	1182397.8	37.56.16.87	-75.27.24.02	62.35	12.72	Z(1-4)	250.9		2/8/2006
39	3767475	1182398.3	37.56.16.89	-75.27.24.23	46.83	18.58	Z(1-4)	175.3		2/8/2006
40	3767467.3	1182399	37.56.16.93	-75.27.24.54	23.8	27.13	Z(1-4)	297		2/8/2006
41	3767488.6	1182399	37.56.16.90	-75.27.23.67	89.37	9.66	Z(1-4)	112.5		2/8/2006
42	3767465.2	1182399.1	37.56.16.93	-75.27.24.63	17.43	29.18	Z(1-4)	245.1		2/8/2006
43	3767465.5	1182399.2	37.56.16.93	-75.27.24.62	18.45	29.25	Z(1-4)	245.6		2/8/2006
44	3767486.5	1182399.7	37.56.16.93	-75.27.23.75	83.6	13.62	Z(1-4)	126.8		2/8/2006
45	3767474.3	1182399.8	37.56.16.94	-75.27.24.25	46.15	23.94	Z(1-4)	117.8		2/8/2006

Geophysical Dig Sheet and Target History

GRID 1C Unique Target ID	ORIGINAL SURVEY									
	Easting Coord. (m)	Northing Coord. (m)	Lat. Coord.	Long. Coord.	X - Local (Grid) Coord. (ft)	Y - Local (Grid) Coord. (ft)	Channel ID (i.e. C1, top senor, gradient)	Response Amplitude (mV)	Dig Priority	Date
46	3767481.7	1182399.8	37.56.16.94	-75.27.23.95	68.93	17.87	Z(1-4)	149.6		2/8/2006
47	3767476	1182400.4	37.56.16.96	-75.27.24.18	51.97	24.47	Z(1-4)	48		2/8/2006
48	3767479	1182400.7	37.56.16.97	-75.27.24.06	61.51	22.96	Z(1-4)	106.6		2/8/2006
49	3767469.6	1182401	37.56.16.99	-75.27.24.44	32.85	31.63	Z(1-4)	2760.9		2/8/2006
50	3767467.2	1182401.3	37.56.17.00	-75.27.24.54	25.75	34.56	Z(1-4)	1482.4		2/8/2006
51	3767469.1	1182401.3	37.56.17.00	-75.27.24.46	31.6	33	Z(1-4)	2831.3		2/8/2006
52	3767475.3	1182401.3	37.56.16.99	-75.27.24.21	50.7	27.91	Z(1-4)	35.3		2/8/2006
53	3767489.8	1182401.3	37.56.16.98	-75.27.23.62	95.33	16.02	Z(1-4)	106.1		2/8/2006
54	3767480.6	1182401.5	37.56.16.99	-75.27.23.99	67.22	24.2	Z(1-4)	144		2/8/2006
55	3767466.4	1182401.6	37.56.17.01	-75.27.24.58	23.57	36.18	Z(1-4)	1402.1		2/8/2006
56	3767476.6	1182402.1	37.56.17.02	-75.27.24.16	55.49	29.4	Z(1-4)	51.9		2/8/2006
57	3767471.3	1182402.5	37.56.17.03	-75.27.24.37	39.56	35.03	Z(1-4)	1420.4		2/8/2006
58	3767475.3	1182402.5	37.56.17.03	-75.27.24.21	51.88	31.75	Z(1-4)	60		2/8/2006
59	3767482.8	1182402.6	37.56.17.03	-75.27.23.90	75.08	25.91	Z(1-4)	339.9		2/8/2006
60	3767477.7	1182402.9	37.56.17.04	-75.27.24.11	59.67	31.05	Z(1-4)	118.6		2/8/2006

Geophysical Dig Sheet and Target History

GRID 1C Unique Target ID	ORIGINAL SURVEY									
	Easting Coord. (m)	Northing Coord. (m)	Lat. Coord.	Long. Coord.	X - Local (Grid) Coord. (ft)	Y - Local (Grid) Coord. (ft)	Channel ID (i.e. C1, top senor, gradient)	Response Amplitude (mV)	Dig Priority	Date
61	3767465.2	1182403	37.56.17.06	-75.27.24.62	21.24	41.64	Z(1-4)	1099		2/8/2006
62	3767487.9	1182403	37.56.17.03	-75.27.23.69	91.17	23	Z(1-4)	296.8		2/8/2006
63	3767485.1	1182403.3	37.56.17.05	-75.27.23.81	82.85	26.26	Z(1-4)	187.6		2/8/2006
64	3767472.5	1182403.6	37.56.17.07	-75.27.24.32	44.34	37.56	Z(1-4)	1334		2/8/2006
65	3767457.4	1182404.2	37.56.17.10	-75.27.24.94	-1.65	51.88	Z(1-4)	11830		2/8/2006
66	3767469.2	1182404.8	37.56.17.11	-75.27.24.46	35.34	44.1	Z(1-4)	46.2		2/8/2006
67	3767478.4	1182404.8	37.56.17.10	-75.27.24.08	63.69	36.55	Z(1-4)	616.6		2/8/2006
68	3767485.9	1182405.1	37.56.17.10	-75.27.23.77	87.09	31.35	Z(1-4)	147.1		2/8/2006
69	3767483	1182405.5	37.56.17.12	-75.27.23.89	78.55	35.01	Z(1-4)	192.1		2/8/2006
70	3767481.6	1182405.8	37.56.17.13	-75.27.23.95	74.54	37.11	Z(1-4)	318.2		2/8/2006
71	3767461.3	1182406.4	37.56.17.17	-75.27.24.78	12.54	55.7	Z(1-4)	21604		2/8/2006
72	3767488.4	1182406.4	37.56.17.14	-75.27.23.67	96.07	33.45	Z(1-4)	2914.4		2/8/2006
73	3767467.3	1182406.7	37.56.17.17	-75.27.24.53	31.35	51.73	Z(1-4)	37.5		2/8/2006
74	3767479.6	1182406.9	37.56.17.17	-75.27.24.03	69.46	42.27	Z(1-4)	255.4		2/8/2006
75	3767461.9	1182407.1	37.56.17.19	-75.27.24.75	15.08	57.45	Z(1-4)	24076		2/8/2006

Geophysical Dig Sheet and Target History

GRID 1C Unique Target ID	ORIGINAL SURVEY									
	Easting Coord. (m)	Northing Coord. (m)	Lat. Coord.	Long. Coord.	X - Local (Grid) Coord. (ft)	Y - Local (Grid) Coord. (ft)	Channel ID (i.e. C1, top senor, gradient)	Response Amplitude (mV)	Dig Priority	Date
76	3767460.3	1182407.4	37.56.17.20	-75.27.24.82	10.43	59.72	Z(1-4)	28019		2/8/2006
77	3767484.7	1182407.6	37.56.17.19	-75.27.23.82	85.86	40.31	Z(1-4)	137.6		2/8/2006
78	3767480.8	1182408.3	37.56.17.21	-75.27.23.98	74.54	45.75	Z(1-4)	203.7		2/8/2006
79	3767473	1182408.8	37.56.17.24	-75.27.24.30	50.99	53.75	Z(1-4)	37116		2/8/2006
80	3767457.3	1182409.2	37.56.17.27	-75.27.24.94	2.93	67.94	Z(1-4)	35631		2/8/2006
81	3767482.6	1182409.2	37.56.17.24	-75.27.23.90	80.97	47.15	Z(1-4)	43.1		2/8/2006
82	3767470.1	1182409.3	37.56.17.26	-75.27.24.41	42.54	57.73	Z(1-4)	1765		2/8/2006
83	3767474.4	1182410	37.56.17.27	-75.27.24.24	56.49	56.44	Z(1-4)	37275		2/8/2006
84	3767481.9	1182410.1	37.56.17.27	-75.27.23.93	79.71	50.59	Z(1-4)	46.4		2/8/2006
85	3767484.3	1182410.3	37.56.17.27	-75.27.23.83	87.3	49.26	Z(1-4)	20.8		2/8/2006
86	3767475.1	1182410.6	37.56.17.29	-75.27.24.21	59.24	57.78	Z(1-4)	38191		2/8/2006
87	3767462.6	1182410.7	37.56.17.31	-75.27.24.72	20.76	68.37	Z(1-4)	250.3		2/8/2006
88	3767466.7	1182410.7	37.56.17.30	-75.27.24.55	33.42	65	Z(1-4)	55.1		2/8/2006
89	3767486.9	1182410.7	37.56.17.28	-75.27.23.72	95.7	48.4	Z(1-4)	43.9		2/8/2006
90	3767482.7	1182410.8	37.56.17.29	-75.27.23.90	82.86	52.17	Z(1-4)	89.8		2/8/2006

Geophysical Dig Sheet and Target History

GRID 1C Unique Target ID	ORIGINAL SURVEY									
	Easting Coord. (m)	Northing Coord. (m)	Lat. Coord.	Long. Coord.	X - Local (Grid) Coord. (ft)	Y - Local (Grid) Coord. (ft)	Channel ID (i.e. C1, top senor, gradient)	Response Amplitude (mV)	Dig Priority	Date
91	3767475.9	1182411.6	37.56.17.32	-75.27.24.17	62.69	60.31	Z(1-4)	39714		2/8/2006
92	3767469.8	1182411.7	37.56.17.33	-75.27.24.42	43.97	65.64	Z(1-4)	1802.5		2/8/2006
93	3767484	1182411.9	37.56.17.33	-75.27.23.84	87.96	54.62	Z(1-4)	26.1		2/8/2006
94	3767458.7	1182412.1	37.56.17.36	-75.27.24.88	10.09	76.05	Z(1-4)	6511		2/8/2006
95	3767476.8	1182412.4	37.56.17.35	-75.27.24.14	66.25	62.13	Z(1-4)	40130		2/8/2006
96	3767462.4	1182412.8	37.56.17.38	-75.27.24.72	22.2	75.24	Z(1-4)	357		2/8/2006
97	3767470.5	1182412.8	37.56.17.37	-75.27.24.39	47.21	68.58	Z(1-4)	1849.1		2/8/2006
98	3767486.1	1182412.9	37.56.17.36	-75.27.23.75	95.42	56.08	Z(1-4)	43.3		2/8/2006
99	3767457.2	1182413.2	37.56.17.40	-75.27.24.94	6.53	80.8	Z(1-4)	10150		2/8/2006
100	3767466.6	1182413.2	37.56.17.39	-75.27.24.55	35.57	73.07	Z(1-4)	492		2/8/2006
101	3767477.6	1182413.2	37.56.17.37	-75.27.24.10	69.51	64.02	Z(1-4)	39229		2/8/2006
102	3767485.6	1182413.5	37.56.17.38	-75.27.23.77	94.47	58.41	Z(1-4)	38.9		2/8/2006
103	3767456.6	1182413.7	37.56.17.41	-75.27.24.96	5.17	82.89	Z(1-4)	10201		2/8/2006
104	3767480.9	1182413.7	37.56.17.39	-75.27.23.97	80.18	62.91	Z(1-4)	503.9		2/8/2006
105	3767471.4	1182414.2	37.56.17.41	-75.27.24.35	51.37	72.31	Z(1-4)	2334.8		2/8/2006

Geophysical Dig Sheet and Target History

GRID 1C Unique Target ID	ORIGINAL SURVEY									
	Easting Coord. (m)	Northing Coord. (m)	Lat. Coord.	Long. Coord.	X - Local (Grid) Coord. (ft)	Y - Local (Grid) Coord. (ft)	Channel ID (i.e. C1, top senor, gradient)	Response Amplitude (mV)	Dig Priority	Date
106	3767459.5	1182414.3	37.56.17.43	-75.27.24.84	14.72	82.42	Z(1-4)	1908.7		2/8/2006
107	3767484	1182414.3	37.56.17.40	-75.27.23.84	90.33	62.28	Z(1-4)	46.1		2/8/2006
108	3767485.1	1182414.9	37.56.17.42	-75.27.23.79	94.32	63.29	Z(1-4)	51.5		2/8/2006
109	3767455.3	1182415.2	37.56.17.46	-75.27.25.01	2.62	88.75	Z(1-4)	11008		2/8/2006
110	3767472.5	1182415.3	37.56.17.45	-75.27.24.31	55.85	74.92	Z(1-4)	2117.2		2/8/2006
111	3767458.3	1182415.5	37.56.17.47	-75.27.24.89	12.18	87.24	Z(1-4)	1963.7		2/8/2006
112	3767464.3	1182415.7	37.56.17.47	-75.27.24.64	30.92	82.94	Z(1-4)	419.7		2/8/2006
113	3767473.4	1182416	37.56.17.47	-75.27.24.27	59.31	76.42	Z(1-4)	2268.7		2/8/2006
114	3767476.8	1182416.4	37.56.17.48	-75.27.24.13	70.2	74.9	Z(1-4)	2267.6		2/8/2006
115	3767476.5	1182416.6	37.56.17.49	-75.27.24.14	69.47	75.78	Z(1-4)	2258		2/8/2006
116	3767457	1182416.7	37.56.17.51	-75.27.24.94	9.34	92.14	Z(1-4)	1807		2/8/2006
117	3767468.4	1182416.8	37.56.17.50	-75.27.24.47	44.66	83.08	Z(1-4)	221.6		2/8/2006
118	3767483.3	1182417.1	37.56.17.50	-75.27.23.86	90.95	71.79	Z(1-4)	59.9		2/8/2006
119	3767462.5	1182417.4	37.56.17.53	-75.27.24.71	27.03	89.85	Z(1-4)	763.6		2/8/2006
120	3767454.8	1182417.5	37.56.17.54	-75.27.25.03	3.32	96.51	Z(1-4)	1835.7		2/8/2006

Geophysical Dig Sheet and Target History

GRID 1C Unique Target ID	ORIGINAL SURVEY									
	Easting Coord. (m)	Northing Coord. (m)	Lat. Coord.	Long. Coord.	X - Local (Grid) Coord. (ft)	Y - Local (Grid) Coord. (ft)	Channel ID (i.e. C1, top senor, gradient)	Response Amplitude (mV)	Dig Priority	Date
121	3767475.3	1182417.6	37.56.17.52	-75.27.24.19	66.76	79.96	Z(1-4)	2800.6		2/8/2006
122	3767484.5	1182417.8	37.56.17.52	-75.27.23.81	95.34	73.04	Z(1-4)	45.7		2/8/2006
123	3767459	1182417.9	37.56.17.55	-75.27.24.86	16.7	94.33	Z(1-4)	58		2/8/2006
124	3767461.4	1182418.4	37.56.17.56	-75.27.24.76	24.61	93.95	Z(1-4)	830.8		2/8/2006
125	3767475.9	1182418.6	37.56.17.55	-75.27.24.16	69.6	82.66	Z(1-4)	2031.9		2/8/2006
126	3767471.6	1182418.7	37.56.17.56	-75.27.24.34	56.42	86.52	Z(1-4)	27.6		2/8/2006
127	3767466.5	1182419	37.56.17.57	-75.27.24.55	40.96	91.67	Z(1-4)	228		2/8/2006
128	3767468.6	1182419.5	37.56.17.59	-75.27.24.46	47.94	91.54	Z(1-4)	291.9		2/8/2006
129	3767463	1182419.8	37.56.17.60	-75.27.24.69	30.93	97.11	Z(1-4)	29.2		2/8/2006
130	3767458.6	1182419.9	37.56.17.61	-75.27.24.87	17.42	101.05	Z(1-4)	20956		2/8/2006
131	3767469	1182420.6	37.56.17.62	-75.27.24.44	50.26	94.72	Z(1-4)	321.8		2/8/2006
132	3767478	1182420.6	37.56.17.61	-75.27.24.08	78.06	87.32	Z(1-4)	141.1		2/8/2006
133	3767480.5	1182420.8	37.56.17.62	-75.27.23.97	85.97	85.9	Z(1-4)	79.7		2/8/2006
134	3767482.2	1182421	37.56.17.62	-75.27.23.90	91.42	85.14	Z(1-4)	8003.9		2/8/2006
135	3767472.9	1182421.8	37.56.17.66	-75.27.24.28	63.49	95.35	Z(1-4)	17.5		2/8/2006

Geophysical Dig Sheet and Target History

GRID 1C Unique Target ID	ORIGINAL SURVEY									
	Easting Coord. (m)	Northing Coord. (m)	Lat. Coord.	Long. Coord.	X - Local (Grid) Coord. (ft)	Y - Local (Grid) Coord. (ft)	Channel ID (i.e. C1, top senor, gradient)	Response Amplitude (mV)	Dig Priority	Date
136	3767476.2	1182422.3	37.56.17.67	-75.27.24.15	74.18	94.23	Z(1-4)	65.8		2/8/2006
137	3767470.4	1182422.7	37.56.17.69	-75.27.24.38	56.66	100.28	Z(1-4)	66.2		2/8/2006
138	3767477.1	1182423	37.56.17.69	-75.27.24.11	77.65	95.72	Z(1-4)	11		2/8/2006
139	3767474.7	1182423.5	37.56.17.71	-75.27.24.21	70.73	99.29	Z(1-4)	22.1		2/8/2006
140	3767478	1182423.6	37.56.17.71	-75.27.24.07	81.03	96.9	Z(1-4)	29.3		2/8/2006
141	3767476.7	1182423.7	37.56.17.72	-75.27.24.12	77.11	98.28	Z(1-4)	12.1		2/8/2006
142	3767482.3	1182423.8	37.56.17.71	-75.27.23.89	94.5	94	Z(1-4)	143.1		2/8/2006
143	3767475.7	1182423.9	37.56.17.72	-75.27.24.16	74.22	99.75	Z(1-4)	20.2		2/8/2006
144	3767472.3	1182424.1	37.56.17.73	-75.27.24.30	63.91	103.18	Z(1-4)	558.5		2/8/2006

Note: *Fill in Acceptable Units (mV, nT/m, ppt, etc).

**Optional field – refer to SOW for applicability to specific project.

***For Anomaly type, U = UXO, F = frag, MD = munitions debris, S = scrap, A = small arms ammunition, NC = no contact, O = other.

Geophysical Dig Sheet and Target History

GRID 1C	REACQUISITION SURVEY				
Unique Target ID	Geophysical Instrument **	GPS Instrument**	Date	Comment	Response Amplitude (units*)**
1	Schonstedt	NA	2-13-06	used x/y coordinates to locate targets	NA
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					
14					
15					

Geophysical Dig Sheet and Target History

GRID 1C Unique Target ID	REACQUISITION SURVEY				
	Geophysical Instrument **	GPS Instrument**	Date	Comment	Response Amplitude (units*)**
16	Schonstedt	NA	2-13-06	used x/y coordinates to locate targets	NA
17					
18					
19					
20					
21					
22					
23					
24					
25					
26					
27					
28					
29					
30					

Geophysical Dig Sheet and Target History

GRID 1C Unique Target ID	REACQUISITION SURVEY				
	Geophysical Instrument **	GPS Instrument**	Date	Comment	Response Amplitude (units*)**
31	Schondstedt	NA	2-13-06	used x/y coordinates to locate targets	NA
32					
33					
34					
35					
36					
37					
38					
39					
40					
41					
42					
43					
44					
45					

Geophysical Dig Sheet and Target History

GRID 1C Unique Target ID	REACQUISITION SURVEY				
	Geophysical Instrument **	GPS Instrument**	Date	Comment	Response Amplitude (units*)**
46	Schondstedt	NA	2-13-06	used x/y coordinates to locate targets	NA
47					
48					
49					
50					
51					
52					
53					
54					
55					
56					
57					
58					
59					
60					

Geophysical Dig Sheet and Target History

GRID 1C Unique Target ID	REACQUISITION SURVEY				
	Geophysical Instrument **	GPS Instrument**	Date	Comment	Response Amplitude (units*)**
61	Schondstedt	NA	2-13-06	used x/y coordinates to locate targets	NA
62					
63					
64					
65					
66					
67					
68					
69					
70					
71					
72					
73					
74					
75					

Geophysical Dig Sheet and Target History

GRID 1C Unique Target ID	REACQUISITION SURVEY Geophysical Instrument **	GPS Instrument**	Date	Comment	Response Amplitude (units*)**
76	Schondstedt	NA	2-13-06	used X/Y coordinates to locate targets	NA
77					
78					
79					
80					
81					
82					
83					
84					
85					
86					
87					
88					
89					
90					

Geophysical Dig Sheet and Target History

GRID 1C Unique Target ID	REACQUISITION SURVEY Geophysical Instrument **	GPS Instrument**	Date	Comment	Response Amplitude (units*)**
91	Schondstedt	NA	2-13-06	used X/Y coordinates to locate targets	NA
92					
93					
94					
95					
96					
97					
98					
99					
100					
101					
102					
103					
104					
105					

Geophysical Dig Sheet and Target History

GRID 1C	REACQUISITION SURVEY				
Unique Target ID	Geophysical Instrument **	GPS Instrument**	Date	Comment	Response Amplitude (units*)**
106	Schondstedt	NA	2-13-06	used X/Y coordinates to locate targets	NA
107					
108					
109					
110					
111					
112					
113					
114					
115					
116					
117					
118					
119					
120					

Geophysical Dig Sheet and Target History

GRID 1C Unique Target ID	REACQUISITION SURVEY				
	Geophysical Instrument **	GPS Instrument**	Date	Comment	Response Amplitude (units*)**
121	Schondstedt	NA	2-13-06	used X/Y coordinates to locate targets	NA
122					
123					
124					
125					
126					
127					
128					
129					
130					
131					
132					
133					
134					
135					

Geophysical Dig Sheet and Target History

GRID 1C Unique Target ID	REACQUISITION SURVEY				
	Geophysical Instrument **	GPS Instrument**	Date	Comment	Response Amplitude (units*)**
136	Schondstedt	NA	2-13-06	used X/Y coordinates to locate targets	NA
137					
138					
139					
140					
141					
142					
143					
144					

Geophysical Dig Sheet and Target History

GRID 1C Unique Target ID	DIG RESULTS										
	Anomaly Type ***	Approx. Weight (lbs-oz/kg-g)	Comments (e.g., response below 1 foot)	Offset Distance (ft)	Offset Direction (N, NE, etc.)	Orientation of Nose (Azimuth deg)	Inclination of Nose (deg)	Depth to Top of Item (in/cm)	Digital Photo Number	2006 Date	Team Leader
1	S	.2	nail	1.0				4.0		14Feb06	[illegible]
2	S	.5	scrap	0				8.0		14Feb06	[illegible]
3	S	.3	scrap	0				6.0		14Feb06	[illegible]
4	S	.3	nail	0				3.0		14Feb06	[illegible]
5			LIP - NO PIC	0				>12.0"		14Feb06	[illegible]
6	S	.2	wire	0				6.0		14Feb06	[illegible]
7			LIP NO PIC	0				>12.0"		14Feb06	[illegible]
8	S	.2	scrap	0				8.0		14Feb06	[illegible]
9	S	.1	scrap	1.0				4.0		14Feb06	[illegible]
10			LIP - NO PIC concrete	0				6.0		14Feb06	[illegible]
11			LIP - NO PIC	0				>12.0"		14Feb06	[illegible]
12			LIP NO PIC	0				>12.0"		14Feb06	[illegible]
13			LIP NO PIC	0				>12.0"		14Feb06	[illegible]
14			Sidewalk	0						14Feb06	[illegible]
15			LIP NO PIC	0				>12.0"		14Feb06	[illegible]

Geophysical Dig Sheet and Target History

GRID 1C Unique Target ID	DIG RESULTS Anomaly Type ***	Approx. Weight (lbs-~~oz/kg~~-g)	Comments (e.g., response below 1 foot)	Offset Distance (ft)	Offset Direction (N, NE, etc.)	Orientation of Nose (Azimuth deg)	Inclination of Nose (deg)	Depth to Top of Item (in/~~cm~~)	Digital Photo Number	2006 Date	Team Leader
16	S	.2	scrap	0				5.0		14Feb06	[signature]
17			sidewalk	0						14Feb06	[signature]
18			sidewalk	0						14Feb06	[signature]
19			side walk	0						14Feb06	[signature]
20			sidewalk	0						14Feb06	[signature]
21			LIP - NO Pic	0				>12.0"		14Feb06	[signature]
22			sidewalk	0						14Feb06	[signature]
23			side walk	0						14Feb06	[signature]
24			sidewalk	0						14Feb06	[signature]
25			sidewalk	0						14Feb06	[signature]
26			side walk	0						14Feb06	[signature]
27			side walk	0						14Feb06	[signature]
28			side walk	0						14Feb06	[signature]
29			LIP - rocket display	0						14Feb06	[signature]
30			side walk	0						14Feb06	[signature]

Geophysical Dig Sheet and Target History

GRID 1C Unique Target ID	Anomaly Type ***	Approx. Weight (lbs-oz/kg-g)	Comments (e.g., response below 1 foot)	Offset Distance (ft)	Offset Direction (N, NE, etc.)	Orientation of Nose (Azimuth deg)	Inclination of Nose (deg)	Depth to Top of Item (in/cm)	Digital Photo Number	2006 Date	Team Leader
			DIG RESULTS								
31			sidewalk	0						14 Feb 06	
32			sidewalk	0						14 Feb 06	
33			sidewalk	0						14 Feb 06	
34			side walk	0						14 Feb 06	
35			side walk	0						14 Feb 06	
36			side walk	0						14 Feb 06	
37	S	.2	scrap	0				8.0		14 Feb 06	
38	S	.2	wire	0				6.0		14 Feb 06	
39			LIP - NO PIC	0				>12.0"		14 Feb 06	
40			LIP - NO PIC					>12			
41	S	.2	~~LIP - NO PIC~~ scrap	1.0				~~>12.0"~~ 8.0		14 Feb 06	
42			LIP - NO PIC	0				>12.0"		14 Feb 06	
43			LIP - NO PIC	0				>12.0"		14 Feb 06	
44	S	.1	scrap	1.0				6.0		14 Feb 06	
45			LIP - NO PIC	0				>12.0"		14 Feb 06	

Geophysical Dig Sheet and Target History

GRID 1C Unique Target ID	DIG RESULTS										
	Anomaly Type ***	Approx. Weight (lbs-~~oz/kg-g~~)	Comments (e.g., response below 1 foot)	Offset Distance (ft)	Offset Direction (N, NE, etc.)	Orientation of Nose (Azimuth deg)	Inclination of Nose (deg)	Depth to Top of Item (in/~~cm~~)	Digital Photo Number	2006 Date	Team Leader
46	S	.3	Scrap	0				10.0		14 Feb 06	[illegible]
47			LIP - NO PIC	0				>12.0"		14 Feb 06	[illegible]
48			LIP - NO PIC	0				>12.0"		14 Feb 06	[illegible]
49			LIP - NO PIC	0				>12.0"		14 Feb 06	[illegible]
50			LIP - NO PIC	0				>12.0"		14 Feb 06	[illegible]
51			LIP - NO PIC	0				>12.0"		14 Feb 06	[illegible]
52			LIP - NO PIC	0				>12.0"		14 Feb 06	[illegible]
53			LIP - NO PIC	0				>12.0"		14 Feb 06	[illegible]
54	S	.1	Scrap	1.0				5.0		14 Feb 06	[illegible]
55			LIP - NO PIC	0				>12.0"		14 Feb 06	[illegible]
56			LIP - NO PIC	0				>12.0"		14 Feb 06	[illegible]
57			LIP - NO PIC	0				>12.0"		14 Feb 06	[illegible]
58			LIP - NO PIC	0				>12.0"		14 Feb 06	[illegible]
59			LIP - NO PIC	0				>12.0"		14 Feb 06	[illegible]
60			LIP - NO PIC	0				>12.0"		14 Feb 06	[illegible]

Geophysical Dig Sheet and Target History

GRID 1C Unique Target ID	DIG RESULTS										
	Anomaly Type ***	Approx. Weight (lbs-oz/kg-g)	Comments (e.g., response below 1 foot)	Offset Distance (ft)	Offset Direction (N, NE, etc.)	Orientation of Nose (Azimuth deg)	Inclination of Nose (deg)	Depth to Top of Item (in/cm)	Digital Photo Number	2006 Date	Team Leader
61			LIP - No Pic	0				>12.0"		14 Feb 06	[illegible]
62			LIP - NO PIC	0				>12.0"		14 Feb 06	[illegible]
63	S	.2	scrap	0				8.0		14 Feb 06	[illegible]
64			LIP - NO PIC	0				>12.0"		14 Feb 06	[illegible]
65			LIP - NO PIC concrete	0				5.0		14 Feb 06	[illegible]
66			LIP - NO PIC	0				>12.0"		14 Feb 06	[illegible]
67			LIP - NO PIC	0				>12.0"		14 Feb 06	[illegible]
68	S	.1	scrap	1.0				9.0		14 Feb 06	[illegible]
69			LIP No PIC	0				>12.0"		14 Feb 06	[illegible]
70	~~S~~ grd	~~1~~ grd	LIP - NO PIC	0				>12.0" ~~6.0~~		14 Feb 06	[illegible]
71	S		LIP - concrete	0				6.0		14 Feb 06	[illegible]
72			LIP - NO PIC	0				>12.0"		14 Feb 06	[illegible]
73			LIP - NO PIC	0				>12.0"		14 Feb 06	[illegible]
74			LIP - NO PIC	0				>12.0"		14 Feb 06	[illegible]
75	S	.2	nail	1.0				6.0		14 Feb 06	[illegible]

Geophysical Dig Sheet and Target History

GRID IC Unique Target ID	DIG RESULTS										
	Anomaly Type ***	Approx. Weight (lbs-oz/kg-g)	Comments (e.g., response below 1 foot)	Offset Distance (ft)	Offset Direction (N, NE, etc.)	Orientation of Nose (Azimuth deg)	Inclination of Nose (deg)	Depth to Top of Item (in/cm)	Digital Photo Number	2006 Date	Team Leader
76	S	.2	nail	0				2.0		14Feb06	[illegible]
77			LIP - NO PIC	0				>12.0"		14Feb06	[illegible]
78	S	.8	scrap	0				7.0		14Feb06	[illegible]
79			LIP - NO PIC concrete	0				12.0		14Feb06	[illegible]
80			LIP - Display sign post	0				1.0		14Feb06	[illegible]
81	S	.1	scrap	1.0				8.0		14Feb06	[illegible]
82			LIP - NO PIC	0				>12.0"		14Feb06	[illegible]
83			LIP - Concrete NO PIC	0				>12.0"		14Feb06	[illegible]
84			LIP - NO PIC	0				>12.0"		14Feb06	[illegible]
85	S	.2	nail	0				6.0		14Feb06	[illegible]
86			LIP - Concrete NO PIC	0				12.0		14Feb06	[illegible]
87	S	.1	nail	1.0				2.0		14Feb06	[illegible]
88			LIP NO PIC	0				>12.0"		14Feb06	[illegible]
89	S	2.0	scrap	0				5.0		14Feb06	[illegible]
90	S	.4	wire	.5	E			8.0		14Feb06	[illegible]

Geophysical Dig Sheet and Target History

GRID 1C Unique Target ID	DIG RESULTS										
	Anomaly Type ***	Approx. Weight (lbs-~~oz/kg-g~~)	Comments (e.g., response below 1 foot)	Offset Distance (ft)	Offset Direction (N, NE, etc.)	Orientation of Nose (Azimuth deg)	Inclination of Nose (deg)	Depth to Top of Item (in/~~cm~~)	Digital Photo Number	2006 Date	Team Leader
91			LIP - NO PIC	0				>12.0"		14 Feb 06	[signature]
92			LIP - NO PIC	0				>12.0"		14 Feb 06	[signature]
93			utility line - LIP NO PIC	0				6.0		14 Feb 06	[signature]
94	S	.1	wire	1.0				3.0		14 Feb 06	[signature]
95			LIP - NO PIC	0				>12.0"		|	[signature]
96			LIP - NO PIC	0				>12.0"		14 Feb 06	[signature]
97			LIP - NO PIC	0				>12.0"		14 Feb 06	[signature]
98			LIP - NO PIC	0				>12.0"		14 Feb 06	[signature]
99			LIP. concrete NO PIC	0				3.0		14 Feb 06	[signature]
100			LIP - NO PIC	0				>12.0"		14 Feb 06	[signature]
101			LIP - NO PIC	0				>12.0"		14 Feb 06	[signature]
102			LIP - NO PIC	0				>12.0"		14 Feb 06	[signature]
103			Side walk	0						14 Feb 06	[signature]
104			LIP - utility line NO PIC	0						14 Feb 06	[signature]
105			LIP - concrete NO PIC	0				12.0"		14 Feb 06	[signature]

Geophysical Dig Sheet and Target History

GRID 1C Unique Target ID	DIG RESULTS										
	Anomaly Type ***	Approx. Weight (lbs-~~oz/kg-g~~)	Comments (e.g., response below 1 foot)	Offset Distance (ft)	Offset Direction (N, NE, etc.)	Orientation of Nose (Azimuth deg)	Inclination of Nose (deg)	Depth to Top of Item (in/~~cm~~)	Digital Photo Number	2006 Date	Team Leader
106			LIP - NO PIC concrete	0				2.0		14Feb06	[illegible]
107	S	.3	bolt	.5	N			6.0		14Feb06	[illegible]
108	S	.6	bolt	0				10.0		14Feb06	[illegible]
109			sidewalk	0						14Feb06	[illegible]
110			LIP - NO PIC	0				>12.0"		14Feb06	[illegible]
111			side walk	0						14Feb06	[illegible]
112			LIP - NO PIC	0				>12.0"		14Feb06	[illegible]
113			LIP - NO PIC	0				>12.0"		14Feb06	[illegible]
114			LIP - NO PIC	0				>12.0"		14Feb06	[illegible]
115			LIP - NO PIC concrete	0				>12.0"		14Feb06	[illegible]
116			side walk	0						14Feb06	[illegible]
117	S	2.0	scrap	0				6.0		14Feb06	[illegible]
118	S	.8	scrap	0				6.0		14Feb06	[illegible]
119			side walk	0						14Feb06	[illegible]
120			side walk	0						14Feb06	[illegible]

Geophysical Dig Sheet and Target History

GRID 1C Unique Target ID	DIG RESULTS										
	Anomaly Type ***	Approx. Weight (lbs-~~oz/kg-g~~)	Comments (e.g., response below 1 foot)	Offset Distance (ft)	Offset Direction (N, NE, etc.)	Orientation of Nose (Azimuth deg)	Inclination of Nose (deg)	Depth to Top of Item (in/~~cm~~)	Digital Photo Number	2006 Date	Team Leader
121			LIP - NO PIC	0				>12.0"		14Feb06	[signature]
122			LIP NO PIC	0				>12.0"		14Feb06	[signature]
123			sidewalk	0						14Feb06	[signature]
124			sidewalk	0						14Feb06	[signature]
125			LIP - NO PIC	0				>12.0"		14Feb06	[signature]
126			LIP NO PIC	0				>12.0"		14Feb06	[signature]
127	S		rebar LIP	0				10.0		14Feb06	[signature]
128			LIP - NO PIC	0				>12.0"		14Feb06	[signature]
129			sidewalk	0						14Feb06	[signature]
130			sidewalk	0						14Feb06	[signature]
131	S	1.0+	LIP NO PIC metal going down	0				>12.0"		14Feb06	[signature]
132			LIP - NO PIC	0				>12.0"		14Feb06	[signature]
133			LIP - NO PIC	0				>12.0"		14Feb06	[signature]
134			LIP - NO PIC	0				>12.0"		14Feb06	[signature]
135			LIP - NO PIC	0				>12.0"		14Feb06	[signature]

Geophysical Dig Sheet and Target History

GRID 1C Unique Target ID	DIG RESULTS Anomaly Type ***	Approx. Weight (lbs-oz/kg-g)	Comments (e.g., response below 1 foot)	Offset Distance (ft)	Offset Direction (N, NE, etc.)	Orientation of Nose (Azimuth deg)	Inclination of Nose (deg)	Depth to Top of Item (in/cm)	Digital Photo Number	2006 Date	Team Leader
136			LIP - utility line NO PIC	0						14 Feb 06	[signature]
137			LIP - concrete NO PIC	0				3.0		14 Feb 06	[signature]
138			LIP - utility line NO PIC	0						14 Feb 06	[signature]
139	S	.2	nail	0				6.0		14 Feb 06	[signature]
140	S	.5	wire	0				4.0		14 Feb 06	[signature]
141			LIP - utility line NO PIC	0						14 Feb 06	[signature]
142			LIP - NO PIC	0				712.0"		14 Feb 06	[signature]
143			LIP - utility line NO PIC	0						14 Feb 06	[signature]
144			LIP - concrete NO PIC	0				4.0		14 Feb 06	[signature]

Geophysical Dig Sheet and Target History

GRID 1C Unique Target ID	POST-DIG UXO QC RESULTS			POST-DIG PROJECT QC		
	Excavation Hole Cleared?	UXO QC Spec. Initials	Date	Agreement Between Dig Results & Geophysical Data? (G=good, P=poor, U=unacceptable)	Project QC Initials	Date
1	Yes	EMD	2/14/06	G	VAS	2-14-06
2						
3						
4						
5						
6						
7						
8						
9						
10	NO, Concrete LIP	EMD	2/14/06	G	VAS	2-14-06
11						
12						
13						
14						
15						

Geophysical Dig Sheet and Target History

GRID 1C Unique Target ID	POST-DIG UXO QC RESULTS			POST-DIG PROJECT QC		
	Excavation Hole Cleared?	UXO QC Spec. Initials	Date	Agreement Between Dig Results & Geophysical Data? (G=good, P=poor, U=unacceptable)	Project QC Initials	Date
16	Yes	EMD	14 Feb 06	G	VAS	2-14-06
17						
18						
19						
20						
21						
22						
23						
24						
25						
26						
27						
28						
29						
30						

Geophysical Dig Sheet and Target History

GRID 1C	POST-DIG UXO QC RESULTS			POST-DIG PROJECT QC		
Unique Target ID	Excavation Hole Cleared?	UXO QC Spec. Initials	Date	Agreement Between Dig Results & Geophysical Data? (G=good, P=poor, U=unacceptable)	Project QC Initials	Date
31						
32						
33						
34						
35						
36						
37	Yes	EMD	2/14/06	G	VAS	2-14-06
38						
39						
40	~~Yes~~ NO	EMD	2/14/06	G	VAS	2-14-06
41						
42						
43						
44						
45						

Geophysical Dig Sheet and Target History

RID C nique arget ID	POST-DIG UXO QC RESULTS			POST-DIG PROJECT QC		
	Excavation Hole Cleared?	UXO QC Spec. Initials	Date	Agreement Between Dig Results & Geophysical Data? (G=good, P=poor, U=unacceptable)	Project QC Initials	Date
6						
7						
8						
9						
0	NO	EGD	2/14/06	G	VAS	2-14-06
1						
2						
3						
4						
5						
6						
7						
8						
9						
0	NO	EGD	2/14/06	G	VAS	2-14-06

Geophysical Dig Sheet and Target History

	POST-DIG UXO QC RESULTS			POST-DIG PROJECT QC		
GRID 1C Unique Target ID	Excavation Hole Cleared?	UXO QC Spec. Initials	Date	Agreement Between Dig Results & Geophysical Data? (G=good, P=poor, U=unacceptable)	Project QC Initials	Date
61						
62						
63						
64						
65						
66						
67						
68						
69						
70	NO	[illegible]	2/14/06	G	VAS	2-14-06
71						
72						
73						
74						
75						

Geophysical Dig Sheet and Target History

GRID 1C Unique Target ID	POST-DIG UXO QC RESULTS			POST-DIG PROJECT QC		
	Excavation Hole Cleared?	UXO QC Spec. Initials	Date	Agreement Between Dig Results & Geophysical Data? (G=good, P=poor, U=unacceptable)	Project QC Initials	Date
76						
77						
78						
79						
80						
81	Yes	EMD	2/14/06	G	VAS	2-14-06
82						
83						
84						
85						
86						
87						
88						
89						
90	Yes	EMD	2/14/06	G	VAS	2-14-06

Geophysical Dig Sheet and Target History

GRID 1C	POST-DIG UXO QC RESULTS			POST-DIG PROJECT QC		
Unique Target ID	Excavation Hole Cleared?	UXO QC Spec. Initials	Date	Agreement Between Dig Results & Geophysical Data? (G=good, P=poor, U=unacceptable)	Project QC Initials	Date
91						
92						
93						
94						
95						
96						
97						
98						
99						
100	NO, LIP	~~LIP~~ EnD	2/14/06	G	VAS	2-14-06
101						
102						
103						
104						
105						

Geophysical Dig Sheet and Target History

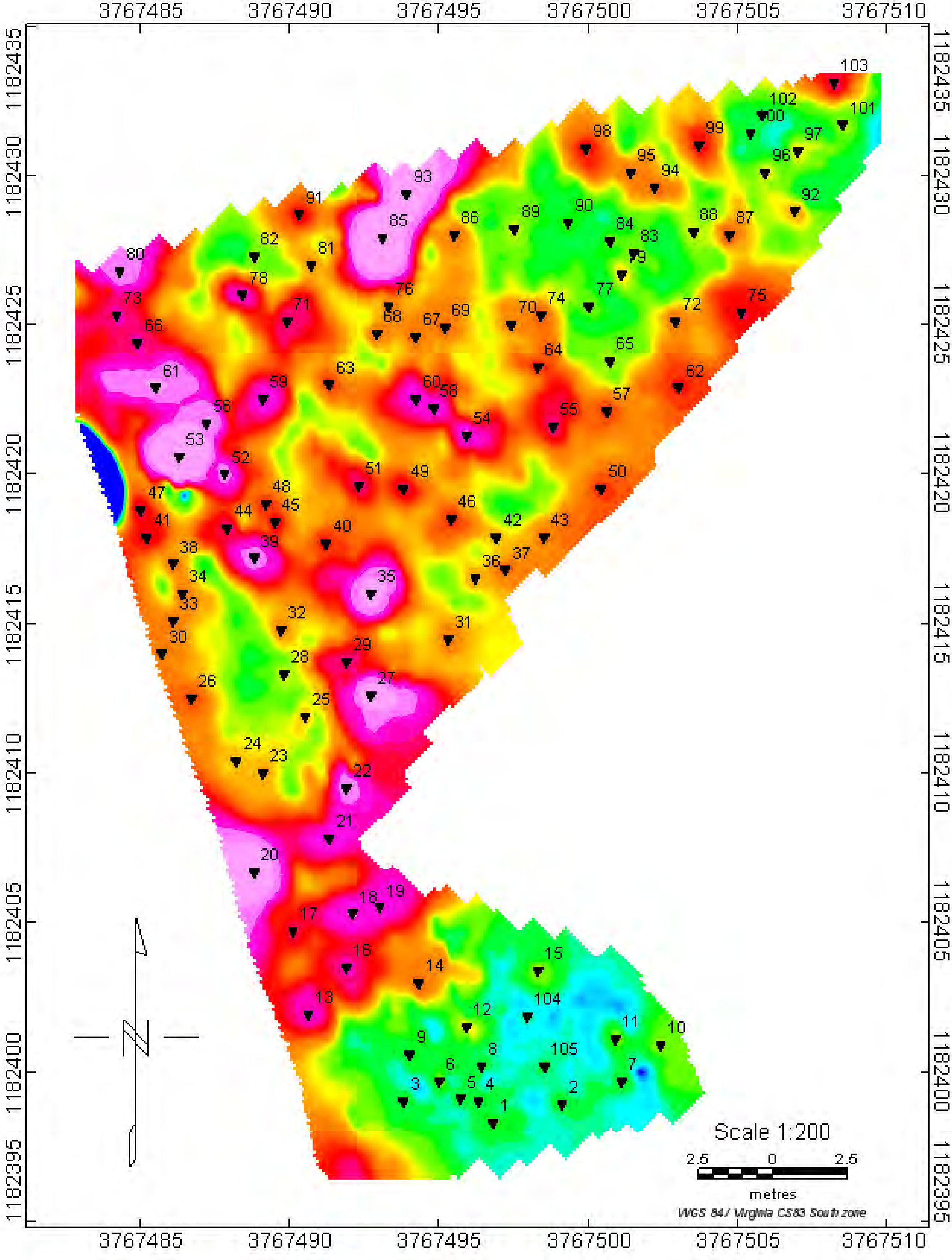
GRID 1C Unique Target ID	POST-DIG UXO QC RESULTS			POST-DIG PROJECT QC		
	Excavation Hole Cleared?	UXO QC Spec. Initials	Date	Agreement Between Dig Results & Geophysical Data? (G=good, P=poor, U=unacceptable)	Project QC Initials	Date
106						
107						
108	Yes	EMD	2/14/06	G	VAS	2-14-06
109						
110						
111						
112						
113						
114						
115						
116						
117						
118	Yes	EMD	2/14/06	G	VAS	2-14-06
119						
120						

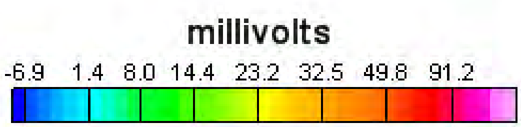
Geophysical Dig Sheet and Target History

GRID 1C Unique Target ID	POST-DIG UXO QC RESULTS			POST-DIG PROJECT QC		
	Excavation Hole Cleared?	UXO QC Spec. Initials	Date	Agreement Between Dig Results & Geophysical Data? (G=good, P=poor, U=unacceptable)	Project QC Initials	Date
121						
122						
123						
124						
125						
126						
127						
128						
129						
130						
131	NO, LIP	EMD	2/14/06	G	VAS	2-14-06
132						
133						
134						
135						

Geophysical Dig Sheet and Target History

GRID 1C Unique Target ID	POST-DIG UXO QC RESULTS			POST-DIG PROJECT QC		
	Excavation Hole Cleared?	UXO QC Spec. Initials	Date	Agreement Between Dig Results & Geophysical Data? (G=good, P=poor, U=unacceptable)	Project QC Initials	Date
136						
137						
138						
139						
140	Yes	EMD	2/14/06	G	VAS	2-14-06
141						
142						
143						
144						





NASA

Wallops Flight Center
EM61 MK2 Data
Grid 1D

February 8, 2006

Tetra Tech EM Inc.

Geophysical Dig Sheet and Target History

GRID 1D Unique Target ID	ORIGINAL SURVEY									
	Easting Coord. (m)	Northing Coord. (m)	Lat. Coord.	Long. Coord.	X - Local (Grid) Coord. (ft)	Y - Local (Grid) Coord. (ft)	Channel ID (i.e. C1, top senor, gradient)	Response Amplitude (mV)	Dig Priority	Date
1	3767496.8	1182398.3	37.56.16.87	-75.27.23.34	14.59	0.68	Z(1-4)	12.4		2/8/2006
2	3767499.1	1182398.9	37.56.16.89	-75.27.23.24	21.63	0.69	Z(1-4)	8.4		2/8/2006
3	3767493.8	1182399	37.56.16.90	-75.27.23.46	6.76	5.39	Z(1-4)	8.9		2/8/2006
4	3767496.3	1182399	37.56.16.89	-75.27.23.35	13.82	3.32	Z(1-4)	8.5		2/8/2006
5	3767495.7	1182399.1	37.56.16.90	-75.27.23.38	12.21	4.14	Z(1-4)	8.6		2/8/2006
6	3767495	1182399.7	37.56.16.92	-75.27.23.41	10.78	6.63	Z(1-4)	17.5		2/8/2006
7	3767501.1	1182399.7	37.56.16.91	-75.27.23.16	28.01	1.59	Z(1-4)	8.6		2/8/2006
8	3767496.4	1182400.2	37.56.16.93	-75.27.23.35	15.19	7.07	Z(1-4)	8.9		2/8/2006
9	3767494	1182400.6	37.56.16.95	-75.27.23.45	8.77	10.33	Z(1-4)	11		2/8/2006
10	3767502.4	1182400.9	37.56.16.95	-75.27.23.10	32.77	4.35	Z(1-4)	16.8		2/8/2006
11	3767500.9	1182401.1	37.56.16.96	-75.27.23.16	28.71	6.23	Z(1-4)	17.1		2/8/2006
12	3767495.9	1182401.5	37.56.16.98	-75.27.23.37	14.96	11.63	Z(1-4)	25.7		2/8/2006
13	3767490.6	1182401.9	37.56.16.99	-75.27.23.58	0.35	17.28	Z(1-4)	137.6		2/8/2006
14	3767494.3	1182403	37.56.17.03	-75.27.23.43	11.8	17.74	Z(1-4)	47.7		2/8/2006
15	3767498.3	1182403.4	37.56.17.04	-75.27.23.27	23.46	15.71	Z(1-4)	18.9		2/8/2006

Geophysical Dig Sheet and Target History

GRID 1D Unique Target ID	ORIGINAL SURVEY									
	Easting Coord. (m)	Northing Coord. (m)	Lat. Coord.	Long. Coord.	X - Local (Grid) Coord. (ft)	Y - Local (Grid) Coord. (ft)	Channel ID (i.e. C1, top senor, gradient)	Response Amplitude (mV)	Dig Priority	Date
16	3767491.9	1182403.5	37.56.17.05	-75.27.23.53	5.48	21.31	Z(1-4)	123.2		2/8/2006
17	3767490.1	1182404.7	37.56.17.09	-75.27.23.60	1.48	26.63	Z(1-4)	86.1		2/8/2006
18	3767492.1	1182405.3	37.56.17.10	-75.27.23.52	7.68	26.89	Z(1-4)	192.7		2/8/2006
19	3767493	1182405.5	37.56.17.11	-75.27.23.48	10.4	26.78	Z(1-4)	172.3		2/8/2006
20	3767488.8	1182406.7	37.56.17.15	-75.27.23.65	-0.37	34.08	Z(1-4)	930.4		2/8/2006
21	3767491.3	1182407.8	37.56.17.19	-75.27.23.55	7.69	35.53	Z(1-4)	190.3		2/8/2006
22	3767491.9	1182409.5	37.56.17.24	-75.27.23.52	10.92	40.45	Z(1-4)	250.9		2/8/2006
23	3767489.1	1182410	37.56.17.26	-75.27.23.63	3.47	44.36	Z(1-4)	35.1		2/8/2006
24	3767488.2	1182410.4	37.56.17.27	-75.27.23.67	1.29	46.38	Z(1-4)	30.1		2/8/2006
25	3767490.5	1182411.9	37.56.17.32	-75.27.23.57	9.15	49.27	Z(1-4)	31.9		2/8/2006
26	3767486.7	1182412.5	37.56.17.34	-75.27.23.73	-1.04	54.32	Z(1-4)	52.4		2/8/2006
27	3767492.7	1182412.6	37.56.17.34	-75.27.23.48	16	49.68	Z(1-4)	679		2/8/2006
28	3767489.8	1182413.3	37.56.17.37	-75.27.23.60	8.44	54.31	Z(1-4)	21.3		2/8/2006
29	3767491.9	1182413.7	37.56.17.38	-75.27.23.52	14.74	53.85	Z(1-4)	114.3		2/8/2006
30	3767485.7	1182414	37.56.17.39	-75.27.23.77	-2.5	59.93	Z(1-4)	42.5		2/8/2006

Geophysical Dig Sheet and Target History

GRID 1D Unique Target ID	ORIGINAL SURVEY									
	Easting Coord. (m)	Northing Coord. (m)	Lat. Coord.	Long. Coord.	X - Local (Grid) Coord. (ft)	Y - Local (Grid) Coord. (ft)	Channel ID (i.e. C1, top senor, gradient)	Response Amplitude (mV)	Dig Priority	Date
31	3767495.3	1182414.5	37.56.17.40	-75.27.23.38	25.06	53.6	Z(1-4)	42.9		2/8/2006
32	3767489.7	1182414.8	37.56.17.41	-75.27.23.60	9.52	59.18	Z(1-4)	38.8		2/8/2006
33	3767486.1	1182415.1	37.56.17.43	-75.27.23.75	-0.37	63.11	Z(1-4)	45.3		2/8/2006
34	3767486.4	1182416	37.56.17.46	-75.27.23.74	1.29	65.73	Z(1-4)	44.9		2/8/2006
35	3767492.7	1182416	37.56.17.45	-75.27.23.48	19.08	60.53	Z(1-4)	520.2		2/8/2006
36	3767496.2	1182416.5	37.56.17.46	-75.27.23.34	29.42	59.24	Z(1-4)	33.9		2/8/2006
37	3767497.2	1182416.8	37.56.17.47	-75.27.23.29	32.52	59.37	Z(1-4)	49.5		2/8/2006
38	3767486.1	1182417	37.56.17.49	-75.27.23.75	1.36	69.17	Z(1-4)	45.6		2/8/2006
39	3767488.8	1182417.2	37.56.17.49	-75.27.23.64	9.16	67.58	Z(1-4)	256.4		2/8/2006
40	3767491.2	1182417.7	37.56.17.51	-75.27.23.54	16.39	67.19	Z(1-4)	65.3		2/8/2006
41	3767485.2	1182417.9	37.56.17.52	-75.27.23.78	-0.37	72.78	Z(1-4)	83.9		2/8/2006
42	3767496.9	1182417.9	37.56.17.51	-75.27.23.31	32.67	63.13	Z(1-4)	31.3		2/8/2006
43	3767498.5	1182417.9	37.56.17.51	-75.27.23.24	37.19	61.81	Z(1-4)	46.3		2/8/2006
44	3767487.9	1182418.2	37.56.17.53	-75.27.23.67	7.53	71.51	Z(1-4)	101.5		2/8/2006
45	3767489.5	1182418.4	37.56.17.53	-75.27.23.61	12.23	70.83	Z(1-4)	82.3		2/8/2006

Geophysical Dig Sheet and Target History

GRID 1D Unique Target ID	ORIGINAL SURVEY									
	Easting Coord. (m)	Northing Coord. (m)	Lat. Coord.	Long. Coord.	X - Local (Grid) Coord. (ft)	Y - Local (Grid) Coord. (ft)	Channel ID (i.e. C1, top senor, gradient)	Response Amplitude (mV)	Dig Priority	Date
46	3767495.4	1182418.5	37.56.17.53	-75.27.23.37	28.98	66.28	Z(1-4)	59.6		2/8/2006
47	3767485	1182418.8	37.56.17.55	-75.27.23.79	-0.12	75.82	Z(1-4)	91.2		2/8/2006
48	3767489.2	1182419	37.56.17.55	-75.27.23.62	11.92	72.99	Z(1-4)	66.8		2/8/2006
49	3767493.8	1182419.5	37.56.17.56	-75.27.23.43	25.37	70.79	Z(1-4)	91.4		2/8/2006
50	3767500.4	1182419.5	37.56.17.55	-75.27.23.16	44	65.34	Z(1-4)	58.6		2/8/2006
51	3767492.3	1182419.6	37.56.17.57	-75.27.23.49	21.22	72.35	Z(1-4)	111.6		2/8/2006
52	3767487.8	1182420	37.56.17.58	-75.27.23.67	8.88	77.34	Z(1-4)	229.6		2/8/2006
53	3767486.3	1182420.6	37.56.17.61	-75.27.23.74	5.19	80.49	Z(1-4)	3694.8		2/8/2006
54	3767495.9	1182421.3	37.56.17.62	-75.27.23.34	32.93	74.8	Z(1-4)	205.4		2/8/2006
55	3767498.8	1182421.6	37.56.17.62	-75.27.23.22	41.39	73.36	Z(1-4)	101.8		2/8/2006
56	3767487.2	1182421.7	37.56.17.64	-75.27.23.70	8.73	83.26	Z(1-4)	346.1		2/8/2006
57	3767500.6	1182422.1	37.56.17.64	-75.27.23.15	46.93	73.47	Z(1-4)	61		2/8/2006
58	3767494.8	1182422.2	37.56.17.65	-75.27.23.39	30.64	78.58	Z(1-4)	171.1		2/8/2006
59	3767489.1	1182422.5	37.56.17.66	-75.27.23.62	14.82	84.24	Z(1-4)	175.6		2/8/2006
60	3767494.2	1182422.5	37.56.17.66	-75.27.23.41	29.22	80.03	Z(1-4)	164.2		2/8/2006

Geophysical Dig Sheet and Target History

GRID 1D Unique Target ID	ORIGINAL SURVEY									
	Easting Coord. (m)	Northing Coord. (m)	Lat. Coord.	Long. Coord.	X - Local (Grid) Coord. (ft)	Y - Local (Grid) Coord. (ft)	Channel ID (i.e. C1, top senor, gradient)	Response Amplitude (mV)	Dig Priority	Date
61	3767485.5	1182422.9	37.56.17.68	-75.27.23.77	5.02	88.49	Z(1-4)	374.9		2/8/2006
62	3767503	1182422.9	37.56.17.66	-75.27.23.05	54.43	74.04	Z(1-4)	66.5		2/8/2006
63	3767491.3	1182423	37.56.17.68	-75.27.23.53	21.49	84.02	Z(1-4)	60.2		2/8/2006
64	3767498.3	1182423.6	37.56.17.69	-75.27.23.24	41.8	80.16	Z(1-4)	59		2/8/2006
65	3767500.7	1182423.8	37.56.17.69	-75.27.23.14	48.76	78.81	Z(1-4)	19.7		2/8/2006
66	3767484.9	1182424.4	37.56.17.73	-75.27.23.79	4.69	93.77	Z(1-4)	112.5		2/8/2006
67	3767494.2	1182424.6	37.56.17.73	-75.27.23.41	31.13	86.73	Z(1-4)	45.4		2/8/2006
68	3767492.9	1182424.7	37.56.17.73	-75.27.23.46	27.55	88.12	Z(1-4)	43.4		2/8/2006
69	3767495.2	1182424.9	37.56.17.74	-75.27.23.37	34.22	86.86	Z(1-4)	49.1		2/8/2006
70	3767497.4	1182425	37.56.17.74	-75.27.23.28	40.53	85.37	Z(1-4)	42		2/8/2006
71	3767489.9	1182425.1	37.56.17.75	-75.27.23.58	19.44	91.87	Z(1-4)	109		2/8/2006
72	3767502.9	1182425.1	37.56.17.73	-75.27.23.05	56.15	81.15	Z(1-4)	43.9		2/8/2006
73	3767484.2	1182425.3	37.56.17.76	-75.27.23.82	3.53	97.22	Z(1-4)	115		2/8/2006
74	3767498.4	1182425.3	37.56.17.75	-75.27.23.23	43.62	85.5	Z(1-4)	52.5		2/8/2006
75	3767505.1	1182425.4	37.56.17.74	-75.27.22.96	62.63	80.29	Z(1-4)	82.2		2/8/2006

Geophysical Dig Sheet and Target History

GRID 1D Unique Target ID	ORIGINAL SURVEY									
	Easting Coord. (m)	Northing Coord. (m)	Lat. Coord.	Long. Coord.	X - Local (Grid) Coord. (ft)	Y - Local (Grid) Coord. (ft)	Channel ID (i.e. C1, top senor, gradient)	Response Amplitude (mV)	Dig Priority	Date
76	3767493.3	1182425.6	37.56.17.76	-75.27.23.44	29.49	90.66	Z(1-4)	47.1		2/8/2006
77	3767500	1182425.6	37.56.17.75	-75.27.23.17	48.41	85.13	Z(1-4)	16		2/8/2006
78	3767488.4	1182426	37.56.17.78	-75.27.23.64	16.02	95.98	Z(1-4)	131.4		2/8/2006
79	3767501.1	1182426.7	37.56.17.79	-75.27.23.12	52.52	87.74	Z(1-4)	28.2		2/8/2006
80	3767484.3	1182426.8	37.56.17.81	-75.27.23.81	5.17	101.92	Z(1-4)	280.2		2/8/2006
81	3767490.7	1182427	37.56.17.81	-75.27.23.55	23.42	97.28	Z(1-4)	36.4		2/8/2006
82	3767488.8	1182427.3	37.56.17.82	-75.27.23.62	18.33	99.8	Z(1-4)	20.7		2/8/2006
83	3767501.5	1182427.4	37.56.17.81	-75.27.23.10	54.28	89.64	Z(1-4)	20		2/8/2006
84	3767500.7	1182427.8	37.56.17.82	-75.27.23.14	52.39	91.58	Z(1-4)	15.1		2/8/2006
85	3767493.1	1182427.9	37.56.17.83	-75.27.23.45	31.02	98.17	Z(1-4)	1280.5		2/8/2006
86	3767495.5	1182428	37.56.17.84	-75.27.23.35	37.89	96.51	Z(1-4)	47.9		2/8/2006
87	3767504.7	1182428	37.56.17.83	-75.27.22.97	63.86	88.91	Z(1-4)	51.9		2/8/2006
88	3767503.5	1182428.1	37.56.17.83	-75.27.23.02	60.57	90.22	Z(1-4)	20.9		2/8/2006
89	3767497.5	1182428.2	37.56.17.84	-75.27.23.27	43.71	95.49	Z(1-4)	20.8		2/8/2006
90	3767499.3	1182428.4	37.56.17.84	-75.27.23.19	48.98	94.65	Z(1-4)	13.5		2/8/2006

Geophysical Dig Sheet and Target History

GRID 1D Unique Target ID	ORIGINAL SURVEY									
	Easting Coord. (m)	Northing Coord. (m)	Lat. Coord.	Long. Coord.	X - Local (Grid) Coord. (ft)	Y - Local (Grid) Coord. (ft)	Channel ID (i.e. C1, top senor, gradient)	Response Amplitude (mV)	Dig Priority	Date
91	3767490.3	1182428.7	37.56.17.86	-75.27.23.56	23.84	103.03	Z(1-4)	84.3		2/8/2006
92	3767506.9	1182428.8	37.56.17.85	-75.27.22.88	70.8	89.65	Z(1-4)	33.1		2/8/2006
93	3767493.9	1182429.4	37.56.17.88	-75.27.23.41	34.64	102.29	Z(1-4)	633.3		2/8/2006
94	3767502.2	1182429.6	37.56.17.88	-75.27.23.07	58.26	96.08	Z(1-4)	48.3		2/8/2006
95	3767501.4	1182430.1	37.56.17.90	-75.27.23.10	56.45	98.34	Z(1-4)	45.5		2/8/2006
96	3767505.9	1182430.1	37.56.17.89	-75.27.22.92	69.16	94.62	Z(1-4)	23.8		2/8/2006
97	3767507	1182430.8	37.56.17.91	-75.27.22.87	72.9	95.95	Z(1-4)	24.1		2/8/2006
98	3767499.9	1182430.9	37.56.17.93	-75.27.23.17	52.94	102.13	Z(1-4)	74		2/8/2006
99	3767503.7	1182431	37.56.17.92	-75.27.23.01	63.76	99.31	Z(1-4)	72.9		2/8/2006
100	3767505.4	1182431.4	37.56.17.94	-75.27.22.94	68.93	99.18	Z(1-4)	10		2/8/2006
101	3767508.5	1182431.7	37.56.17.94	-75.27.22.81	77.95	97.58	Z(1-4)	21.6		2/8/2006
102	3767505.8	1182432	37.56.17.95	-75.27.22.92	70.6	100.77	Z(1-4)	10.4		2/8/2006
103	3767508.2	1182433.1	37.56.17.99	-75.27.22.82	78.38	102.29	Z(1-4)	93		2/8/2006
104	3767497.94	1182401.87	37.56.16.99	-75.27.23.28	21.04	11.13	Z(1-4)	4.6		2/8/2006
105	3767498.51	1182400.17	37.56.16.93	-75.27.23.26	21.13	5.23	Z(1-4)	7.2		2/8/2006

Geophysical Dig Sheet and Target History

GRID 1D Unique Target ID	ORIGINAL SURVEY									
	Easting Coord. (m)	Northing Coord. (m)	Lat. Coord.	Long. Coord.	X - Local (Grid) Coord. (ft)	Y - Local (Grid) Coord. (ft)	Channel ID (i.e. C1, top senor, gradient)	Response Amplitude (mV)	Dig Priority	Date

Note: *Fill in Acceptable Units (mV, nT/m, ppt, etc).

**Optional field – refer to SOW for applicability to specific project.

***For Anomaly type, U = UXO, F = frag, MD = munitions debris, S = scrap, A = small arms ammunition, NC = no contact, O = other.

Geophysical Dig Sheet and Target History

GRID 1D Unique Target ID	REACQUISITION SURVEY Geophysical Instrument **	GPS Instrument**	Date	Comment	Response Amplitude (units*)**
1	Schondstedt	NA	2-13-06	used x/y coordinates to locate targets	NA
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					
14					
15					

Geophysical Dig Sheet and Target History

GRID 1D Unique Target ID	REACQUISITION SURVEY				
	Geophysical Instrument **	GPS Instrument**	Date	Comment	Response Amplitude (units*)**
16	Schondstedt	NA	2-13-06	used x/y coordinates to locate targets	NA
17					
18					
19					
20					
21					
22					
23					
24					
25					
26					
27					
28					
29					
30					

Geophysical Dig Sheet and Target History

GRID 1D Unique Target ID	REACQUISITION SURVEY				
	Geophysical Instrument **	GPS Instrument**	Date	Comment	Response Amplitude (units*)**
31	Schondstedt	NA	2-13-06	used x/y coordinates to locate targets	NA
32					
33					
34					
35					
36					
37			2-14-06		
38					
39					
40					
41					
42					
43					
44					
45					

Geophysical Dig Sheet and Target History

GRID 1D Unique Target ID	REACQUISITION SURVEY				
	Geophysical Instrument **	GPS Instrument**	Date	Comment	Response Amplitude (units*)**
46	Schondstedt	NA	2-14-06	used x/y coordinates to locate targets	NA
47					
48					
49					
50					
51					
52					
53					
54					
55					
56					
57					
58					
59					
60					

Geophysical Dig Sheet and Target History

GRID 1D Unique Target ID	REACQUISITION SURVEY				
	Geophysical Instrument **	GPS Instrument**	Date	Comment	Response Amplitude (units*)**
61	Schondstedt	NA	2-14-06	used x/y coordinates to locate targets	NA
62					
63					
64					
65					
66					
67					
68					
69					
70					
71					
72					
73					
74					
75					

Geophysical Dig Sheet and Target History

GRID 1D Unique Target ID	REACQUISITION SURVEY				
	Geophysical Instrument **	GPS Instrument**	Date	Comment	Response Amplitude (units*)**
76	Schondstedt	NA	2-14-06	used x/y coordinates to locate targets	NA
77					
78					
79					
80					
81					
82					
83					
84					
85					
86					
87					
88					
89					
90					

Geophysical Dig Sheet and Target History

GRID 1D Unique Target ID	REACQUISITION SURVEY Geophysical Instrument **	GPS Instrument**	Date	Comment	Response Amplitude (units*)**
91	Schondstedt	NA	2-14-06	used x/y coordinates to locate targets	NA
92					
93					
94					
95					
96					
97					
98					
99					
100					
101					
102					
103					
104					
105					

Geophysical Dig Sheet and Target History

GRID 1D Unique Target ID	REACQUISITION SURVEY				
	Geophysical Instrument **	GPS Instrument**	Date	Comment	Response Amplitude (units*)**

Geophysical Dig Sheet and Target History

GRID 1D Unique Target ID	DIG RESULTS										
	Anomaly Type ***	Approx. Weight (lbs-~~oz/kg-g~~)	Comments (e.g., response below 1 foot)	Offset Distance (ft)	Offset Direction (N, NE, etc.)	Orientation of Nose (Azimuth deg)	Inclination of Nose (deg)	Depth to Top of Item (in/~~cm~~)	Digital Photo Number	2006 Date	Team Leader
1			LIP	0				>12.0"	NO PIC	14 Feb 06	RW
2			LIP	0				>12.0"	NO PIC	14 Feb 06	RW
3			LIP	0				>12.0"	NO PIC	14 Feb 06	RW
4			LIP	0				>12.0"	NO PIC	14 Feb 06	RW
5			LIP	0				>12.0"	NO PIC	14 Feb 06	RW
6			LIP	0				>12.0"	NO PIC	14 Feb 06	RW
7			LIP	0				>12.0"	NO PIC	14 Feb 06	RW
8			LIP	0				>12.0"	NO PIC	14 Feb 06	RW
9			LIP	0				>12.0"	NO PIC	14 Feb 06	RW
10			LIP	0				>12.0"	NO PIC	14 Feb 06	RW
11	MD	.4	20mm cart	0				8.0		14 Feb 06	RW
12	S	.1	Scrap	0				4.0		14 Feb 06	RW
13	S	1.0	Scrap	0				8.0		14 Feb 06	RW
14			LIP	0				>12.0"	NO PIC	14 Feb 06	RW
15	S	.5	Scrap	0				6.0		14 Feb 06	RW

Geophysical Dig Sheet and Target History

GRID 1D Unique Target ID	DIG RESULTS										
	Anomaly Type ***	Approx. Weight (lbs/~~oz/kg-g~~)	Comments (e.g., response below 1 foot)	Offset Distance (ft)	Offset Direction (N, NE, etc.)	Orientation of Nose (Azimuth deg)	Inclination of Nose (deg)	Depth to Top of Item (in/~~cm~~)	Digital Photo Number	2006 Date	Team Leader
16			LIP	0				>12.0"	NO PIC	14 Feb 06	RW
17			LIP	0				>12.0"	NO PIC	14 Feb 06	RW
18			LIP	0				>12.0"	NO PIC	14 Feb 06	RW
19			LIP	0				>12.0"	NO PIC	14 Feb 06	RW
20			LIP	0				>12.0"	NO PIC	14 Feb 06	RW
21			LIP	0				>12.0"	NO PIC	14 Feb 06	RW
22			LIP	0				>12.0"	NO PIC	14 Feb 06	RW
23	S	.2	scrap	1.0				6.0		14 Feb 06	RW
24			LIP	0				>12.0"	NO PIC	14 Feb 06	RW
25	S	.1	scrap	0				3.0		14 Feb 06	RW
26			LIP	0				>12.0"	NO PIC	14 Feb 06	RW
27	S	2.0+	pipe LIP	0				5.0		14 Feb 06	RW
28	S	.1	nail	1.0				2.0		14 Feb 06	RW
29	S	1.0	scrap	0				6.0		14 Feb 06	RW
30			LIP concrete	0				12.0	NO PIC	14 Feb 06	RW

Geophysical Dig Sheet and Target History

GRID 1D Unique Target ID	DIG RESULTS										
	Anomaly Type ***	Approx. Weight (lbs/~~oz/kg-g~~)	Comments (e.g., response below 1 foot)	Offset Distance (ft)	Offset Direction (N, NE, etc.)	Orientation of Nose (Azimuth deg)	Inclination of Nose (deg)	Depth to Top of Item (in/~~cm~~)	Digital Photo Number	2006 Date	Team Leader
31			LIP	0				>12.0"	NO PIC	14Feb06	RW
32		10.0	concrete x2	0				10.0		14Feb06	RW
33	S	.4	spark plug	0				4.0		14Feb06	RW
34	MD	.3	20mm	0				8.0		14Feb06	RW
35			LIP	0				>12.0"	NO PIC	14Feb06	RW
36	S	.1	nail	0				4.0		14Feb06	RW
37	S	.2	nail	0				6.0		14Feb06	RW
38	S	.3	metal clamp	0				6.0		14Feb06	RW
39	S	.1	nail	1.0				2.0		14Feb06	RW
40	S	.5	bolt	0				8.0		14Feb06	RW
41			LIP	0				>12.0"	NO PIC	14Feb06	RW
42	S	.3	scrap x2	0				6.0		14Feb06	RW
43	S	.4	scrap	0				6.0		14Feb06	RW
44	S	2.5	scrap x2	0				10.0		14Feb06	RW
45	S	.3	scrap	0				8.0		14Feb06	RW

Geophysical Dig Sheet and Target History

GRID 1D Unique Target ID	DIG RESULTS										
	Anomaly Type ***	Approx. Weight (lbs ~~oz/kg-g~~)	Comments (e.g., response below 1 foot)	Offset Distance (ft)	Offset Direction (N, NE, etc.)	Orientation of Nose (Azimuth deg)	Inclination of Nose (deg)	Depth to Top of Item (in/~~cm~~)	Digital Photo Number	2006 Date	Team Leader
46	S	.2	scrap	0				5.0		14Feb06	RW
47		2.0	concrete	0				10.0		14Feb06	RW
48	S	.2	scrap	0				8.0		14Feb06	RW
49	S	.1	wire	1.0				6.0		14Feb06	RW
50	S	.1	nail	1.0				4.0		14Feb06	RW
51	S	2.0	scrap	0				8.0		14Feb06	RW
52	S	1.2	Scrap x5	0				10.0		14Feb06	RW
53			LIP	0				>12.0"	NO PIC	14Feb06	RW
54	S	.8	rod	0				8.0		14Feb06	RW
55	S	.5	scrap	0				7.0		14Feb06	RW
56			LIP	0				>12.0"	NO PIC	14Feb06	RW
57	S	.4	scrap	0				8.0		14Feb06	RW
58	S	.5	scrap *see #60	0				6.0		14Feb06	RW
59	S	.8	scrap x2	0				6.0		14Feb06	RW
60	S	.5	same item as #58	0.5	N			6.0	*see #58	14Feb06	RW

Geophysical Dig Sheet and Target History

GRID 1D Unique Target ID	DIG RESULTS										
	Anomaly Type ***	Approx. Weight (lbs/~~oz/kg g~~)	Comments (e.g., response below 1 foot)	Offset Distance (ft)	Offset Direction (N, NE, etc.)	Orientation of Nose (Azimuth deg)	Inclination of Nose (deg)	Depth to Top of Item (in/~~cm~~)	Digital Photo Number	2006 Date	Team Leader
61			LIP concrete	0				12.0	NO PIC	14Feb06	RW
62	S	.1	Scrap	1.0				6.0		14Feb06	RW
63	S	.3	Scrap	0				4.0		14Feb06	RW
64	S	.5	Scrap	0				6.0		14Feb06	RW
65	S	.4	Scrap	0				8.0		14Feb06	RW
66			LIP	0				>12.0"	NO PIC	14Feb06	RW
67	S	.2	Scrap	0				6.0		14Feb06	RW
68	S	.3	Scrap	0				6.0		14Feb06	RW
69	S	.2	Scrap	0				6.0		14Feb06	RW
70	S	.4	Scrap	0				4.0		14Feb06	RW
71	S	.5	Scrap	0				7.0		14Feb06	RW
72			LIP	0				>12.0"	NO PIC	14Feb06	RW
73			LIP	0				>12.0"	NO PIC	14Feb06	RW
74	S	.6	Scrap	0				8.0		14Feb06	RW
75			LIP	0				>12.0"	NO PIC	14Feb06	RW

Geophysical Dig Sheet and Target History

GRID 1D Unique Target ID	DIG RESULTS Anomaly Type ***	Approx. Weight (lbs/~~oz/kg-g~~)	Comments (e.g., response below 1 foot)	Offset Distance (ft)	Offset Direction (N, NE, etc.)	Orientation of Nose (Azimuth deg)	Inclination of Nose (deg)	Depth to Top of Item (in/~~cm~~)	Digital Photo Number	2006 Date	Team Leader
76	S	.4	scrap	0				6.0		14 Feb 06	RW
77	S	.6	scrap	0				10.0		14 Feb 06	RW
78	S	1.0	pipe	0				8.0		14 Feb 06	RW
79			LIP					>12.0"	NO PIC	14 Feb 06	RW
80	S	.1	scrap	0				6.0		14 Feb 06	RW
81			LIP	0				>12.0"	NO PIC	14 Feb 06	RW
82			LIP	0				>12.0"	NO PIC	14 Feb 06	RW
83			LIP	0				>12.0"	NO PIC	14 Feb 06	RW
84			LIP	0				>12.0"	NO PIC	14 Feb 06	RW
85	S	1.5	scrap x3	0				10.0		14 Feb 06	RW
86	S	2.0	scrap x6	0				8.0		14 Feb 06	RW
87			LIP	0				>12.0"	NO PIC	14 Feb 06	RW
88	MD	.4	20 mm	0				6.0		14 Feb 06	RW
89	S	.1	nail	1.0				6.0		14 Feb 06	RW
90			LIP	0				>12.0"	NO PIC	14 Feb 06	RW

Geophysical Dig Sheet and Target History

GRID 1D Unique Target ID	DIG RESULTS										
	Anomaly Type ***	Approx. Weight (lbs ~~oz/kg g~~)	Comments (e.g., response below 1 foot)	Offset Distance (ft)	Offset Direction (N, NE, etc.)	Orientation of Nose (Azimuth deg)	Inclination of Nose (deg)	Depth to Top of Item (in ~~cm~~)	Digital Photo Number	2006 Date	Team Leader
91	S	1.0	Scrap	0				8.0		14 Feb 06	RW
92	S	1.2	nut & bolt	0				8.0		14 Feb 06	RW
93	S	2.0	Scrap	0				6.0		14 Feb 06	RW
94	S	2.5	Scrap	0				8.0		14 Feb 06	RW
95			LIP	0				>12.0"	NO PIC	14 Feb 06	RW
96	~~S~~	~~1~~	LIP	0				>12.0"	NO PIC	14 Feb 06	RW
97	MD	.4	20mm cart	0				10.0		14 Feb 06	RW
98			LIP	0				>12.0"	NO PIC	14 Feb 06	RW
99	S	.8	chain	0				6.0		14 Feb 06	RW
100	S	1.5	chain	0				6.0		14 Feb 06	RW
101	S	.4	scrap	0				8.0		14 Feb 06	RW
102	S	1.0	scrap	0				5.0		14 Feb 06	RW
103	S	.6	scrap	0				6.0		14 Feb 06	RW
104	MD	.4	20 mm cart	0				8.0		14 Feb 06	RW
105			LIP	0				>12.0"	NO PIC	14 Feb 06	RW

Geophysical Dig Sheet and Target History

GRID 1D Unique Target ID	DIG RESULTS										
	Anomaly Type ***	Approx. Weight (lbs-oz/kg-g)	Comments (e.g., response below 1 foot)	Offset Distance (ft)	Offset Direction (N, NE, etc.)	Orientation of Nose (Azimuth deg)	Inclination of Nose (deg)	Depth to Top of Item (in/cm)	Digital Photo Number	Date	Team Leader

Geophysical Dig Sheet and Target History

GRID 1D Unique Target ID	POST-DIG UXO QC RESULTS			POST-DIG PROJECT QC		
	Excavation Hole Cleared?	UXO QC Spec. Initials	Date	Agreement Between Dig Results & Geophysical Data? (G=good, P=poor, U=unacceptable)	Project QC Initials	Date
1						
2						
3						
4						
5						
6						
7						
8						
9						
10	Y					
11	Yes	EMD	2/14/06	G	VAS	2-14-06
12	Yes	EMD	2/14/06	G	VAS	2-14-06
13						
14						
15						

Geophysical Dig Sheet and Target History

GRID 1D Unique Target ID	POST-DIG UXO QC RESULTS			POST-DIG PROJECT QC		
	Excavation Hole Cleared?	UXO QC Spec. Initials	Date	Agreement Between Dig Results & Geophysical Data? (G=good, P=poor, U=unacceptable)	Project QC Initials	Date
16						
17						
18						
19						
20						
21						
22						
23	Yes	EMD	2/14/06	G	VAS	2-14-06
24						
25						
26						
27						
28						
29	Yes	EMD	2/14/06	G	VAS	2-14-06
30						

Geophysical Dig Sheet and Target History

GRID 1D Unique Target ID	POST-DIG UXO QC RESULTS			POST-DIG PROJECT QC		
	Excavation Hole Cleared?	UXO QC Spec. Initials	Date	Agreement Between Dig Results & Geophysical Data? (G=good, P=poor, U=unacceptable)	Project QC Initials	Date
31						
32						
33						
34						
35						
36						
37						
38						
39						
40	Yes	EMD	2/14/06	G	VAS	2-14-06
41						
42						
43						
44						
45						

Geophysical Dig Sheet and Target History

GRID 1D Unique Target ID	POST-DIG UXO QC RESULTS			POST-DIG PROJECT QC		
	Excavation Hole Cleared?	UXO QC Spec. Initials	Date	Agreement Between Dig Results & Geophysical Data? (G=good, P=poor, U=unacceptable)	Project QC Initials	Date
46						
47						
48						
49						
50	Yes	EMD	2/14/06	G	VAS	2-14-06
51						
52						
53						
54						
55						
56						
57						
58						
59						
60	Yes	EMD	2/14/06	G	VAS	2-14-06

Geophysical Dig Sheet and Target History

GRID 1D Unique Target ID	POST-DIG UXO QC RESULTS			POST-DIG PROJECT QC		
	Excavation Hole Cleared?	UXO QC Spec. Initials	Date	Agreement Between Dig Results & Geophysical Data? (G=good, P=poor, U=unacceptable)	Project QC Initials	Date
61						
62						
63						
64						
65						
66						
67						
68						
69						
70	Yes	EuD	2/14/06	G	VAS	2-14-06
71						
72						
73						
74						
75						

Geophysical Dig Sheet and Target History

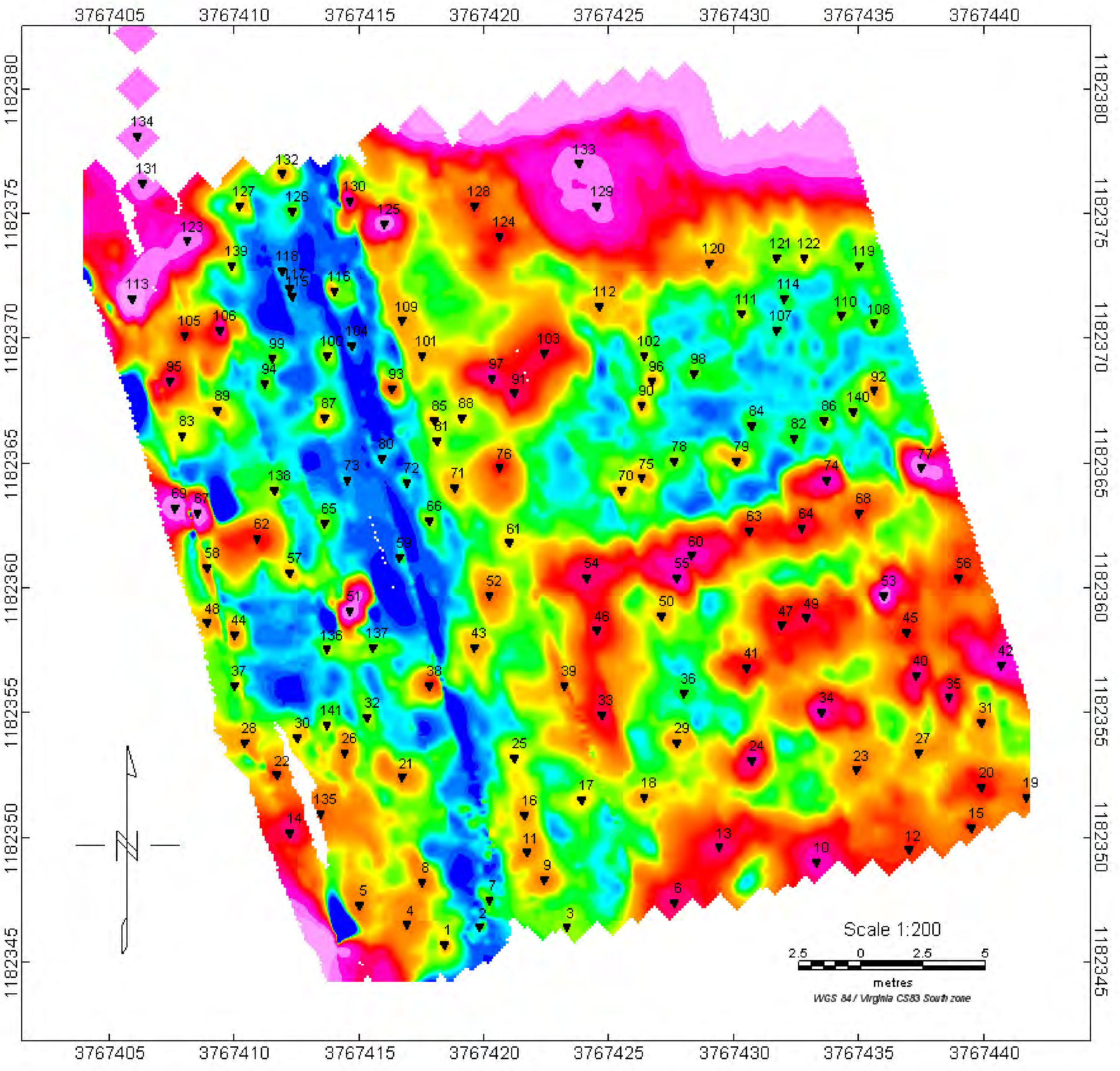
GRID 1D Unique Target ID	POST-DIG UXO QC RESULTS			POST-DIG PROJECT QC		
	Excavation Hole Cleared?	UXO QC Spec. Initials	Date	Agreement Between Dig Results & Geophysical Data? (G=good, P=poor, U=unacceptable)	Project QC Initials	Date
76						
77						
78						
79						
80	Yes	EMD	2/14/06	G	VAS	2-14-06
81						
82						
83						
84						
85						
86						
87						
88						
89	Yes	EMD	2/14/06	G	VAS	2-14-06
90						

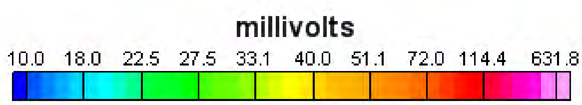
Geophysical Dig Sheet and Target History

GRID 1D Unique Target ID	POST-DIG UXO QC RESULTS			POST-DIG PROJECT QC		
	Excavation Hole Cleared?	UXO QC Spec. Initials	Date	Agreement Between Dig Results & Geophysical Data? (G=good, P=poor, U=unacceptable)	Project QC Initials	Date
91						
92						
93						
94						
95						
96						
97						
98						
99						
100	Yes	EMD	2/14/06	G	VAS	2-14-06
101						
102						
103						
104						
105						

Geophysical Dig Sheet and Target History

GRID 1D	POST-DIG UXO QC RESULTS			POST-DIG PROJECT QC		
Unique Target ID	Excavation Hole Cleared?	UXO QC Spec. Initials	Date	Agreement Between Dig Results & Geophysical Data? (G=good, P=poor, U=unacceptable)	Project QC Initials	Date





NASA

Wallops Flight Center
EM61 MK2 Data
Grid 2A

February 8, 2006

Tetra Tech EM Inc.

Geophysical Dig Sheet and Target History

GRID 2A Unique Target ID	ORIGINAL SURVEY									
	Easting Coord. (m)	Northing Coord. (m)	Lat. Coord.	Long. Coord.	X - Local (Grid) Coord. (ft)	Y - Local (Grid) Coord. (ft)	Channel ID (i.e. C1, top senor, gradient)	Response Amplitude (mV)	Dig Priority	Date
1	3767418.4	1182345.7	37.56.15.25	-75.27.26.61	16.03	-1.39		46.5		2/8/2006
2	3767419.8	1182346.4	37.56.15.27	-75.27.26.56	21.04	-0.26		24.7		2/8/2006
3	3767423.3	1182346.4	37.56.15.27	-75.27.26.41	31.81	-2.97		32.4		2/8/2006
4	3767416.9	1182346.5	37.56.15.28	-75.27.26.67	12.2	2.29		65.4		2/8/2006
5	3767415	1182347.3	37.56.15.30	-75.27.26.75	7.14	6.27		63.3		2/8/2006
6	3767427.6	1182347.4	37.56.15.29	-75.27.26.23	46.04	-3.14		165.4		2/8/2006
7	3767420.2	1182347.5	37.56.15.30	-75.27.26.54	23.35	2.89		29.2		2/8/2006
8	3767417.5	1182348.2	37.56.15.33	-75.27.26.65	15.73	7.18		65.5		2/8/2006
9	3767422.4	1182348.3	37.56.15.33	-75.27.26.45	30.92	3.71		67.7		2/8/2006
10	3767433.3	1182349	37.56.15.34	-75.27.26.00	65.17	-2.5		202.8		2/8/2006
11	3767421.7	1182349.4	37.56.15.36	-75.27.26.47	29.84	7.71		58.4		2/8/2006
12	3767437	1182349.5	37.56.15.35	-75.27.25.85	77.06	-3.79		88.3		2/8/2006
13	3767429.4	1182349.6	37.56.15.36	-75.27.26.16	53.75	2.4		151.9		2/8/2006
14	3767412.2	1182350.2	37.56.15.40	-75.27.26.86	1.38	17.56		170.4		2/8/2006
15	3767439.5	1182350.4	37.56.15.38	-75.27.25.74	85.64	-2.88		84.6		2/8/2006

Geophysical Dig Sheet and Target History

GRID 2A Unique Target ID	ORIGINAL SURVEY									
	Easting Coord. (m)	Northing Coord. (m)	Lat. Coord.	Long. Coord.	X - Local (Grid) Coord. (ft)	Y - Local (Grid) Coord. (ft)	Channel ID (i.e. C1, top senor, gradient)	Response Amplitude (mV)	Dig Priority	Date
16	3767421.6	1182350.9	37.56.15.41	-75.27.26.48	31.02	12.51		55.1		2/8/2006
17	3767423.9	1182351.5	37.56.15.43	-75.27.26.38	38.69	12.62		39.8		2/8/2006
18	3767426.4	1182351.6	37.56.15.43	-75.27.26.28	46.49	11.01		51		2/8/2006
19	3767441.7	1182351.6	37.56.15.42	-75.27.25.65	93.6	-0.8		72		2/8/2006
20	3767439.9	1182352	37.56.15.43	-75.27.25.73	88.45	1.84		102.7		2/8/2006
21	3767416.7	1182352.4	37.56.15.47	-75.27.26.67	17.41	21.01		64.9		2/8/2006
22	3767411.7	1182352.5	37.56.15.48	-75.27.26.88	2.11	25.19		76.1		2/8/2006
23	3767434.9	1182352.7	37.56.15.46	-75.27.25.93	73.75	7.91		72.4		2/8/2006
24	3767430.7	1182353.1	37.56.15.48	-75.27.26.10	61.21	12.41		186.3		2/8/2006
25	3767421.2	1182353.2	37.56.15.49	-75.27.26.49	32.05	20.06		38.2		2/8/2006
26	3767414.4	1182353.4	37.56.15.50	-75.27.26.77	11.31	25.93		60.9		2/8/2006
27	3767437.4	1182353.4	37.56.15.48	-75.27.25.83	82.14	8.18		56.9		2/8/2006
28	3767410.4	1182353.8	37.56.15.52	-75.27.26.93	-0.61	30.28		55		2/8/2006
29	3767427.7	1182353.8	37.56.15.50	-75.27.26.22	52.66	16.93		49.8		2/8/2006
30	3767412.5	1182354	37.56.15.52	-75.27.26.84	6.05	29.29		41.9		2/8/2006

Geophysical Dig Sheet and Target History

GRID 2A Unique Target ID	ORIGINAL SURVEY									
	Easting Coord. (m)	Northing Coord. (m)	Lat. Coord.	Long. Coord.	X - Local (Grid) Coord. (ft)	Y - Local (Grid) Coord. (ft)	Channel ID (i.e. C1, top senor, gradient)	Response Amplitude (mV)	Dig Priority	Date
31	3767439.9	1182354.6	37.56.15.51	-75.27.25.72	91.02	10.03		72		2/8/2006
32	3767415.3	1182354.8	37.56.15.55	-75.27.26.73	15.46	29.65		34.3		2/8/2006
33	3767424.7	1182354.9	37.56.15.54	-75.27.26.34	44.51	22.7		133		2/8/2006
34	3767433.5	1182355	37.56.15.53	-75.27.25.98	71.7	16.22		206.9		2/8/2006
35	3767438.6	1182355.6	37.56.15.55	-75.27.25.77	88	14.18		160.2		2/8/2006
36	3767428	1182355.8	37.56.15.57	-75.27.26.21	55.56	22.99		27.5		2/8/2006
37	3767410	1182356.1	37.56.15.59	-75.27.26.94	0.42	37.83		33.1		2/8/2006
38	3767417.8	1182356.1	37.56.15.59	-75.27.26.62	24.44	31.81		83.7		2/8/2006
39	3767423.2	1182356.1	37.56.15.58	-75.27.26.40	41.07	27.64		68.2		2/8/2006
40	3767437.3	1182356.5	37.56.15.58	-75.27.25.83	84.88	18.01		177.5		2/8/2006
41	3767430.5	1182356.8	37.56.15.60	-75.27.26.10	64.24	24.21		110.9		2/8/2006
42	3767440.7	1182356.9	37.56.15.59	-75.27.25.69	95.75	16.65		273.4		2/8/2006
43	3767419.6	1182357.6	37.56.15.63	-75.27.26.55	31.46	35.14		49.2		2/8/2006
44	3767410	1182358.1	37.56.15.66	-75.27.26.94	2.4	44.12		56.8		2/8/2006
45	3767436.9	1182358.2	37.56.15.63	-75.27.25.84	85.33	23.67		108.6		2/8/2006

Geophysical Dig Sheet and Target History

GRID 2A Unique Target ID	ORIGINAL SURVEY									
	Easting Coord. (m)	Northing Coord. (m)	Lat. Coord.	Long. Coord.	X - Local (Grid) Coord. (ft)	Y - Local (Grid) Coord. (ft)	Channel ID (i.e. C1, top senor, gradient)	Response Amplitude (mV)	Dig Priority	Date
46	3767424.5	1182358.3	37.56.15.65	-75.27.26.35	47.24	33.56		129.2		2/8/2006
47	3767431.9	1182358.5	37.56.15.65	-75.27.26.04	70.23	28.47		123.3		2/8/2006
48	3767408.9	1182358.6	37.56.15.68	-75.27.26.99	-0.5	46.54		53.7		2/8/2006
49	3767432.9	1182358.8	37.56.15.66	-75.27.26.00	73.6	28.65		135.3		2/8/2006
50	3767427.1	1182358.9	37.56.15.67	-75.27.26.24	55.84	33.44		48.9		2/8/2006
51	3767414.6	1182359.1	37.56.15.69	-75.27.26.75	17.55	43.72		856.4		2/8/2006
52	3767420.2	1182359.7	37.56.15.70	-75.27.26.52	35.38	41.28		72.5		2/8/2006
53	3767436	1182359.7	37.56.15.68	-75.27.25.87	84.04	29.09		502.8		2/8/2006
54	3767424.1	1182360.4	37.56.15.72	-75.27.26.36	48.08	40.47		148		2/8/2006
55	3767427.7	1182360.4	37.56.15.72	-75.27.26.21	59.17	37.7		256.4		2/8/2006
56	3767439	1182360.4	37.56.15.70	-75.27.25.75	93.97	28.97		93.8		2/8/2006
57	3767412.2	1182360.6	37.56.15.74	-75.27.26.85	11.64	50.29		44.6		2/8/2006
58	3767408.9	1182360.8	37.56.15.75	-75.27.26.98	1.67	53.47		58.8		2/8/2006
59	3767416.6	1182361.2	37.56.15.75	-75.27.26.67	25.78	48.78		21.7		2/8/2006
60	3767428.3	1182361.3	37.56.15.74	-75.27.26.19	61.9	40.06		198.6		2/8/2006

Geophysical Dig Sheet and Target History

GRID 2A Unique Target ID	ORIGINAL SURVEY									
	Easting Coord. (m)	Northing Coord. (m)	Lat. Coord.	Long. Coord.	X - Local (Grid) Coord. (ft)	Y - Local (Grid) Coord. (ft)	Channel ID (i.e. C1, top senor, gradient)	Response Amplitude (mV)	Dig Priority	Date
61	3767421	1182361.8	37.56.15.77	-75.27.26.49	39.92	47.27		41.1		2/8/2006
62	3767410.9	1182362	37.56.15.78	-75.27.26.90	9.01	55.7		99.7		2/8/2006
63	3767430.6	1182362.3	37.56.15.77	-75.27.26.09	69.97	41.44		101.3		2/8/2006
64	3767432.7	1182362.4	37.56.15.77	-75.27.26.01	76.54	40.13		126.8		2/8/2006
65	3767413.6	1182362.6	37.56.15.80	-75.27.26.79	17.92	55.5		31.8		2/8/2006
66	3767417.8	1182362.7	37.56.15.80	-75.27.26.62	30.95	52.58		35		2/8/2006
67	3767408.5	1182363	37.56.15.82	-75.27.27.00	2.61	60.7		681.3		2/8/2006
68	3767435	1182363	37.56.15.79	-75.27.25.91	84.21	40.24		87.6		2/8/2006
69	3767407.6	1182363.2	37.56.15.83	-75.27.27.03	0.03	62.02		604.9		2/8/2006
70	3767425.5	1182363.9	37.56.15.83	-75.27.26.30	55.85	50.41		44.3		2/8/2006
71	3767418.8	1182364	37.56.15.84	-75.27.26.57	35.31	55.9		49.7		2/8/2006
72	3767416.9	1182364.2	37.56.15.85	-75.27.26.65	29.66	57.99		23.1		2/8/2006
73	3767414.5	1182364.3	37.56.15.86	-75.27.26.75	22.37	60.16		16.3		2/8/2006
74	3767433.7	1182364.3	37.56.15.84	-75.27.25.96	81.49	45.34		217		2/8/2006
75	3767426.3	1182364.4	37.56.15.85	-75.27.26.27	58.8	51.36		48.7		2/8/2006

Geophysical Dig Sheet and Target History

GRID 2A Unique Target ID	ORIGINAL SURVEY									
	Easting Coord. (m)	Northing Coord. (m)	Lat. Coord.	Long. Coord.	X - Local (Grid) Coord. (ft)	Y - Local (Grid) Coord. (ft)	Channel ID (i.e. C1, top senor, gradient)	Response Amplitude (mV)	Dig Priority	Date
76	3767420.6	1182364.8	37.56.15.87	-75.27.26.50	41.64	57.02		103.5		2/8/2006
77	3767437.5	1182364.8	37.56.15.85	-75.27.25.81	93.69	43.98		527.8		2/8/2006
78	3767427.6	1182365.1	37.56.15.87	-75.27.26.21	63.5	52.56		34.2		2/8/2006
79	3767430.1	1182365.1	37.56.15.86	-75.27.26.11	71.19	50.63		58.1		2/8/2006
80	3767415.9	1182365.2	37.56.15.88	-75.27.26.69	27.57	61.91		18.7		2/8/2006
81	3767418.1	1182365.9	37.56.15.90	-75.27.26.60	35.03	62.41		38.7		2/8/2006
82	3767432.4	1182366	37.56.15.89	-75.27.26.01	79.16	51.69		27.3		2/8/2006
83	3767407.9	1182366.1	37.56.15.92	-75.27.27.02	3.82	70.92		37		2/8/2006
84	3767430.7	1182366.5	37.56.15.91	-75.27.26.08	74.42	54.58		27.7		2/8/2006
85	3767418	1182366.7	37.56.15.93	-75.27.26.60	35.51	65.01		40.9		2/8/2006
86	3767433.6	1182366.7	37.56.15.91	-75.27.25.96	83.55	52.97		34.2		2/8/2006
87	3767413.6	1182366.8	37.56.15.94	-75.27.26.78	22.06	68.72		43.5		2/8/2006
88	3767419.1	1182366.8	37.56.15.93	-75.27.26.56	39	64.48		39.3		2/8/2006
89	3767409.3	1182367.1	37.56.15.95	-75.27.26.96	9.12	72.98		47		2/8/2006
90	3767426.3	1182367.3	37.56.15.94	-75.27.26.26	61.66	60.49		49		2/8/2006

Geophysical Dig Sheet and Target History

GRID 2A Unique Target ID	ORIGINAL SURVEY									
	Easting Coord. (m)	Northing Coord. (m)	Lat. Coord.	Long. Coord.	X - Local (Grid) Coord. (ft)	Y - Local (Grid) Coord. (ft)	Channel ID (i.e. C1, top senor, gradient)	Response Amplitude (mV)	Dig Priority	Date
91	3767421.2	1182367.8	37.56.15.96	-75.27.26.47	46.45	66		139.7		2/8/2006
92	3767435.6	1182367.9	37.56.15.95	-75.27.25.88	90.89	55.2		57.8		2/8/2006
93	3767416.3	1182368	37.56.15.97	-75.27.26.67	31.56	70.41		81.2		2/8/2006
94	3767411.2	1182368.2	37.56.15.99	-75.27.26.88	16.05	74.98		29.6		2/8/2006
95	3767407.4	1182368.3	37.56.15.99	-75.27.27.03	4.45	78.23		162.5		2/8/2006
96	3767426.7	1182368.3	37.56.15.97	-75.27.26.24	63.88	63.33		49.6		2/8/2006
97	3767420.3	1182368.4	37.56.15.98	-75.27.26.51	44.27	68.58		196.5		2/8/2006
98	3767428.4	1182368.6	37.56.15.98	-75.27.26.17	69.41	62.96		28.5		2/8/2006
99	3767411.5	1182369.2	37.56.16.02	-75.27.26.86	17.96	77.89		31		2/8/2006
100	3767413.7	1182369.3	37.56.16.02	-75.27.26.77	24.83	76.51		34.9		2/8/2006
101	3767417.5	1182369.3	37.56.16.01	-75.27.26.62	36.54	73.58		47.6		2/8/2006
102	3767426.4	1182369.3	37.56.16.00	-75.27.26.25	63.94	66.71		38		2/8/2006
103	3767422.4	1182369.4	37.56.16.01	-75.27.26.42	51.72	70.11		126.5		2/8/2006
104	3767414.7	1182369.7	37.56.16.03	-75.27.26.73	28.31	77		18.1		2/8/2006
105	3767408	1182370.1	37.56.16.05	-75.27.27.01	8.07	83.43		105.9		2/8/2006

Geophysical Dig Sheet and Target History

GRID 2A Unique Target ID	ORIGINAL SURVEY									
	Easting Coord. (m)	Northing Coord. (m)	Lat. Coord.	Long. Coord.	X - Local (Grid) Coord. (ft)	Y - Local (Grid) Coord. (ft)	Channel ID (i.e. C1, top senor, gradient)	Response Amplitude (mV)	Dig Priority	Date
106	3767409.4	1182370.3	37.56.16.06	-75.27.26.95	12.58	82.98		188.4		2/8/2006
107	3767431.7	1182370.3	37.56.16.03	-75.27.26.04	81.25	65.76		22.4		2/8/2006
108	3767435.6	1182370.6	37.56.16.04	-75.27.25.88	93.56	63.7		32.2		2/8/2006
109	3767416.7	1182370.7	37.56.16.06	-75.27.26.65	35.45	78.6		51.4		2/8/2006
110	3767434.3	1182370.9	37.56.16.05	-75.27.25.93	89.85	65.64		28.9		2/8/2006
111	3767430.3	1182371	37.56.16.06	-75.27.26.09	77.63	69.05		33.7		2/8/2006
112	3767424.6	1182371.3	37.56.16.07	-75.27.26.33	60.37	74.39		46.8		2/8/2006
113	3767405.9	1182371.6	37.56.16.10	-75.27.27.09	3.08	89.77		1702.2		2/8/2006
114	3767432	1182371.6	37.56.16.07	-75.27.26.02	83.46	69.62		24.8		2/8/2006
115	3767412.3	1182371.7	37.56.16.10	-75.27.26.83	22.89	85.14		16.6		2/8/2006
116	3767414	1182371.9	37.56.16.10	-75.27.26.76	28.32	84.46		39.2		2/8/2006
117	3767412.2	1182372	37.56.16.11	-75.27.26.83	22.88	86.17		15.9		2/8/2006
118	3767411.9	1182372.7	37.56.16.13	-75.27.26.84	22.64	88.6		16.5		2/8/2006
119	3767435	1182372.9	37.56.16.11	-75.27.25.90	93.98	71.4		30.9		2/8/2006
120	3767429	1182373	37.56.16.12	-75.27.26.14	75.6	76.34		55.8		2/8/2006

Geophysical Dig Sheet and Target History

GRID 2A Unique Target ID	ORIGINAL SURVEY									
	Easting Coord. (m)	Northing Coord. (m)	Lat. Coord.	Long. Coord.	X - Local (Grid) Coord. (ft)	Y - Local (Grid) Coord. (ft)	Channel ID (i.e. C1, top senor, gradient)	Response Amplitude (mV)	Dig Priority	Date
121	3767431.7	1182373.2	37.56.16.13	-75.27.26.03	84.11	74.89		32.5		2/8/2006
122	3767432.8	1182373.2	37.56.16.12	-75.27.25.99	87.5	74.04		38.7		2/8/2006
123	3767408.1	1182373.9	37.56.16.17	-75.27.27.00	12.13	95.31		475.8		2/8/2006
124	3767420.6	1182374.1	37.56.16.17	-75.27.26.49	50.82	86.29		126.2		2/8/2006
125	3767416	1182374.6	37.56.16.19	-75.27.26.67	37.14	91.41		628.3		2/8/2006
126	3767412.3	1182375.1	37.56.16.21	-75.27.26.82	26.24	95.84		33.7		2/8/2006
127	3767410.2	1182375.3	37.56.16.22	-75.27.26.91	19.97	98.09		41.2		2/8/2006
128	3767419.6	1182375.3	37.56.16.21	-75.27.26.53	48.92	90.84		82.1		2/8/2006
129	3767424.5	1182375.3	37.56.16.20	-75.27.26.32	64.01	87.06		490.5		2/8/2006
130	3767414.6	1182375.5	37.56.16.22	-75.27.26.73	33.72	95.33		223.2		2/8/2006
131	3767406.3	1182376.2	37.56.16.25	-75.27.27.07	8.85	103.94		566.6		2/8/2006
132	3767411.9	1182376.6	37.56.16.26	-75.27.26.84	26.49	100.87		51.6		2/8/2006
133	3767423.8	1182377	37.56.16.26	-75.27.26.35	63.53	92.95		497.5		2/8/2006
134	3767406.1	1182378.1	37.56.16.31	-75.27.27.07	10.11	110.07		642.9		2/8/2006
135	3767413.44	1182350.96	37.56.15.42	-75.27.26.81	5.95	19		73.6		2/8/2006

Geophysical Dig Sheet and Target History

GRID 2A Unique Target ID	ORIGINAL SURVEY									
	Easting Coord. (m)	Northing Coord. (m)	Lat. Coord.	Long. Coord.	X - Local (Grid) Coord. (ft)	Y - Local (Grid) Coord. (ft)	Channel ID (i.e. C1, top senor, gradient)	Response Amplitude (mV)	Dig Priority	Date
136	3767413.69	1182357.54	37.56.15.64	-75.27.26.79	13.2	39.5		35		2/8/2006
137	3767415.53	1182357.6	37.56.15.64	-75.27.26.72	18.93	38.27		29.5		2/8/2006
138	3767411.6	1182363.93	37.56.15.85	-75.27.26.87	13.06	61.23		33.7		2/8/2006
139	3767409.88	1182372.9	37.56.16.14	-75.27.26.93	16.61	90.8		34.8		2/8/2006
140	3767434.77	1182367.06	37.56.15.92	-75.27.25.92	87.51	53.21		32.5		2/8/2006
141	3767413.69	1182354.53	37.56.15.54	-75.27.26.79	10.23	30.03		38.4		2/8/2006

Note: *Fill in Acceptable Units (mV, nT/m, ppt, etc).

**Optional field – refer to SOW for applicability to specific project.

***For Anomaly type, U = UXO, F = frag, MD = munitions debris, S = scrap, A = small arms ammunition, NC = no contact, O = other.

Geophysical Dig Sheet and Target History

GRID 2A Unique Target ID	REACQUISITION SURVEY				
	Geophysical Instrument **	GPS Instrument**	Date	Comment	Response Amplitude (units*)**
1	Schondstedt	NA	2-10-06	used X/y coordinates to locate Targets	NA
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					
14					
15					

Geophysical Dig Sheet and Target History

GRID 2A Unique Target ID	REACQUISITION SURVEY Geophysical Instrument **	GPS Instrument**	Date	Comment	Response Amplitude (units*)**
16	Schondstedt	NA	2-10-06	used x/y coordinates to locate Targets	NA
17					
18					
19					
20					
21					
22					
23					
24					
25					
26					
27					
28					
29					
30					

Geophysical Dig Sheet and Target History

GRID 2A Unique Target ID	REACQUISITION SURVEY				
	Geophysical Instrument **	GPS Instrument**	Date	Comment	Response Amplitude (units*)**
31	Schondstedt	NA	2-10-06	used X/Y coordinates to locate targets	NA
32					
33					
34					
35					
36					
37					
38					
39					
40					
41					
42					
43					
44					
45					

Geophysical Dig Sheet and Target History

GRID 2A Unique Target ID	REACQUISITION SURVEY				
	Geophysical Instrument **	GPS Instrument**	Date	Comment	Response Amplitude (units*)**
46	Schondstedt	NA	2-10-06	used X/Y coordinates to locate Targets	NA
47					
48					
49					
50					
51					
52					
53					
54					
55					
56					
57					
58					
59					
60					

Geophysical Dig Sheet and Target History

GRID 2A Unique Target ID	REACQUISITION SURVEY				
	Geophysical Instrument **	GPS Instrument**	Date	Comment	Response Amplitude (units*)**
61	Schondstedt	NA	2-10-06	used X/Y coordinates to locate targets	N.A
62					
63					
64					
65					
66					
67					
68					
69					
70					
71					
72					
73					
74					
75					

Geophysical Dig Sheet and Target History

GRID 2A	REACQUISITION SURVEY				
Unique Target ID	Geophysical Instrument **	GPS Instrument**	Date	Comment	Response Amplitude (units*)**
76	Schondstedt	NA	2-10-06	used X/Y coordinates to locate targets	NA
77					
78					
79					
80					
81					
82					
83					
84					
85					
86					
87					
88					
89					
90					

Geophysical Dig Sheet and Target History

GRID 2A Unique Target ID	REACQUISITION SURVEY Geophysical Instrument **	GPS Instrument**	Date	Comment	Response Amplitude (units*)**
91	Schondstedt	NA	2-10-06	used X/Y coordinates to locate targets	NA
92					
93					
94					
95					
96					
97					
98					
99					
100					
101					
102					
103					
104					
105					

Geophysical Dig Sheet and Target History

GRID 2A Unique Target ID	REACQUISITION SURVEY				
	Geophysical Instrument **	GPS Instrument**	Date	Comment	Response Amplitude (units*)**
106	Schondstedt	NA	2-10-06	used X/Y coordinates to locate Targets	NA
107					
108					
109					
110					
111					
112					
113					
114					
115					
116					
117					
118					
119					
120					

Geophysical Dig Sheet and Target History

GRID 2A Unique Target ID	REACQUISITION SURVEY				
	Geophysical Instrument **	GPS Instrument**	Date	Comment	Response Amplitude (units*)**
121	Schondstedt	NA	2-10-06	used X/Y coordinates to locate targets	NA
122					
123					
124					
125					
126					
127					
128					
129					
130					
131					
132					
133					
134					
135					

Geophysical Dig Sheet and Target History

GRID 2A Unique Target ID	REACQUISITION SURVEY				
	Geophysical Instrument **	GPS Instrument**	Date	Comment	Response Amplitude (units*)**
136	Schondstedt	NA	2-10-06	used X/Y coordinates to locate Targets	NA
137					
138					
139					
140					
141					

Geophysical Dig Sheet and Target History

GRID 2A Unique Target ID	DIG RESULTS										
	Anomaly Type ***	Approx. Weight (lbs-oz/kg-g)	Comments (e.g., response below 1 foot)	Offset Distance (ft)	Offset Direction (N, NE, etc.)	Orientation of Nose (Azimuth deg)	Inclination of Nose (deg)	Depth to Top of Item (in/cm)	Digital Photo Number	Date	Team Leader
1	MD	.3	20MM	2	N			3.0		2/11/06	RW
2	S	.1	NAIL	1.0				5.0		2/11/06	RW
3	HR	.4	HR	0				5		2/11/06	RW
4	S	.1	NAIL	1.0				4.0		2/11/06	RW
5	S	.1	NAIL	1.0				2.0		2/11/06	RW
6	MD	.6	20MM (2) items	0				4.0		2/11/06	RW
7	MA	.3	20 MM	0				3.0		2/11/06	RW
8	S	.2	BRACKET	0				2.0		2/11/06	RW
9	MD	.3	20 MM	0				5.0		2/11/06	RW
10	MD	.9	20MM (4) items	0				6.0		2/11/06	RW
11	S	.3	Scrap	0.5				4.0		2/11/06	RW
12	MD	.3	20 MM	0				4.0		2/11/06	RW
13	MD	.3	20 MM	0				5		2/11/06	RW
14	S	.3	NAILS	0				4.0		2/11/06	RW
15	MA	.6	20MM (2) items	0				4.0		2/11/06	RW

Geophysical Dig Sheet and Target History

GRID 2A Unique Target ID	DIG RESULTS										
	Anomaly Type ***	Approx. Weight (lbs-oz/kg-g)	Comments (e.g., response below 1 foot)	Offset Distance (ft)	Offset Direction (N, NE, etc.)	Orientation of Nose (Azimuth deg)	Inclination of Nose (deg)	Depth to Top of Item (in/cm)	Digital Photo Number	Date	Team Leader
16	S	.2	Scrap	2	W			4.0		2/11/06	RW
17	MD	.3	20 mm	0				5.0		2/11/06	RW
18	S	.1	NAIL	0				3.0		2/11/06	RW
19	MD	.3	20 MM	0				4.0		2/11/06	[illegible]
20	MD	.3	20 MM	0				4.0		2/11/06	RW
21	S	.1	NAIL	1.0				2.0		2/11/06	RW
22	S	.1	NAIL	1.0				3.0	22	2/11/06	RW
23	MD	.3	20 MM	0				4.0		2/11/06	RW
24	S	1.0	Scrap	0				2.0		2/11/06	RW
25	S	.1	NAIL	0				5.0		2/11/06	RW
26	MD	.3	20 MM	0				2.0		2/11/06	RW
27	S	.4	BOLT.	0				3.0		2/11/06	RW
28	S	.1	NAIL	1.0				3.0		2/11/06	RW
29	MD	.3	20 MM	0				4.0		2/11/06	RW
30	S	.1	NAIL	0				2.0		2/11/06	RW

Geophysical Dig Sheet and Target History

GRID 2A Unique Target ID	Anomaly Type ***	Approx. Weight (lbs-oz/kg-g)	Comments (e.g., response below 1 foot)	Offset Distance (ft)	Offset Direction (N, NE, etc.)	Orientation of Nose (Azimuth deg)	Inclination of Nose (deg)	Depth to Top of Item (in/cm)	Digital Photo Number	Date	Team Leader
	DIG RESULTS										
31	S	.2	Scrap	2	W			3.0		2/11/06	RW
32	MD	.3	20 mm	2	N			2.0		2/11/06	RW
33	S	.1	Nail	0				6.0		2/11/06	RW
34	MD	.3	20 mm	0				4.0		2/11/06	RW
35	S	2.0	Rebar	0				3.0		2/11/06	RW
36	MD	.3	20 mm	2	W			4.0		2/11/06	RW
37	S	.1	Nail	1.0				3.0		2/11/06	RW
38	S	.1	Scrap	0				4.0		2/11/06	RW
39	MD	.2	20mm Cartridge	2	N			4.0		2/11/06	RW
40			Concrete								
41			Concrete							2/11/06	RW
42	S	4.0	Pipe	0				4.0		2/11/06	RW
43	S	.1	Nail	1.0				2.0		2/11/06	RW
44	S	.2	Scrap	2	E			3.0	44	2/14/06	RW
45	MD	.3	20 mm	0				3.0		2/11/06	RW

Geophysical Dig Sheet and Target History

GRID 2A Unique Target ID	DIG RESULTS										
	Anomaly Type ***	Approx. Weight (lbs-oz/kg-g)	Comments (e.g., response below 1 foot)	Offset Distance (ft)	Offset Direction (N, NE, etc.)	Orientation of Nose (Azimuth deg)	Inclination of Nose (deg)	Depth to Top of Item (in/cm)	Digital Photo Number	Date	Team Leader
46	S	.1	Scrap	0				4.0		2/11/06	RW
47	S	.1	Scrap	1.0				2.0		2/11/06	RW
48	S	.2	Scrap	0				5.0	48	2/11/06	RW
49	MD	.3	20MM	0				4.0		2/11/06	RW
50	S	.1	Scrap	0				4.0		2/11/06	RW
51	S	.1	Nail	0.5				2.0		2/11/06	RW
52	S	12	Scrap	0				3.0		2/11/06	RW
53	S	.3	Pipe	2	W			4.0		2/11/06	RW
54	—		Drain From	Pipe							
55	S	1.0	Angle Iron	2	W			5.0		2/11/06	RW
56	S	.1	Nail/Wire	0				6.0		2/11/06	RW
57	MD	.2	20 MM	0				3.0	57	2/11/06	RW
58	S	.1	Scrap	0				3.0	58	2/11/06	RW
59	S	.1	Nail	1.0				4.0		2/11/06	RW
60	MD	.3	20 MM	0				6.0		2/11/06	RW

Geophysical Dig Sheet and Target History

GRID 2A Unique Target ID	DIG RESULTS										
	Anomaly Type ***	Approx. Weight (lbs-oz/kg-g)	Comments (e.g., response below 1 foot)	Offset Distance (ft)	Offset Direction (N, NE, etc.)	Orientation of Nose (Azimuth deg)	Inclination of Nose (deg)	Depth to Top of Item (in/cm)	Digital Photo Number	Date	Team Leader
61	S	.1	Scrap	0.5				5.0		2/11/06	RW
62	S	.1	Scrap	0.5				4.0		2/11/06	RW
63	S	.3	20mm	0				3.0	63	2/11/06	RW
64	S	.3	20mm	0				4.0		2/11/06	RW
65	MD	.3	20mm	0				6.0		2/11/06	RW
66	S	.2	Scrap	0				4.0		2/11/06	RW
67	S	.1	Scrap	1.0				4.0	67	2/11/06	RW
68	MD	.3	20mm	0				4.0		2/11/06	RW
69	S	2.0	Scrap	0				3.0	69	2/11/06	RW
70	S	2.0	Bolt	0				4.0		2/11/06	RW
71	S	.1	Scrap	0				4.0		2/11/06	RW
72	MD	.3	20mm	0				5.0		2/11/06	RW
73	S	.1	Nail	1.0				2.0		2/11/06	RW
74	S	1.0	Pipe	0				3.0		2/11/06	RW
75	S	.	Drain fein	0						2/11/06	RW

Geophysical Dig Sheet and Target History

GRID 2A Unique Target ID	DIG RESULTS Anomaly Type ***	Approx. Weight (lbs-oz/kg-g)	Comments (e.g., response below 1 foot)	Offset Distance (ft)	Offset Direction (N, NE, etc.)	Orientation of Nose (Azimuth deg)	Inclination of Nose (deg)	Depth to Top of Item (in/cm)	Digital Photo Number	Date	Team Leader
76	MD	4	30 mm	0				4.0		2/11/06	RW
77	S	.2	Scrap	0.5				Sur		2/11/06	RW
78	S	.2	Scrap	0.5				4.0		2/11/06	RW
79	S	.4	Pipe	2	W			5.0		2/11/06	RW
80	S	.2	Washer	1.5				3.0		2/11/06	RW
81	S	.2	NUT	0.5				5.0		2/11/06	RW
82	S	.1	Scrap	2	W			4.0		2/11/06	RW
83	S	.1	NAIL	0.5				2.0	83	2/11/06	RW
84	MD	.3	20 mm	0				4.0		2/11/06	RW
85	S	.3	Bolt	0				4.0		2/11/06	RW
86	S	.1	Scrap	1.0				6.0		2/11/06	RW
87	S	.1	Bic Lighter	1.0				3.0		2/11/06	RW
88	S	.2	Scrap	0				2.0		2/11/06	RW
89	S	.1	NAIL	0.5				4.0	89	2/11/06	RW
90	S	.1	NAIL	0.5				3.0		2/11/06	RW

Geophysical Dig Sheet and Target History

GRID 2A Unique Target ID	DIG RESULTS										
	Anomaly Type ***	Approx. Weight (lbs-oz/kg-g)	Comments (e.g., response below 1 foot)	Offset Distance (ft)	Offset Direction (N, NE, etc.)	Orientation of Nose (Azimuth deg)	Inclination of Nose (deg)	Depth to Top of Item (in/cm)	Digital Photo Number	Date	Team Leader
91	~~S~~		(LIP) Drain Field					>12"		2/11/06	RW
92	MD	.3	20 mm	0				4.0		2/11/06	RW
93	S	.4	[illegible]	0				4.0		2/11/06	RW
94	S	.2	Bracket	2	~~E~~	~~E~~		3.0		2/11/06	RW
95	S	.1	Scrap	0.5				2.0	95	2/11/06	RW
96	S	.4	Spike/Nail	0.5				3.0		2/11/06	RW
97	S	.3	Rebar	0				3.0		2/11/06	RW
98	S	.1	Scrap	1.0				Sur		2/11/06	RW
99	S	.1	Scrap	1.0				Sur		2/11/06	RW
100	MD	.2	20 mm Can	0				3.0		2/11/06	RW
101	S	.1	Nail	0				2.0		2/11/06	RW
102			Drain Field (LIP)					>12"		2/11/06	[illegible]
103			Drain Field (LIP)					>12"		2/11/06	RW
104	S	.1	Scrap	1.0				2.0		2/11/06	RW
105	S	.1	Nail	1.0				2.0	105	2/11/06	RW

Geophysical Dig Sheet and Target History

GRID 2A Unique Target ID	DIG RESULTS Anomaly Type ***	Approx. Weight (lbs-oz/kg-g)	Comments (e.g., response below 1 foot)	Offset Distance (ft)	Offset Direction (N, NE, etc.)	Orientation of Nose (Azimuth deg)	Inclination of Nose (deg)	Depth to Top of Item (in/cm)	Digital Photo Number	Date	Team Leader
106	S	.1	Banding	0				3.0	106	2/11/06	RW
107	S	.2	Scrap	0				4.0		2/11/06.	RW
108	MD	.3	20 MM	0.5				5.0		2/11/06	RW
109	S	.2	Scrap	2	W			3.0		2/11/06	RW
110	S	.2	Scrap	0				3.0		2/11/06	RW
111	S	.1	Scrap	1.0				6.0		2/11/06	RW
112	S	.1	Scrap	1.0				2.0		2/11/06	RW
113	S	.1	Scrap	Ø				4.0	[illegible]	2/11/06	RW
114	MD	.3	20MM	0				5.0		2/11/06	RW
115	S	.2	Scrap	0				4.0		2/11/06	RW
116	MD	.3	20MM CART.	0				3.0		2/11/06	RW
117	S	.2	Scrap	0				3.0		2/11/06	RW
118	S	.2	Scrap	0				2.0		2/11/06	RW
119	S	.1	NAIL	1.0				Sur		2/11/06	RW
120	S	.1	NAIL	0				Sur		2/11/06	[illegible]

Geophysical Dig Sheet and Target History

GRID 2A Unique Target ID	DIG RESULTS										
	Anomaly Type ***	Approx. Weight (lbs-oz/kg-g)	Comments (e.g., response below 1 foot)	Offset Distance (ft)	Offset Direction (N, NE, etc.)	Orientation of Nose (Azimuth deg)	Inclination of Nose (deg)	Depth to Top of Item (in/cm)	Digital Photo Number	Date	Team Leader
121	S	.1	Scrap	1.0				4.0		2/11/06	RW
122	S	.2	Scrap	0				5.0		2/11/06	RW
123	S	.1	Scrap	1.0				4.0		2/11/06	RW
124			Drain Farm	0						2/11/06	RW
125	S	.2	PIPE / LIP	0	2	N		3.0		2/11/06	RW
126	S	.2	Scrap	0.5				3.0		2/11/06	RW
127	S	.2	Scrap	0				3.0		2/11/06	RW
128	S	.1	NAIL	1.0	2	E		2.0		2/11/06	RW
129	S	.3	Scrap	0				4.0		2/11/06	RW
130	S	1.0	Scrap	0				4.0		2/11/06	RW
131	WIRE	.3	Scrap	0				2.0	131	2/11/06	RW
132	S	.2	Scrap	0				5.0		2/11/06	RW
133	MD	.4	20 mm	0				4.0		2/11/06	RW
134	LM	.2	Scrap	0				2.0	134	2/11/06	RW
135	S/MD	.4	20mm / Scr	0				2.0		2/11/06	RW

Geophysical Dig Sheet and Target History

GRID 2A Unique Target ID	DIG RESULTS										
	Anomaly Type ***	Approx. Weight (lbs-oz/kg-g)	Comments (e.g., response below 1 foot)	Offset Distance (ft)	Offset Direction (N, NE, etc.)	Orientation of Nose (Azimuth deg)	Inclination of Nose (deg)	Depth to Top of Item (in/cm)	Digital Photo Number	Date	Team Leader
136	S	.1	NAIL	2	←			3.0		2/11/06	RN
137	S	.1	NAIL	1.0				2.0		2/11/06	RN
138	S	.1	Scrap	1.0				5		2/11/06	RN
139	S	.2	Scrap	0				3.0		2/11/06	RN
140	S	.3	METAL ROD	0				4.0		2/11/06	RN
141	S	.1	Nail	0				2.0		2/11/06	RN

Geophysical Dig Sheet and Target History

GRID 2A Unique Target ID	POST-DIG UXO QC RESULTS			POST-DIG PROJECT QC		
	Excavation Hole Cleared?	UXO QC Spec. Initials	Date	Agreement Between Dig Results & Geophysical Data? (G=good, P=poor, U=unacceptable)	Project QC Initials	Date
1	Yes	EMD	2/11/06	G	VAS	2-11-06
2						
3						
4						
5						
6						
7						
8						
9						
10	Yes	EMD	2/11/06	G	VAS	2-11-06
11						
12						
13						
14						
15						

Geophysical Dig Sheet and Target History

GRID 2A Unique Target ID	POST-DIG UXO QC RESULTS			POST-DIG PROJECT QC		
	Excavation Hole Cleared?	UXO QC Spec. Initials	Date	Agreement Between Dig Results & Geophysical Data? (G=good, P=poor, U=unacceptable)	Project QC Initials	Date
16						
17						
18						
19						
20	Yes	EMD	2/11/06	G	VAS	2-11-06
21						
22						
23						
24						
25						
26						
27						
28						
29						
30	Yes	EMD	2/11/06	G	VAS	2-11-06

Geophysical Dig Sheet and Target History

GRID 2A Unique Target ID	POST-DIG UXO QC RESULTS			POST-DIG PROJECT QC		
	Excavation Hole Cleared?	UXO QC Spec. Initials	Date	Agreement Between Dig Results & Geophysical Data? (G=good, P=poor, U=unacceptable)	Project QC Initials	Date
31						
32						
33						
34						
35						
36						
37						
38						
39						
40	NO-LIP	EWD	2/11/06	G	VAS	2-11-06
41						
42						
43						
44						
45						

Geophysical Dig Sheet and Target History

GRID 2A Unique Target ID	POST-DIG UXO QC RESULTS			POST-DIG PROJECT QC		
	Excavation Hole Cleared?	UXO QC Spec. Initials	Date	Agreement Between Dig Results & Geophysical Data? (G=good, P=poor, U=unacceptable)	Project QC Initials	Date
46						
47						
48						
49						
50	Yes	[illegible]	2/11/06	G	VAS	2-11-06
51						
52						
53						
54						
55						
56						
57						
58						
59						
60	Yes	[illegible]	2/11/06	G	VAS	2-11-06

Geophysical Dig Sheet and Target History

GRID 2A Unique Target ID	POST-DIG UXO QC RESULTS			POST-DIG PROJECT QC		
	Excavation Hole Cleared?	UXO QC Spec. Initials	Date	Agreement Between Dig Results & Geophysical Data? (G=good, P=poor, U=unacceptable)	Project QC Initials	Date
61						
62						
63						
64						
65						
66						
67						
68						
69						
70	[illegible]	[illegible]	2/11/06	G	VAS	2-11-06
71						
72						
73						
74						
75						

Geophysical Dig Sheet and Target History

GRID 2A Unique Target ID	POST-DIG UXO QC RESULTS			POST-DIG PROJECT QC		
	Excavation Hole Cleared?	UXO QC Spec. Initials	Date	Agreement Between Dig Results & Geophysical Data? (G=good, P=poor, U=unacceptable)	Project QC Initials	Date
76						
77						
78						
79						
80	Yes	EMD	2/11/06	G	VAS	2-11-06
81						
82						
83						
84						
85						
86						
87						
88						
89						
90	Yes	EMD	2/11/06	G	VAS	2-11-06

Geophysical Dig Sheet and Target History

GRID 2A Unique Target ID	POST-DIG UXO QC RESULTS			POST-DIG PROJECT QC		
	Excavation Hole Cleared?	UXO QC Spec. Initials	Date	Agreement Between Dig Results & Geophysical Data? (G=good, P=poor, U=unacceptable)	Project QC Initials	Date
91						
92						
93						
94						
95						
96						
97						
98						
99						
100	Yes	[illegible]	2/11/06	G	VAS	2-11-06
101						
102						
103						
104						
105						

Geophysical Dig Sheet and Target History

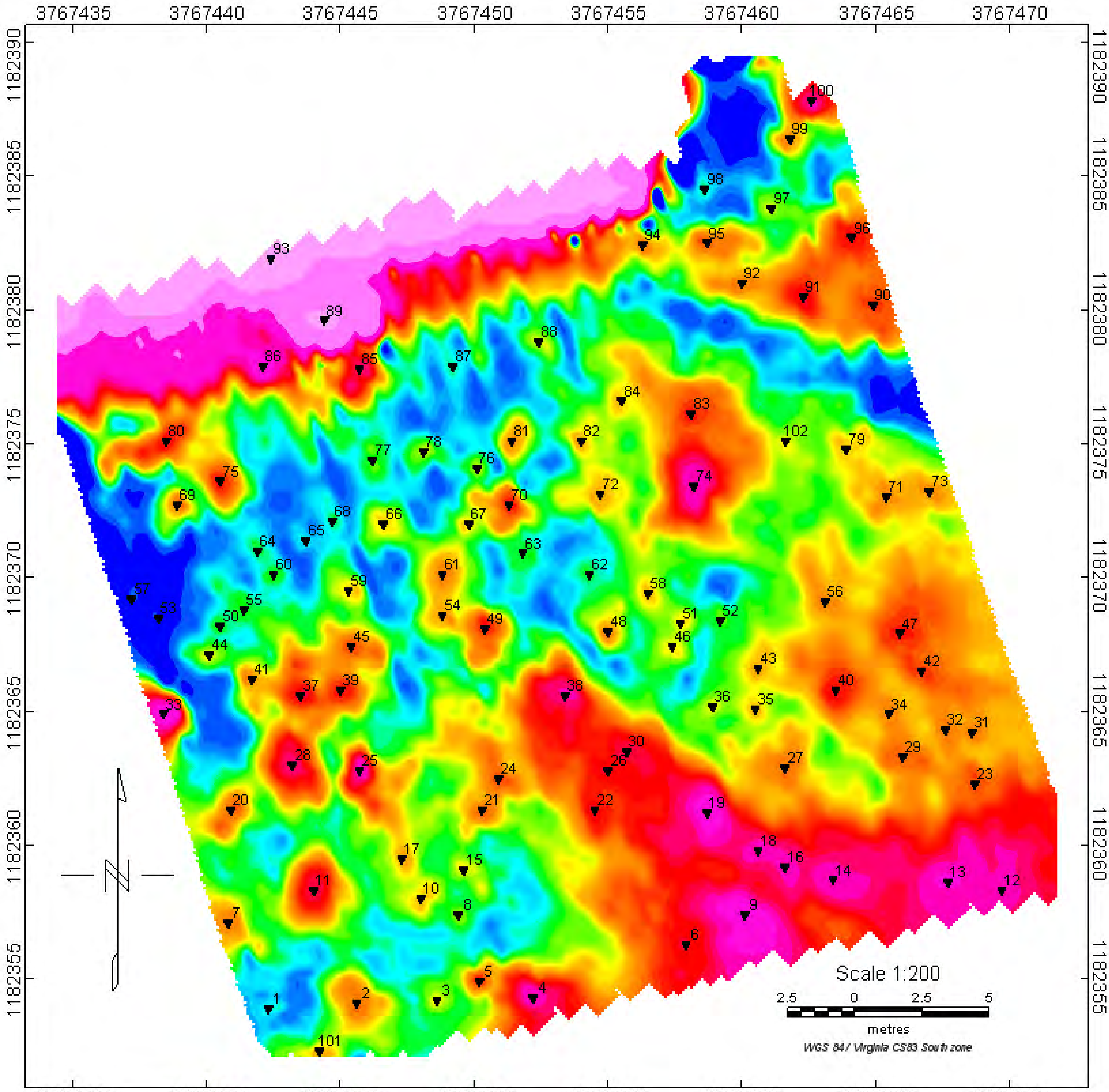
GRID 2A Unique Target ID	POST-DIG UXO QC RESULTS			POST-DIG PROJECT QC		
	Excavation Hole Cleared?	UXO QC Spec. Initials	Date	Agreement Between Dig Results & Geophysical Data? (G=good, P=poor, U=unacceptable)	Project QC Initials	Date
106						
107						
108						
109						
110	Yes	EMD	2/11/06	G	VAS	2-11-06
111						
112						
113						
114						
115						
116						
117						
118						
119						
120	Yes	EMD	2/11/06	G	VAS	2-11-06

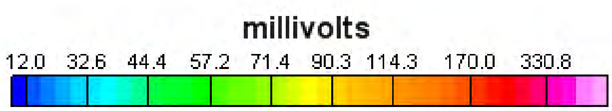
Geophysical Dig Sheet and Target History

GRID 2A Unique Target ID	POST-DIG UXO QC RESULTS			POST-DIG PROJECT QC		
	Excavation Hole Cleared?	UXO QC Spec. Initials	Date	Agreement Between Dig Results & Geophysical Data? (G=good, P=poor, U=unacceptable)	Project QC Initials	Date
121						
122						
123						
124						
125						
126						
127						
128						
129						
130	Yes	EMD	2/11/06	G	VAS	2-11-06
131						
132						
133						
134						
135						

Geophysical Dig Sheet and Target History

GRID 2A Unique Target ID	POST-DIG UXO QC RESULTS			POST-DIG PROJECT QC		
	Excavation Hole Cleared?	UXO QC Spec. Initials	Date	Agreement Between Dig Results & Geophysical Data? (G=good, P=poor, U=unacceptable)	Project QC Initials	Date
136						
137						
138						
139						
140	Yes	EWD	2/11/06	G	VAS	2-11-06
141						





NASA

Wallops Flight Center
EM61 MK2 Data
Grid 2B

February 8, 2006

Tetra Tech EM Inc.

Geophysical Dig Sheet and Target History

GRID 2B Unique Target ID	ORIGINAL SURVEY									
	Easting Coord. (m)	Northing Coord. (m)	Lat. Coord.	Long. Coord.	X - Local (Grid) Coord. (ft)	Y - Local (Grid) Coord. (ft)	Channel ID (i.e. C1, top senor, gradient)	Response Amplitude (units*)	Dig Priority	Date
1	3767442.3	1182353.9	37.56.15.49	-75.27.25.62	-0.28	5.97		38.3		2/8/2006
2	3767445.6	1182354.1	37.56.15.49	-75.27.25.49	10.05	3.97		142.2		2/8/2006
3	3767448.6	1182354.2	37.56.15.49	-75.27.25.37	19.36	1.9		82.4		2/8/2006
4	3767452.2	1182354.3	37.56.15.49	-75.27.25.22	30.5	-0.64		411.6		2/8/2006
5	3767450.2	1182354.9	37.56.15.51	-75.27.25.30	24.96	2.82		198.2		2/8/2006
6	3767457.9	1182356.3	37.56.15.55	-75.27.24.98	49.96	1.1		250.1		2/8/2006
7	3767440.8	1182357.1	37.56.15.59	-75.27.25.68	-1.74	17.21		128.2		2/8/2006
8	3767449.4	1182357.4	37.56.15.60	-75.27.25.33	24.99	11.28		69.2		2/8/2006
9	3767460.1	1182357.4	37.56.15.58	-75.27.24.89	57.8	2.8		581.7		2/8/2006
10	3767448	1182358	37.56.15.62	-75.27.25.39	21.28	14.28		95.1		2/8/2006
11	3767444	1182358.3	37.56.15.63	-75.27.25.55	9.28	18.41		280.7		2/8/2006
12	3767469.7	1182358.3	37.56.15.60	-75.27.24.50	88.09	-1.97		344.3		2/8/2006
13	3767467.7	1182358.6	37.56.15.61	-75.27.24.58	82.28	0.54		434.8		2/8/2006
14	3767463.4	1182358.7	37.56.15.62	-75.27.24.75	69.22	4.24		414		2/8/2006
15	3767449.6	1182359.1	37.56.15.65	-75.27.25.32	27.29	16.44		83.1		2/8/2006
16	3767461.6	1182359.2	37.56.15.64	-75.27.24.83	64.21	7.22		357.3		2/8/2006
17	3767447.3	1182359.5	37.56.15.67	-75.27.25.41	20.62	19.53		114.1		2/8/2006
18	3767460.6	1182359.8	37.56.15.66	-75.27.24.87	61.74	9.89		361		2/8/2006

Geophysical Dig Sheet and Target History

GRID 2B Unique Target ID	ORIGINAL SURVEY									
	Easting Coord. (m)	Northing Coord. (m)	Lat. Coord.	Long. Coord.	X - Local (Grid) Coord. (ft)	Y - Local (Grid) Coord. (ft)	Channel ID (i.e. C1, top senor, gradient)	Response Amplitude (units*)	Dig Priority	Date
19	3767458.7	1182361.2	37.56.15.71	-75.27.24.94	57.32	15.76		495		2/8/2006
20	3767440.9	1182361.3	37.56.15.73	-75.27.25.67	2.71	30.3		149.9		2/8/2006
21	3767450.3	1182361.3	37.56.15.72	-75.27.25.29	31.63	22.76		152.6		2/8/2006
22	3767454.5	1182361.3	37.56.15.72	-75.27.25.12	44.53	19.41		228.9		2/8/2006
23	3767468.7	1182362.3	37.56.15.73	-75.27.24.53	89.09	11.26		164		2/8/2006
24	3767450.9	1182362.5	37.56.15.76	-75.27.25.26	34.67	26.04		172.8		2/8/2006
25	3767445.7	1182362.8	37.56.15.77	-75.27.25.47	18.97	31.14		430.1		2/8/2006
26	3767455	1182362.8	37.56.15.76	-75.27.25.09	47.57	23.7		241.1		2/8/2006
27	3767461.6	1182362.9	37.56.15.76	-75.27.24.82	67.93	18.75		142.3		2/8/2006
28	3767443.2	1182363	37.56.15.78	-75.27.25.58	11.47	33.78		331.9		2/8/2006
29	3767466	1182363.3	37.56.15.77	-75.27.24.64	81.83	16.51		156.4		2/8/2006
30	3767455.7	1182363.5	37.56.15.79	-75.27.25.06	50.42	25.32		267.9		2/8/2006
31	3767468.6	1182364.2	37.56.15.80	-75.27.24.53	90.71	17.24		141.3		2/8/2006
32	3767467.6	1182364.3	37.56.15.80	-75.27.24.58	87.74	18.35		141		2/8/2006
33	3767438.4	1182364.9	37.56.15.85	-75.27.25.77	-1.45	43.6		578.1		2/8/2006
34	3767465.5	1182364.9	37.56.15.82	-75.27.24.66	81.91	21.88		131		2/8/2006
35	3767460.5	1182365.1	37.56.15.83	-75.27.24.86	66.77	26.48		101.5		2/8/2006
36	3767458.9	1182365.2	37.56.15.84	-75.27.24.93	61.96	28.07		81.6		2/8/2006

Geophysical Dig Sheet and Target History

GRID 2B Unique Target ID	ORIGINAL SURVEY									
	Easting Coord. (m)	Northing Coord. (m)	Lat. Coord.	Long. Coord.	X - Local (Grid) Coord. (ft)	Y - Local (Grid) Coord. (ft)	Channel ID (i.e. C1, top senor, gradient)	Response Amplitude (units*)	Dig Priority	Date
37	3767443.5	1182365.6	37.56.15.87	-75.27.25.56	14.97	41.68		241.8		2/8/2006
38	3767453.4	1182365.6	37.56.15.86	-75.27.25.15	45.46	33.72		343.8		2/8/2006
39	3767445	1182365.8	37.56.15.87	-75.27.25.50	19.8	41.09		204.4		2/8/2006
40	3767463.5	1182365.8	37.56.15.85	-75.27.24.74	76.69	26.27		222.5		2/8/2006
41	3767441.7	1182366.2	37.56.15.89	-75.27.25.63	10.02	45.01		122.3		2/8/2006
42	3767466.7	1182366.5	37.56.15.87	-75.27.24.61	87.21	25.9		178.2		2/8/2006
43	3767460.6	1182366.6	37.56.15.88	-75.27.24.86	68.59	31.07		106.3		2/8/2006
44	3767440.1	1182367.1	37.56.15.92	-75.27.25.70	5.97	49.12		82.8		2/8/2006
45	3767445.4	1182367.4	37.56.15.92	-75.27.25.48	22.62	45.78		175.9		2/8/2006
46	3767457.4	1182367.4	37.56.15.91	-75.27.24.99	59.56	36.13		83.9		2/8/2006
47	3767465.9	1182367.9	37.56.15.92	-75.27.24.64	86.18	30.89		204.6		2/8/2006
48	3767455	1182368	37.56.15.93	-75.27.25.09	52.78	39.92		126.1		2/8/2006
49	3767450.4	1182368.1	37.56.15.94	-75.27.25.27	38.72	43.93		209.7		2/8/2006
50	3767440.5	1182368.2	37.56.15.95	-75.27.25.68	8.3	52.24		55.8		2/8/2006
51	3767457.7	1182368.3	37.56.15.94	-75.27.24.98	61.39	38.69		85.8		2/8/2006
52	3767459.2	1182368.4	37.56.15.94	-75.27.24.91	66.1	37.8		61.5		2/8/2006
53	3767438.2	1182368.5	37.56.15.97	-75.27.25.77	1.5	55.05		11.6		2/8/2006
54	3767448.8	1182368.6	37.56.15.96	-75.27.25.34	34.3	46.78		114.3		2/8/2006

Geophysical Dig Sheet and Target History

GRID 2B Unique Target ID	ORIGINAL SURVEY									
	Easting Coord. (m)	Northing Coord. (m)	Lat. Coord.	Long. Coord.	X - Local (Grid) Coord. (ft)	Y - Local (Grid) Coord. (ft)	Channel ID (i.e. C1, top senor, gradient)	Response Amplitude (units*)	Dig Priority	Date
55	3767441.4	1182368.8	37.56.15.97	-75.27.25.64	11.67	53.39		55.8		2/8/2006
56	3767463.1	1182369.1	37.56.15.96	-75.27.24.75	78.8	36.86		125.4		2/8/2006
57	3767437.2	1182369.2	37.56.15.99	-75.27.25.81	-0.9	58.05		12.4		2/8/2006
58	3767456.5	1182369.4	37.56.15.98	-75.27.25.02	58.81	43.08		102		2/8/2006
59	3767445.3	1182369.5	37.56.15.99	-75.27.25.48	24.4	52.42		90.3		2/8/2006
60	3767442.5	1182370.1	37.56.16.01	-75.27.25.59	16.36	56.57		55		2/8/2006
61	3767448.8	1182370.1	37.56.16.01	-75.27.25.34	35.8	51.47		134.9		2/8/2006
62	3767454.3	1182370.1	37.56.16.00	-75.27.25.11	52.74	47.03		46.9		2/8/2006
63	3767451.8	1182370.9	37.56.16.03	-75.27.25.21	45.84	51.54		50.4		2/8/2006
64	3767441.9	1182371	37.56.16.04	-75.27.25.62	15.4	59.87		47.3		2/8/2006
65	3767443.7	1182371.4	37.56.16.05	-75.27.25.54	21.36	59.66		31.8		2/8/2006
66	3767446.6	1182372	37.56.16.07	-75.27.25.42	30.91	59.18		88.6		2/8/2006
67	3767449.8	1182372	37.56.16.07	-75.27.25.29	40.78	56.59		85.1		2/8/2006
68	3767444.7	1182372.1	37.56.16.08	-75.27.25.50	25.15	61.04		46.3		2/8/2006
69	3767438.9	1182372.7	37.56.16.10	-75.27.25.74	7.82	67.63		142.7		2/8/2006
70	3767451.3	1182372.7	37.56.16.09	-75.27.25.23	46.11	57.56		200.4		2/8/2006
71	3767465.4	1182373	37.56.16.08	-75.27.24.65	89.83	47.14		121.9		2/8/2006
72	3767454.7	1182373.1	37.56.16.10	-75.27.25.09	56.99	56.06		106.7		2/8/2006

Geophysical Dig Sheet and Target History

GRID 2B Unique Target ID	ORIGINAL SURVEY Easting Coord. (m)	Northing Coord. (m)	Lat. Coord.	Long. Coord.	X - Local (Grid) Coord. (ft)	Y - Local (Grid) Coord. (ft)	Channel ID (i.e. C1, top senor, gradient)	Response Amplitude (units*)	Dig Priority	Date
73	3767467	1182373.2	37.56.16.09	-75.27.24.59	94.95	46.48		119.5		2/8/2006
74	3767458.2	1182373.4	37.56.16.10	-75.27.24.95	68.08	54.17		414.1		2/8/2006
75	3767440.5	1182373.6	37.56.16.13	-75.27.25.67	13.66	69.15		200.2		2/8/2006
76	3767450.1	1182374.1	37.56.16.14	-75.27.25.28	43.82	62.9		78.1		2/8/2006
77	3767446.2	1182374.4	37.56.16.15	-75.27.25.44	32.08	67.01		56.1		2/8/2006
78	3767448.1	1182374.7	37.56.16.16	-75.27.25.36	38.24	66.4		72.1		2/8/2006
79	3767463.9	1182374.8	37.56.16.14	-75.27.24.71	87.05	53.94		94.8		2/8/2006
80	3767438.5	1182375.1	37.56.16.18	-75.27.25.75	8.97	75.47		218.2		2/8/2006
81	3767451.4	1182375.1	37.56.16.17	-75.27.25.22	48.83	64.97		119.4		2/8/2006
82	3767454	1182375.1	37.56.16.16	-75.27.25.12	56.85	62.86		103.7		2/8/2006
83	3767458.1	1182376.1	37.56.16.19	-75.27.24.95	70.5	62.66		209.5		2/8/2006
84	3767455.5	1182376.6	37.56.16.21	-75.27.25.05	62.99	66.32		92.7		2/8/2006
85	3767445.7	1182377.8	37.56.16.26	-75.27.25.45	33.94	78.03		290.9		2/8/2006
86	3767442.1	1182377.9	37.56.16.27	-75.27.25.60	22.9	81.29		597.4		2/8/2006
87	3767449.2	1182377.9	37.56.16.26	-75.27.25.31	44.86	75.49		41.7		2/8/2006
88	3767452.4	1182378.8	37.56.16.29	-75.27.25.18	55.65	75.69		74.8		2/8/2006
89	3767444.4	1182379.6	37.56.16.32	-75.27.25.50	31.72	84.72		13021		2/8/2006
90	3767464.9	1182380.2	37.56.16.32	-75.27.24.66	95.63	69.9		179.1		2/8/2006

Geophysical Dig Sheet and Target History

GRID 2B Unique Target ID	ORIGINAL SURVEY									
	Easting Coord. (m)	Northing Coord. (m)	Lat. Coord.	Long. Coord.	X - Local (Grid) Coord. (ft)	Y - Local (Grid) Coord. (ft)	Channel ID (i.e. C1, top senor, gradient)	Response Amplitude (units*)	Dig Priority	Date
91	3767462.3	1182380.5	37.56.16.33	-75.27.24.77	87.92	72.94		255.8		2/8/2006
92	3767460	1182381	37.56.16.35	-75.27.24.86	81.34	76.35		129.2		2/8/2006
93	3767442.4	1182381.9	37.56.16.40	-75.27.25.58	27.83	93.54		38786		2/8/2006
94	3767456.3	1182382.4	37.56.16.40	-75.27.25.01	71.34	83.72		145.4		2/8/2006
95	3767458.7	1182382.5	37.56.16.40	-75.27.24.92	78.86	82.07		154.3		2/8/2006
96	3767464.1	1182382.7	37.56.16.40	-75.27.24.69	95.72	78.31		226.4		2/8/2006
97	3767461.1	1182383.8	37.56.16.44	-75.27.24.82	87.59	84.16		72.8		2/8/2006
98	3767458.6	1182384.5	37.56.16.46	-75.27.24.92	80.58	88.37		43.6		2/8/2006
99	3767461.8	1182386.4	37.56.16.52	-75.27.24.78	92.41	91.66		121.3		2/8/2006
100	3767462.6	1182387.8	37.56.16.57	-75.27.24.75	96.32	95.35		352.6		2/8/2006
101	3767444.21	1182352.32	37.56.15.44	-75.27.25.55	4.04	-0.5		100.1		2/8/2006
102	3767461.63	1182375.12	37.56.16.16	-75.27.24.81	80.39	56.75		80.9		2/8/2006

Note: *Fill in Acceptable Units (mV, nT/m, ppt, etc).

**Optional field – refer to SOW for applicability to specific project.

***For Anomaly type, U = UXO, F = frag, MD = munitions debris, S = scrap, A = small arms ammunition, NC = no contact, O = other.

Geophysical Dig Sheet and Target History

GRID 2B Unique Target ID	REACQUISITION SURVEY Geophysical Instrument **	GPS Instrument**	Date	Comment	Response Amplitude (units*)**
1	Schondstedt	NA	2-10-06	used X/Y coordinates to locate targets	NA
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					
14					
15					
16					
17					
18					

Geophysical Dig Sheet and Target History

GRID 2B Unique Target ID	REACQUISITION SURVEY Geophysical Instrument **	GPS Instrument**	Date	Comment	Response Amplitude (units*)**
19	Schondstedt	NA	2-10-06	used x/y coordinates to locate Targets	NA
20					
21					
22					
23					
24					
25					
26					
27					
28					
29					
30					
31					
32					
33					
34					
35					
36					

Geophysical Dig Sheet and Target History

GRID 2B Unique Target ID	REACQUISITION SURVEY				
	Geophysical Instrument **	GPS Instrument**	Date	Comment	Response Amplitude (units*)**
37	Schondstedt	NA	2-10-06	used x/y coordinates to locate Targets	NA
38					
39					
40					
41					
42					
43					
44					
45					
46					
47					
48					
49					
50					
51					
52					
53					
54					

Geophysical Dig Sheet and Target History

GRID 2B Unique Target ID	REACQUISITION SURVEY				
	Geophysical Instrument **	GPS Instrument**	Date	Comment	Response Amplitude (units*)**
55	Schondstedt	NA	2-10-06	used X/Y coordinates to locate Targets	NA
56					
57					
58					
59					
60					
61					
62					
63					
64					
65					
66					
67					
68					
69					
70					
71					
72					

Geophysical Dig Sheet and Target History

GRID 2B Unique Target ID	REACQUISITION SURVEY				
	Geophysical Instrument **	GPS Instrument**	Date	Comment	Response Amplitude (units*)**
73	Schonstedt	NA	2-10-06	used X/Y coordinates to locate targets	NA
74					
75					
76					
77					
78					
79					
80					
81					
82					
83					
84					
85					
86					
87					
88					
89					
90					

Geophysical Dig Sheet and Target History

GRID 2B Unique Target ID	REACQUISITION SURVEY				
	Geophysical Instrument **	GPS Instrument**	Date	Comment	Response Amplitude (units*)**
91	Schondstedt	NA	2-10-06	used X/Y coordinates to locate targets	NA
92					
93					
94					
95					
96					
97					
98					
99					
100					
101					
102					

Geophysical Dig Sheet and Target History

GRID 2B Unique Target ID	DIG RESULTS										
	Anomaly Type ***	Approx. Weight (lbs-oz/kg-g)	Comments (e.g., response below 1 foot)	Offset Distance (ft)	Offset Direction (N, NE, etc.)	Orientation of Nose (Azimuth deg)	Inclination of Nose (deg)	Depth to Top of Item (in/cm)	Digital Photo Number	Date	Team Leader
1	S	.1	Scrap	1.0				6.0		2/11/06	RW
2	MD	.4	20 mm (2)	2	S			4.0		2/11/06	RW
3	MD	.2	20 mm	0				2.0		2/13/06	RW
4	S	.1	Scrap	0.5				4.0		2/13/06	RW
5	S	.5	REBAR	0				4.0		2/13/06	RW
6	MD/S	.6	20mm / SCRAP	0				6.0		2/13/06	RW
7	MD/S	.5	20mm / REBAR	0				4.0		2/13/06	RW
8	MD	.3	20mm	0				4.0		2/13/06	RW
9	MD	.3	20 mm	0				5.0		2/13/06	RW
10	S	.5	CONCRETE / REBAR	0				3.0		2/13/06	RW
11	—	—	object over 12" deep (LIP)					> 12"		2/11/06	RW
12	MD	.6	20mm (3)	0				8.0		2/13/06	RW
13	MD	.8	20mm (3)	0				6.0		2/13/06	RW
14	MD	.5	30 mm	0				5.0		2/13/06	RW
15	MD	.3	20mm	0				4.0		2/13/06	RW
16	MD	.3	20 mm	0				5.0		2/13/06	RW
17	S	1.0	Concrete / Rebar	0				4.0		2/13/06	RW
18	MD	.3	20mm	0				6.0		2/13/06	RW

Geophysical Dig Sheet and Target History

GRID 2B Unique Target ID	DIG RESULTS Anomaly Type ***	Approx. Weight (lbs-oz/kg-g)	Comments (e.g., response below 1 foot)	Offset Distance (ft)	Offset Direction (N, NE, etc.)	Orientation of Nose (Azimuth deg)	Inclination of Nose (deg)	Depth to Top of Item (in/cm)	Digital Photo Number	Date	Team Leader
19	~~S~~ MD	.4	20MM	0				5.0		2/13/06	RW
20	S	2.0	STEEL ROD	2	E			4.0		2/11/06	RW
21	S	~~1~~.0	CONCRETE / REBAR	0				3.0		2/13/06	RW
22	MD	.3	20 MM	0.5				4.0		2/13/06	RW
23	MD	.7	20MM	0				4.0		2/13/06	RW
24	S	1.0	WIRE CABLE	0				6.0		2/13/06	RW
25	S	?	PIPE L.I.P.	0				4.0		2/13/06	RW
26	MD	.8	20MM / (2)	0							
27	MD	.3	20 MM	2	E			6.0		2/13/06	RW
28	S	1.0	PIPE / REBAR BELOW 12"	0				5.0		2/11/06	RW
29	MD	.6	30 MM	0				6.0		2/13/06	RW
30	MD/S	.2	20MM / SCRAP	0				8.0		2/13/06	RW
31	MD	.2	30 MM	0				4.0		2/13/06	RW
32	S	.2	Scrap	0.5				4.0		2/13/06	RW
33	S	3.0	FENCE POST / PIPE	0				6.0		2/11/06	RW
34	MD	.4	20MM (2)	0				4.0		2/13/06	RW
35	MD	.6	20 MM (2)	0				4.0		2/13/06	RW
36	MD	.3	20 MM	0				6.0		2/13/06	RW

Geophysical Dig Sheet and Target History

GRID 2B Unique Target ID	DIG RESULTS										
	Anomaly Type ***	Approx. Weight (lbs-oz/kg-g)	Comments (e.g., response below 1 foot)	Offset Distance (ft)	Offset Direction (N, NE, etc.)	Orientation of Nose (Azimuth deg)	Inclination of Nose (deg)	Depth to Top of Item (in/cm)	Digital Photo Number	Date	Team Leader
37	S	1.0	REBAR	0				4.0		2/11/06	RW
38	MD	.4	30 mm	0				5.0		2/13/06	RW
39	S	1.0	REBAR	0				2.0		2/11/06	RW
40	MD	.3	20 mm	0				4.0		2/13/06	RW
41	S	1.0	REBAR	0				6.0		2/11/06	RW
42	MD	.3	20 mm	1.0				4.0		2/13/06	RW
43	MD	.3	20 mm	0				5.0		2/13/06	RW
44	MD	.3	20 mm	0				4.0		2/11/06	RW
45	S	1.5	REBAR	0				4.0		2/11/06	RW
46	MD	.3	20 mm	0				6.0		2/13/06	RW
47	MD	.9	20 mm (3)	0				5.0		2/13/06	RW
48	MD	.4	20 mm	0				7.0		2/13/06	RW
49	S	4.0	STEEL ROD	0				6.0		2/13/06	RW
50	S	.1	unknown scrap	1.0				2.0		2/11/06	RW
51	S	.3	NAIL	0				4.0		2/11/06	RW
52	S	1.0	REBAR	0				4.0		2/13/06	RW
53	S	.1	NAIL	1.0				4.0		2/11/06	RW
54	S	2.0	STEEL ROD	0				4.0		2/13/06	RW

Geophysical Dig Sheet and Target History

GRID 2B Unique Target ID	DIG RESULTS										
	Anomaly Type ***	Approx. Weight (lbs-oz/kg-g)	Comments (e.g., response below 1 foot)	Offset Distance (ft)	Offset Direction (N, NE, etc.)	Orientation of Nose (Azimuth deg)	Inclination of Nose (deg)	Depth to Top of Item (in/cm)	Digital Photo Number	Date	Team Leader
55	MD	.3	20 mm	0				5.0		2/11/06	RW
56	MD	.3	20 mm	0				6.0		2/13/06	RW
57	S	.1	Scrap	0				4.0		2/11/06	RW
58	S	.1	Nail	1.0				6.0		2/13/06	RW
59	S	1.0	Rebar	0				4.0		2/11/06	RW
60	S	2.0	Concrete/Rebar	0				3.0		2/11/06	RW
61	S	1.5	Scrap	0				3.0		2/13/06	RW
62	MD	.3	20 mm	0				3.0		2/13/06	RW
63	S	.4	Washer	0				5.0		2/13/06	RW
64	S	.1	Nail	1.0				4.0		2/11/06	RW
65	S	.1	Scrap	1.0				Sur		2/11/06	RW
66	S	1.0	Rebar	0				5.0		2/13/06	RW
67	S	3.0	Rebar	0				4.0		2/13/06	RW
68	MD	.3	20 mm	0				2.0		2/11/06	RW
69	S	1.0	Rebar	0				4.0		2/11/06	RW
70	S	2.0	Rebar	0				3.0		2/13/06	RW
71	MD	.3	20mm	0.5				6.0		2/13/06	RW
72	MD/S	.3	20 mm/Nail	0				4.0		2/13/06	RW

Geophysical Dig Sheet and Target History

GRID 2B Unique Target ID	DIG RESULTS Anomaly Type ***	Approx. Weight (lbs-oz/kg-g)	Comments (e.g., response below 1 foot)	Offset Distance (ft)	Offset Direction (N, NE, etc.)	Orientation of Nose (Azimuth deg)	Inclination of Nose (deg)	Depth to Top of Item (in/cm)	Digital Photo Number	Date	Team Leader
73	MD	.3	20MM	0				6.0		2/13/06	RW
74	MD/S	2.0	20MM (2) SCRAP	0				7.0		2/13/06	RW
75	S	2.0	REBAR/WIRE	0				6.0		2/11/06	RW
76	S	.4	BOLT	0				5.0		2/13/06	RW
77	S	.2	BOLT	1.0				8.0		2/13/06	RW
78	S	1.0	Scrap	0				4.0		2/13/06	RW
79	MD	.6	20MM (2)	0				5.0		2/13/06	RW
80	S	2.0	PIPE	0				4.0		2/11/06	RW
81	S	1.0	STEEL BRACKET	2	N			4.0		2/13/06	RW
82	MD	.3	20 MM	0				3.0		2/13/06	RW
83	S	2.0	STEEL ROD (3)	0				5.0		2/13/06	RW
84	MD	.6	20 MM (2)	0				4.0		2/13/06	RW
85	S	2.0	PIPE ~~BELOW 12"~~	0				2.0		2/11/06	RW
86	S	?	PIPE BELOW 12"	0				~~2~~ 12"		2/11/06	RW
87	S	.2	NUT	0.5				4.0		2/13/06	RW
88	MD	.3	20MM	0				4.0		2/13/06	RW
89			PIPELINE LIP							2/13/06	RW
90	MD	.3	20 MM	0				5.0		2/13/06	RW

Geophysical Dig Sheet and Target History

GRID 2B Unique Target ID	DIG RESULTS										
	Anomaly Type ***	Approx. Weight (lbs-oz/kg-g)	Comments (e.g., response below 1 foot)	Offset Distance (ft)	Offset Direction (N, NE, etc.)	Orientation of Nose (Azimuth deg)	Inclination of Nose (deg)	Depth to Top of Item (in/cm)	Digital Photo Number	Date	Team Leader
91	S	.2	Scrap metal	1.0				4.0		2/13/06	RW
92	MD	.3	20mm	0				6.0		2/13/06	RW
93	S	.3	Bolt (2)	0				4.0		2/13/06	RW
94	S	.3	Bolt	1.0				4.0		2/13/06	RW
95	S	.8	Steel Rod	0				3.0		2/13/06	RW
96			Concrete Slab 12↓					10.0		2/13/06	RW
97	S	.8	Steel Strap	0				8.0		2/13/06	RW
98	MD	.3	20mm Cart.	0				5.0		2/13/06	RW
99	S	1.0	Rod	0				4.0		2/13/06	RW
100	S	.2	unknown scrap	1.0				4.0		2/13/06	RW
101	S	.1	unk scrap	1.0				4.6		2/13/06	RW
102	MD	.2	20mm	0				6.0		2/13/06	RW

Geophysical Dig Sheet and Target History

GRID 2B Unique Target ID	POST-DIG UXO QC RESULTS			POST-DIG PROJECT QC		
	Excavation Hole Cleared?	UXO QC Spec. Initials	Date	Agreement Between Dig Results & Geophysical Data? (G=good, P=poor, U=unacceptable)	Project QC Initials	Date
1	Yes	EMD	2/11/06	G	VAS	2-11-06
2						
3						
4						
5						
6						
7						
8						
9						
10	Yes	EMD	2/13/06	G	VAS	2-11-06
11						
12						
13						
14						
15						
16						
17						
18						

Geophysical Dig Sheet and Target History

GRID 2B Unique Target ID	POST-DIG UXO QC RESULTS			POST-DIG PROJECT QC		
	Excavation Hole Cleared?	UXO QC Spec. Initials	Date	Agreement Between Dig Results & Geophysical Data? (G=good, P=poor, U=unacceptable)	Project QC Initials	Date
19						
20	Yes	EMD	2/11/06	G	VAS	2-11-06
21						
22						
23						
24						
25						
26						
27						
28						
29						
30	Yes	EMD	2/13/06	G	VAS	2-11-06
31						
32						
33						
34						
35						
36						

Geophysical Dig Sheet and Target History

GRID 2B Unique Target ID	POST-DIG UXO QC RESULTS			POST-DIG PROJECT QC		
	Excavation Hole Cleared?	UXO QC Spec. Initials	Date	Agreement Between Dig Results & Geophysical Data? (G=good, P=poor, U=unacceptable)	Project QC Initials	Date
37						
38						
39						
40	Yes	EMD	2/13/06	G	VAS	2-11-06
41						
42						
43						
44						
45						
46						
47						
48						
49						
50	Yes	EMD	2/11/06	G	VAS	2-11-06
51						
52						
53						
54						

Geophysical Dig Sheet and Target History

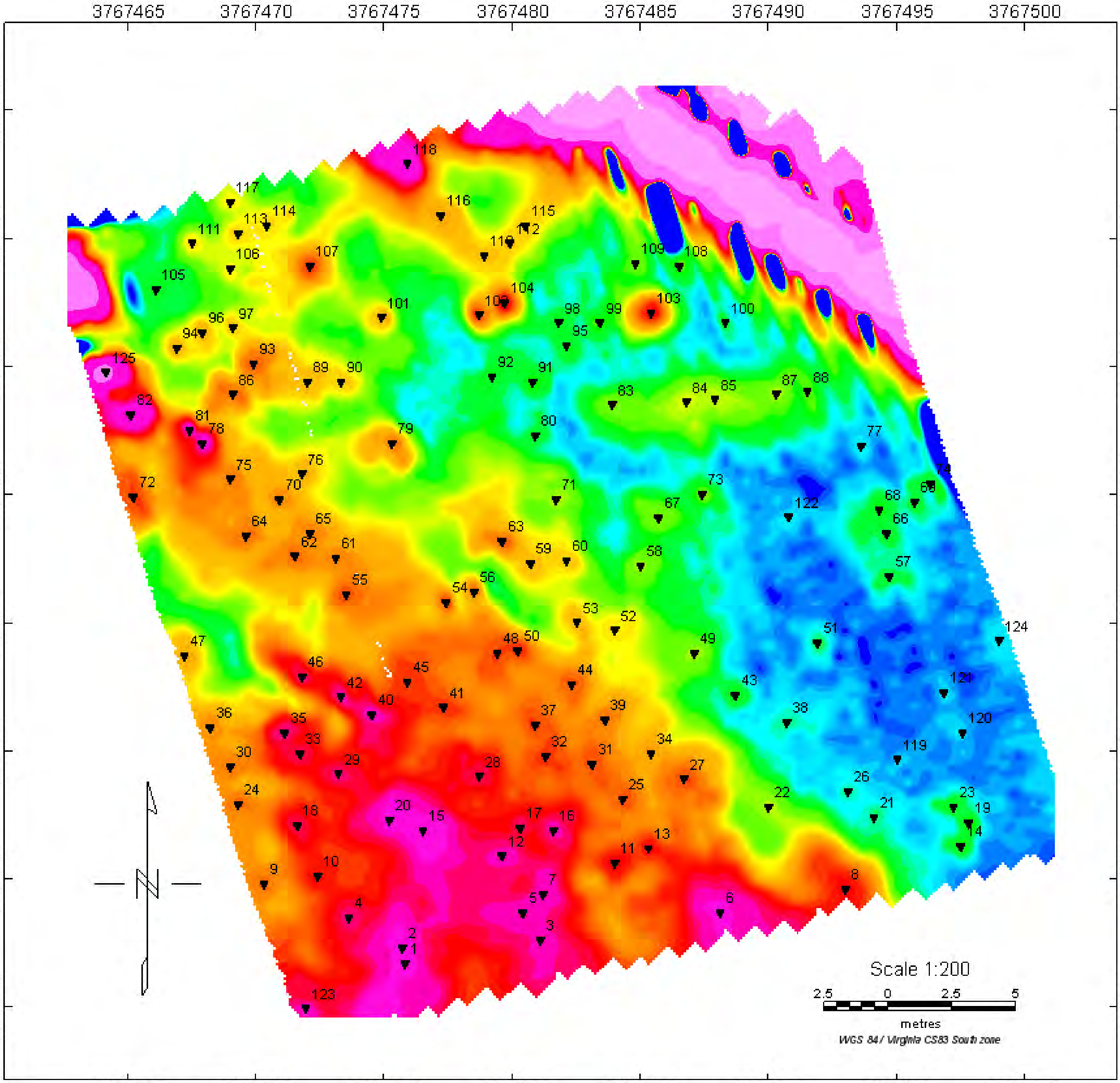
GRID 2B Unique Target ID	POST-DIG UXO QC RESULTS			POST-DIG PROJECT QC		
	Excavation Hole Cleared?	UXO QC Spec. Initials	Date	Agreement Between Dig Results & Geophysical Data? (G=good, P=poor, U=unacceptable)	Project QC Initials	Date
55						
56						
57						
58						
59						
60	Yes	EmD	2/11/06	G	VAS	2-11-06
61						
62						
63						
64						
65						
66						
67						
68						
69						
70	Yes	EmD	2/13/06	G	VAS	2-11-06
71						
72						

Geophysical Dig Sheet and Target History

GRID 2B Unique Target ID	POST-DIG UXO QC RESULTS Excavation Hole Cleared?	UXO QC Spec. Initials	Date	POST-DIG PROJECT QC Agreement Between Dig Results & Geophysical Data? (G=good, P=poor, U=unacceptable)	Project QC Initials	Date
73						
74						
75						
76						
77						
78						
79						
80	Yes	EMD	2/11/06	G	VAS	2-11-06
81						
82						
83						
84						
85						
86						
87						
88						
89						
90	Yes	EMD	2/13/06	G	VAS	2-11-06

Geophysical Dig Sheet and Target History

GRID 2B	POST-DIG UXO QC RESULTS			POST-DIG PROJECT QC		
Unique Target ID	Excavation Hole Cleared?	UXO QC Spec. Initials	Date	Agreement Between Dig Results & Geophysical Data? (G=good, P=poor, U=unacceptable)	Project QC Initials	Date
91						
92						
93						
94						
95						
96						
97						
98						
99						
100	Yes	[illegible]	2/13/06	G	VAS	2-71-06
101						
102						



millivolts

-1.2 6.4 12.5 22.8 39.3 61.2 96.6 135.4 226.2 11813.3

NASA

Wallops Flight Center
EM61 MK2 Data
Grid 2C

February 8, 2006

Tetra Tech EM Inc.

Geophysical Dig Sheet and Target History

GRID 2C Unique Target ID	ORIGINAL SURVEY									
	Easting Coord. (m)	Northing Coord. (m)	Lat. Coord.	Long. Coord.	X - Local (Grid) Coord. (ft)	Y - Local (Grid) Coord. (ft)	Channel ID (i.e. C1, top senor, gradient)	Response Amplitude (mV)	Dig Priority	Date
1	3767475.8	1182361.7	37.56.15.71	-75.27.24.24	12.26	3.89	Z(1-4)	345		2/8/2006
2	3767475.7	1182362.3	37.56.15.73	-75.27.24.25	12.57	5.83	Z(1-4)	344.4		2/8/2006
3	3767481.1	1182362.6	37.56.15.73	-75.27.24.02	29.48	2.64	Z(1-4)	301.9		2/8/2006
4	3767473.6	1182363.5	37.56.15.77	-75.27.24.33	7.33	11.17	Z(1-4)	271.5		2/8/2006
5	3767480.4	1182363.7	37.56.15.77	-75.27.24.05	28.44	6.59	Z(1-4)	313.7		2/8/2006
6	3767488.1	1182363.7	37.56.15.76	-75.27.23.74	52.12	0.73	Z(1-4)	355.6		2/8/2006
7	3767481.2	1182364.4	37.56.15.79	-75.27.24.02	31.62	8.15	Z(1-4)	319		2/8/2006
8	3767493	1182364.6	37.56.15.78	-75.27.23.54	68.11	-0.19	Z(1-4)	211.1		2/8/2006
9	3767470.3	1182364.8	37.56.15.81	-75.27.24.46	-1.48	17.75	Z(1-4)	141.3		2/8/2006
10	3767472.4	1182365.1	37.56.15.82	-75.27.24.38	5.28	17.07	Z(1-4)	203.3		2/8/2006
11	3767484	1182365.6	37.56.15.82	-75.27.23.90	41.45	9.74	Z(1-4)	211.9		2/8/2006
12	3767479.6	1182365.9	37.56.15.84	-75.27.24.08	28.22	14.03	Z(1-4)	288.2		2/8/2006
13	3767485.3	1182366.2	37.56.15.84	-75.27.23.85	46.05	10.61	Z(1-4)	214.8		2/8/2006
14	3767497.5	1182366.3	37.56.15.83	-75.27.23.35	83.68	1.65	Z(1-4)	27.1		2/8/2006
15	3767476.5	1182366.9	37.56.15.87	-75.27.24.21	19.71	19.51	Z(1-4)	397.4		2/8/2006

Geophysical Dig Sheet and Target History

GRID 2C Unique Target ID	ORIGINAL SURVEY									
	Easting Coord. (m)	Northing Coord. (m)	Lat. Coord.	Long. Coord.	X - Local (Grid) Coord. (ft)	Y - Local (Grid) Coord. (ft)	Channel ID (i.e. C1, top senor, gradient)	Response Amplitude (mV)	Dig Priority	Date
16	3767481.6	1182366.9	37.56.15.87	-75.27.24.00	35.39	✓ 15.6	Z(1-4)	299.5		2/8/2006
17	3767480.3	1182367	37.56.15.87	-75.27.24.05	31.5	✓ 16.91	Z(1-4)	262		2/8/2006
18	3767471.6	1182367.1	37.56.15.89	-75.27.24.41	4.86	✓ 23.9	Z(1-4)	250.2		2/8/2006
19	3767497.8	1182367.2	37.56.15.86	-75.27.23.34	85.52	✓ 4.2	Z(1-4)	25.4		2/8/2006
20	3767475.2	1182367.3	37.56.15.89	-75.27.24.26	16.13	✓ 21.75	Z(1-4)	350.8		2/8/2006
21	3767494.1	1182367.4	37.56.15.87	-75.27.23.49	74.34	✓ 7.62	Z(1-4)	14.8		2/8/2006
22	3767490	1182367.8	37.56.15.89	-75.27.23.65	62.13	✓ 11.98	Z(1-4)	45.8		2/8/2006
23	3767497.2	1182367.8	37.56.15.88	-75.27.23.36	84.28	✓ 6.51	Z(1-4)	21.2		2/8/2006
24	3767469.3	1182367.9	37.56.15.91	-75.27.24.50	-1.39	✓ 28.17	Z(1-4)	143.2		2/8/2006
25	3767484.3	1182368.1	37.56.15.91	-75.27.23.89	44.91	✓ 17.26	Z(1-4)	156.8		2/8/2006
26	3767493.1	1182368.4	37.56.15.91	-75.27.23.53	72.28	✓ 11.47	Z(1-4)	13		2/8/2006
27	3767486.7	1182368.9	37.56.15.93	-75.27.23.79	53.1	✓ 17.9	Z(1-4)	160		2/8/2006
28	3767478.7	1182369	37.56.15.94	-75.27.24.11	28.61	✓ 24.34	Z(1-4)	248		2/8/2006
29	3767473.2	1182369.1	37.56.15.95	-75.27.24.34	11.81	✓ 28.89	Z(1-4)	267.5		2/8/2006
30	3767469	1182369.4	37.56.15.96	-75.27.24.51	-0.78	✓ 33.07	Z(1-4)	134.2		2/8/2006

Geophysical Dig Sheet and Target History

GRID 2C Unique Target ID	ORIGINAL SURVEY									
	Easting Coord. (m)	Northing Coord. (m)	Lat. Coord.	Long. Coord.	X - Local (Grid) Coord. (ft)	Y - Local (Grid) Coord. (ft)	Channel ID (i.e. C1, top senor, gradient)	Response Amplitude (mV)	Dig Priority	Date
31	3767483.1	1182369.5	37.56.15.95	-75.27.23.93	42.65	✓22.51	Z(1-4)	160.3		2/8/2006
32	3767481.3	1182369.8	37.56.15.96	-75.27.24.01	37.42	✓24.83	Z(1-4)	167.5		2/8/2006
33	3767471.7	1182369.9	37.56.15.98	-75.27.24.40	8.02	✓32.54	Z(1-4)	248.4		2/8/2006
34	3767485.4	1182369.9	37.56.15.96	-75.27.23.84	50.12	✓21.99	Z(1-4)	107.8		2/8/2006
35	3767471.1	1182370.7	37.56.16.00	-75.27.24.42	6.99	✓35.49	Z(1-4)	266.8		2/8/2006
36	3767468.2	1182370.9	37.56.16.01	-75.27.24.54	-1.71	✓38.36	Z(1-4)	115.6		2/8/2006
37	3767480.9	1182371	37.56.16.00	-75.27.24.02	37.41	✓28.85	Z(1-4)	164.8		2/8/2006
38	3767490.7	1182371.1	37.56.16.00	-75.27.23.62	67.64	✓21.64	Z(1-4)	13.2		2/8/2006
39	3767483.6	1182371.2	37.56.16.01	-75.27.23.91	45.91	✓27.4	Z(1-4)	135.7		2/8/2006
40	3767474.5	1182371.4	37.56.16.02	-75.27.24.28	18.15	✓35.03	Z(1-4)	311.4		2/8/2006
41	3767477.3	1182371.7	37.56.16.03	-75.27.24.17	27.06	✓33.8	Z(1-4)	169.2		2/8/2006
42	3767473.3	1182372.1	37.56.16.05	-75.27.24.33	15.18	✓38.14	Z(1-4)	291.7		2/8/2006
43	3767488.7	1182372.2	37.56.16.03	-75.27.23.70	62.6	✓26.58	Z(1-4)	25.5		2/8/2006
44	3767482.3	1182372.6	37.56.16.05	-75.27.23.96	43.34	✓32.73	Z(1-4)	148.5		2/8/2006
45	3767475.9	1182372.7	37.56.16.06	-75.27.24.22	23.78	✓37.99	Z(1-4)	181.1		2/8/2006

Geophysical Dig Sheet and Target History

GRID 2C Unique Target ID	ORIGINAL SURVEY									
	Easting Coord. (m)	Northing Coord. (m)	Lat. Coord.	Long. Coord.	X - Local (Grid) Coord. (ft)	Y - Local (Grid) Coord. (ft)	Channel ID (i.e. C1, top senor, gradient)	Response Amplitude (mV)	Dig Priority	Date
46	3767471.8	1182372.9	37.56.16.07	-75.27.24.39	11.39	41.79	Z(1-4)	261.9		2/8/2006
47	3767467.2	1182373.7	37.56.16.10	-75.27.24.58	-1.92	47.85	Z(1-4)	91.5		2/8/2006
48	3767479.4	1182373.8	37.56.16.10	-75.27.24.08	35.65	38.69	Z(1-4)	164.3		2/8/2006
49	3767487.1	1182373.8	37.56.16.09	-75.27.23.76	59.31	32.75	Z(1-4)	42.6		2/8/2006
50	3767480.2	1182373.9	37.56.16.10	-75.27.24.05	38.21	38.38	Z(1-4)	177.7		2/8/2006
51	3767491.9	1182374.2	37.56.16.10	-75.27.23.57	74.47	30.3	Z(1-4)	16.9		2/8/2006
52	3767484	1182374.7	37.56.16.12	-75.27.23.89	50.7	37.92	Z(1-4)	68.3		2/8/2006
53	3767482.5	1182375	37.56.16.13	-75.27.23.95	46.39	40.01	Z(1-4)	84.3		2/8/2006
54	3767477.4	1182375.8	37.56.16.16	-75.27.24.16	31.54	46.44	Z(1-4)	166.3		2/8/2006
55	3767473.5	1182376.1	37.56.16.18	-75.27.24.32	19.86	50.4	Z(1-4)	157.9		2/8/2006
56	3767478.5	1182376.2	37.56.16.17	-75.27.24.11	35.32	46.83	Z(1-4)	134.5		2/8/2006
57	3767494.7	1182376.8	37.56.16.18	-75.27.23.45	85.71	36.17	Z(1-4)	18.1		2/8/2006
58	3767485	1182377.2	37.56.16.20	-75.27.23.85	56.31	44.89	Z(1-4)	40.8		2/8/2006
59	3767480.7	1182377.3	37.56.16.21	-75.27.24.02	43.2	48.53	Z(1-4)	83		2/8/2006
60	3767482.1	1182377.4	37.56.16.21	-75.27.23.96	47.6	47.75	Z(1-4)	74.9		2/8/2006

Geophysical Dig Sheet and Target History

GRID 2C Unique Target ID	ORIGINAL SURVEY									
	Easting Coord. (m)	Northing Coord. (m)	Lat. Coord.	Long. Coord.	X - Local (Grid) Coord. (ft)	Y - Local (Grid) Coord. (ft)	Channel ID (i.e. C1, top senor, gradient)	Response Amplitude (mV)	Dig Priority	Date
61	3767473.1	1182377.5	37.56.16.22	-75.27.24.33	20.06	✓ 55.06	Z(1-4)	127.3		2/8/2006
62	3767471.5	1182377.6	37.56.16.23	-75.27.24.40	15.25	✓ 56.62	Z(1-4)	147.1		2/8/2006
63	3767479.6	1182378.2	37.56.16.24	-75.27.24.07	40.73	✓ 52.17	Z(1-4)	144.3		2/8/2006
64	3767469.6	1182378.4	37.56.16.25	-75.27.24.47	10.23	✓ 60.59	Z(1-4)	135.6		2/8/2006
65	3767472.1	1182378.5	37.56.16.26	-75.27.24.37	18.01	✓ 58.95	Z(1-4)	127.1		2/8/2006
66	3767494.6	1182378.5	37.56.16.23	-75.27.23.45	87.13	✓ 41.49	Z(1-4)	19.3		2/8/2006
67	3767485.7	1182379.1	37.56.16.26	-75.27.23.81	60.39	✓ 50.22	Z(1-4)	39.8		2/8/2006
68	3767494.3	1182379.4	37.56.16.26	-75.27.23.46	87.12	✓ 44.5	Z(1-4)	23.7		2/8/2006
69	3767495.7	1182379.7	37.56.16.27	-75.27.23.40	91.72	✓ 44.34	Z(1-4)	20.3		2/8/2006
70	3767470.9	1182379.8	37.56.16.30	-75.27.24.42	15.65	✓ 63.92	Z(1-4)	129.6		2/8/2006
71	3767481.7	1182379.8	37.56.16.29	-75.27.23.98	48.81	✓ 55.49	Z(1-4)	45.7		2/8/2006
72	3767465.2	1182379.9	37.56.16.31	-75.27.24.65	-1.74	✓ 68.71	Z(1-4)	163.6		2/8/2006
73	3767487.4	1182380	37.56.16.29	-75.27.23.74	66.52	✓ 51.68	Z(1-4)	34.2		2/8/2006
74	3767496.3	1182380.4	37.56.16.29	-75.27.23.38	94.27	✓ 46.03	Z(1-4)	18.9		2/8/2006
75	3767469	1182380.6	37.56.16.33	-75.27.24.50	10.63	✓ 67.9	Z(1-4)	133		2/8/2006

Geophysical Dig Sheet and Target History

GRID 2C Unique Target ID	ORIGINAL SURVEY									
	Easting Coord. (m)	Northing Coord. (m)	Lat. Coord.	Long. Coord.	X - Local (Grid) Coord. (ft)	Y - Local (Grid) Coord. (ft)	Channel ID (i.e. C1, top senor, gradient)	Response Amplitude (mV)	Dig Priority	Date
76	3767471.8	1182380.8	37.56.16.33	-75.27.24.38	19.43	✓ 66.32	Z(1-4)	87.4		2/8/2006
77	3767493.6	1182381.9	37.56.16.34	-75.27.23.49	87.5	✓ 52.74	Z(1-4)	8.5		2/8/2006
78	3767467.9	1182382	37.56.16.37	-75.27.24.54	8.68	✓ 73.11	Z(1-4)	361.1		2/8/2006
79	3767475.3	1182382	37.56.16.37	-75.27.24.24	31.39	✓ 67.3	Z(1-4)	126.7		2/8/2006
80	3767480.9	1182382.3	37.56.16.37	-75.27.24.01	48.89	✓ 63.85	Z(1-4)	19.8		2/8/2006
81	3767467.4	1182382.5	37.56.16.39	-75.27.24.56	7.66	✓ 75.06	Z(1-4)	355.6		2/8/2006
82	3767465.1	1182383.1	37.56.16.41	-75.27.24.65	1.21	✓ 78.74	Z(1-4)	481.9		2/8/2006
83	3767483.9	1182383.5	37.56.16.41	-75.27.23.88	59.32	✓ 65.22	Z(1-4)	36.2		2/8/2006
84	3767486.8	1182383.6	37.56.16.41	-75.27.23.76	68.33	✓ 63.26	Z(1-4)	54.3		2/8/2006
85	3767487.9	1182383.7	37.56.16.41	-75.27.23.72	71.81	✓ 62.72	Z(1-4)	48.4		2/8/2006
86	3767469.1	1182383.9	37.56.16.43	-75.27.24.49	14.3	✓ 78.07	Z(1-4)	138.8		2/8/2006
87	3767490.3	1182383.9	37.56.16.41	-75.27.23.62	79.38	✓ 61.46	Z(1-4)	45		2/8/2006
88	3767491.5	1182384	37.56.16.41	-75.27.23.57	83.17	✓ 60.84	Z(1-4)	29.1		2/8/2006
89	3767472	1182384.4	37.56.16.45	-75.27.24.37	23.7	✓ 77.33	Z(1-4)	84.8		2/8/2006
90	3767473.3	1182384.4	37.56.16.45	-75.27.24.32	27.69	✓ 76.31	Z(1-4)	75.3		2/8/2006

Geophysical Dig Sheet and Target History

GRID 2C Unique Target ID	ORIGINAL SURVEY									
	Easting Coord. (m)	Northing Coord. (m)	Lat. Coord.	Long. Coord.	X - Local (Grid) Coord. (ft)	Y - Local (Grid) Coord. (ft)	Channel ID (i.e. C1, top senor, gradient)	Response Amplitude (mV)	Dig Priority	Date
91	3767480.8	1182384.4	37.56.16.44	-75.27.24.01	50.71	70.42	Z(1-4)	24.4		2/8/2006
92	3767479.2	1182384.6	37.56.16.45	-75.27.24.07	46.01	72.29	Z(1-4)	22.6		2/8/2006
93	3767469.9	1182385.1	37.56.16.47	-75.27.24.45	17.97	81.16	Z(1-4)	145.6		2/8/2006
94	3767466.9	1182385.7	37.56.16.49	-75.27.24.58	9.38	85.4	Z(1-4)	90.5		2/8/2006
95	3767482.1	1182385.8	37.56.16.48	-75.27.23.95	56.13	73.73	Z(1-4)	21.1		2/8/2006
96	3767467.9	1182386.3	37.56.16.51	-75.27.24.53	13.06	86.47	Z(1-4)	88.6		2/8/2006
97	3767469.1	1182386.5	37.56.16.52	-75.27.24.48	16.94	86.14	Z(1-4)	77.9		2/8/2006
98	3767481.8	1182386.7	37.56.16.51	-75.27.23.96	56.12	76.75	Z(1-4)	22.4		2/8/2006
99	3767483.4	1182386.7	37.56.16.51	-75.27.23.90	61.03	75.49	Z(1-4)	25.4		2/8/2006
100	3767488.3	1182386.7	37.56.16.50	-75.27.23.70	76.07	71.66	Z(1-4)	17.3		2/8/2006
101	3767474.9	1182386.9	37.56.16.52	-75.27.24.25	35.14	82.8	Z(1-4)	89.9		2/8/2006
102	3767478.7	1182387	37.56.16.52	-75.27.24.09	46.91	80.11	Z(1-4)	164.6		2/8/2006
103	3767485.4	1182387.1	37.56.16.52	-75.27.23.82	67.57	75.16	Z(1-4)	208.7		2/8/2006
104	3767479.7	1182387.5	37.56.16.54	-75.27.24.05	50.48	80.87	Z(1-4)	234.6		2/8/2006
105	3767466.1	1182388	37.56.16.57	-75.27.24.61	9.27	93.17	Z(1-4)	21.7		2/8/2006

Geophysical Dig Sheet and Target History

GRID 2C Unique Target ID	ORIGINAL SURVEY									
	Easting Coord. (m)	Northing Coord. (m)	Lat. Coord.	Long. Coord.	X - Local (Grid) Coord. (ft)	Y - Local (Grid) Coord. (ft)	Channel ID (i.e. C1, top senor, gradient)	Response Amplitude (mV)	Dig Priority	Date
106	3767469	1182388.8	37.56.16.59	-75.27.24.49	18.97	93.35	Z(1-4)	58.7		2/8/2006
107	3767472.1	1182388.9	37.56.16.59	-75.27.24.36	28.58	91.21	Z(1-4)	172.8		2/8/2006
108	3767486.5	1182388.9	37.56.16.58	-75.27.23.77	72.77	79.85	Z(1-4)	28.7		2/8/2006
109	3767484.8	1182389	37.56.16.58	-75.27.23.84	67.66	81.5	Z(1-4)	35.8		2/8/2006
110	3767478.9	1182389.3	37.56.16.60	-75.27.24.08	49.85	87.07	Z(1-4)	77.8		2/8/2006
111	3767467.5	1182389.8	37.56.16.63	-75.27.24.55	15.39	97.65	Z(1-4)	68.8		2/8/2006
112	3767479.9	1182389.8	37.56.16.61	-75.27.24.04	53.43	87.82	Z(1-4)	77.9		2/8/2006
113	3767469.3	1182390.2	37.56.16.64	-75.27.24.47	21.32	97.46	Z(1-4)	72.4		2/8/2006
114	3767470.4	1182390.5	37.56.16.65	-75.27.24.43	25	97.51	Z(1-4)	72.3		2/8/2006
115	3767480.5	1182390.5	37.56.16.64	-75.27.24.01	55.98	89.51	Z(1-4)	75		2/8/2006
116	3767477.2	1182390.9	37.56.16.65	-75.27.24.15	46.26	93.36	Z(1-4)	104.7		2/8/2006
117	3767469	1182391.4	37.56.16.68	-75.27.24.48	21.62	101.42	Z(1-4)	64.4		2/8/2006
118	3767475.9	1182392.9	37.56.16.72	-75.27.24.20	44.3	100.58	Z(1-4)	481		2/8/2006
119	3767495.01	1182369.66	37.56.15.95	-75.27.23.45	79.44	13.92	Z(1-4)	5.3		2/8/2006
120	3767497.56	1182370.71	37.56.15.98	-75.27.23.34	88.32	15.2	Z(1-4)	5.7		2/8/2006

Geophysical Dig Sheet and Target History

GRID 2C Unique Target ID	ORIGINAL SURVEY									
	Easting Coord. (m)	Northing Coord. (m)	Lat. Coord.	Long. Coord.	X - Local (Grid) Coord. (ft)	Y - Local (Grid) Coord. (ft)	Channel ID (i.e. C1, top senor, gradient)	Response Amplitude (mV)	Dig Priority	Date
121	3767496.84	1182372.27	37.56.16.03	-75.27.23.37	87.7	✓ 20.58	Z(1-4)	7		2/8/2006
122	3767490.77	1182379.12	37.56.16.26	-75.27.23.61	76	✓ 46.35	Z(1-4)	7.7		2/8/2006
123	3767471.93	1182359.95	37.56.15.65	-75.27.24.40	-1.43	✓ 1.39	Z(1-4)	299.3		2/8/2006
124	3767498.99	1182374.29	37.56.16.09	-75.27.23.28	96.37	✓ 25.16	Z(1-4)	8		2/8/2006
125	3767464.14	1182384.77	37.56.16.47	-75.27.24.69	-0.04	84.68	Z(1-4)	1563.9		2/8/2006

Geophysical Dig Sheet and Target History

GRID 2C Unique Target ID	ORIGINAL SURVEY									
	Easting Coord. (m)	Northing Coord. (m)	Lat. Coord.	Long. Coord.	X - Local (Grid) Coord. (ft)	Y - Local (Grid) Coord. (ft)	Channel ID (i.e. C1, top senor, gradient)	Response Amplitude (mV)	Dig Priority	Date

Note: *Fill in Acceptable Units (mV, nT/m, ppt, etc).

**Optional field – refer to SOW for applicability to specific project.

***For Anomaly type, U = UXO, F = frag, MD = munitions debris, S = scrap, A = small arms ammunition, NC = no contact, O = other.

Geophysical Dig Sheet and Target History

GRID 2C Unique Target ID	REACQUISITION SURVEY				
	Geophysical Instrument **	GPS Instrument**	Date	Comment	Response Amplitude (units*)**
1	Schonstedt	NA	2-10-06	used X/Y coordinates to locate Targets	NA
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					
14					
15					

Geophysical Dig Sheet and Target History

GRID 2C Unique Target ID	REACQUISITION SURVEY				
	Geophysical Instrument **	GPS Instrument**	Date	Comment	Response Amplitude (units*)**
16	Schondstedt	NA	2-10-06	used X/Y coordinates to locate targets	NA
17					
18					
19					
20					
21					
22					
23					
24					
25					
26					
27					
28					
29					
30					

Geophysical Dig Sheet and Target History

GRID 2C Unique Target ID	REACQUISITION SURVEY				
	Geophysical Instrument **	GPS Instrument**	Date	Comment	Response Amplitude (units*)**
31	Schondstedt	NA	2-10-06	used x/y coordinates to locate targets	NA
32					
33					
34					
35					
36					
37					
38					
39					
40					
41					
42					
43					
44					
45					

Geophysical Dig Sheet and Target History

GRID 2C Unique Target ID	REACQUISITION SURVEY				
	Geophysical Instrument **	GPS Instrument**	Date	Comment	Response Amplitude (units*)**
46	Schonstedt	NA	2-10-06	used X/Y coordinates to locate targets	NA
47					
48					
49					
50					
51					
52					
53					
54					
55					
56					
57					
58					
59					
60					

Geophysical Dig Sheet and Target History

GRID 2C Unique Target ID	REACQUISITION SURVEY				
	Geophysical Instrument **	GPS Instrument**	Date	Comment	Response Amplitude (units*)**
61	Schondstedt	NA	2-10-06	used X/Y coordinates to locate targets	NA
62					
63					
64					
65					
66					
67					
68					
69					
70					
71					
72					
73					
74					
75					

Geophysical Dig Sheet and Target History

GRID 2C Unique Target ID	REACQUISITION SURVEY				
	Geophysical Instrument **	GPS Instrument**	Date	Comment	Response Amplitude (units*)**
76	Schonstedt	NA	2-10-06	used X/Y coordinates to locate targets	NA
77					
78					
79					
80					
81					
82					
83					
84					
85					
86					
87					
88					
89					
90					

Geophysical Dig Sheet and Target History

GRID 2C Unique Target ID	REACQUISITION SURVEY				
	Geophysical Instrument **	GPS Instrument**	Date	Comment	Response Amplitude (units*)**
91	Schonstedt	NA	2-10-06	used X/Y coordinates to locate targets	NA
92					
93					
94					
95					
96					
97					
98					
99					
100					
101					
102					
103					
104					
105					

Geophysical Dig Sheet and Target History

GRID 2C Unique Target ID	REACQUISITION SURVEY				
	Geophysical Instrument **	GPS Instrument**	Date	Comment	Response Amplitude (units*)**
106	Schonstedt	NA	2-10-06	used X/Y coordinates to locate targets	NA
107					
108					
109					
110					
111					
112					
113					
114					
115					
116					
117					
118					
119					
120					

Geophysical Dig Sheet and Target History

GRID 2C Unique Target ID	REACQUISITION SURVEY				
	Geophysical Instrument **	GPS Instrument**	Date	Comment	Response Amplitude (units*)**
121	Schondstedt	NA	2-10-06	used x/y coordinates to locate targets	NA
122					
123					
124					
125					

Geophysical Dig Sheet and Target History

GRID 2C Unique Target ID	REACQUISITION SURVEY				
	Geophysical Instrument **	GPS Instrument**	Date	Comment	Response Amplitude (units*)**

Geophysical Dig Sheet and Target History

GRID 2C Unique Target ID	DIG RESULTS										
	Anomaly Type ***	Approx. Weight (lbs-oz/kg-g)	Comments (e.g., response below 1 foot)	Offset Distance (ft)	Offset Direction (N, NE, etc.)	Orientation of Nose (Azimuth deg)	Inclination of Nose (deg)	Depth to Top of Item (in/cm)	Digital Photo Number	2006 Date	Team Leader
1	MD	.3	20mm	0				5.0		13Feb06	
2	MD	.4	20mm x2	0				8.0		13Feb06	
3	S	.2	Scrap metal	0				5.0		13Feb06	
4	MD	.2	20mm	0				6.0		13Feb06	
5	S	.1	Scrap metal	1.0				2.0		13Feb06	
6	MD	.5	20mm x2	0				7.0		13Feb06	
7	MD	.5	20mm x2	.5	N			11.0		13Feb06	
8	MD	.2	20 mm	0				6.0		13Feb06	
9	S	1.0	x4	0				8.0		13Feb06	
10	MD	.4	20mm x2	.5	N			8.0		13Feb06	
11	MD	.2	20mm	0				6.0		13Feb06	
12	MD	.1	20mm	1.0				4.0		13Feb06	
13	MD	.4	20 mm x2	0				6.0		13Feb06	
14			LIP	0				>12.0"		13Feb06	
15	MD	.2	20mm	0				10.0		13Feb06	

Geophysical Dig Sheet and Target History

GRID 2C Unique Target ID	DIG RESULTS Anomaly Type ***	Approx. Weight (lbs-oz/kg-g)	Comments (e.g., response below 1 foot)	Offset Distance (ft)	Offset Direction (N, NE, etc.)	Orientation of Nose (Azimuth deg)	Inclination of Nose (deg)	Depth to Top of Item (in/cm)	Digital Photo Number	2006 Date	Team Leader
16	S	.2	Scrap metal	0				4.0		13Feb06	
17	S	.1	Scrap metal	1.0				2.0		13Feb06	
18	MD	.2	20mm	0				6.0		13Feb06	
19	S	.2	Scrap metal	0				8.0		14Feb06	
20	MD	.2	20mm	0				8.0		13Feb06	
21	S	.2	Scrap Metal	1.0				10.0		14Feb06	
22	S	.2	Scrap metal	.5	S			10.0		13Feb06	
23	S	.3	Scrap metal	0				6.0		13Feb06	
24	MD	.6	20mm x3	0				10.0		13Feb06	
25	MD	.7	20mm x4	0				12.0		13Feb06	
26	S	.1	Scrap metal	1.0				10.0		14Feb06	
27	MD	.2	20mm	0				6.0		13Feb06	
28	S	.2	Scrap metal	0				4.0		13Feb06	
29	MD	.8	30mmx2/20mmx1	.5	NE			8.0		13Feb06	
30	MD	.2	20mm	0				6.0		13Feb06	

Geophysical Dig Sheet and Target History

GRID 2C Unique Target ID	DIG RESULTS										
	Anomaly Type ***	Approx. Weight (lbs/~~oz/kg/g~~)	Comments (e.g., response below 1 foot)	Offset Distance (ft)	Offset Direction (N, NE, etc.)	Orientation of Nose (Azimuth deg)	Inclination of Nose (deg)	Depth to Top of Item (in/cm)	Digital Photo Number	2006 Date	Team Leader
31	MD	.1	20mm	0				8.0		13Feb06	
32	S	.2	Scrap metal	0				6.0		13Feb06	
33	S	1.0	Rebar	0				10.0		13Feb06	
34	MD	.4	20mm	0				10.0		13Feb06	
35	MD	.2	20mm	0				9.0		13Feb06	
36	MD	.2	20mm	0				10.0		13Feb06	
37	S	.3	Scrap metal	0				6.0		13Feb06	
38	MD	.2	20mm	0				8.0		14Feb06	
39	MD	.6	20mm x2	.5	NE			6.0		13Feb06	
40	MD	.2	20mm	0				9.0		13Feb06	
41	S	1.0	Rebar	0				12.0		13Feb06	
42	S	.6	x5	.5	N			10.0		13Feb06	
43	MD	.2	20mm	0				6.0		14Feb06	
44	MD	.4	20mm x2	0				8.0		13Feb06	
45	MD	.2	20mm	0				8.0		13Feb06	

Geophysical Dig Sheet and Target History

GRID 2C Unique Target ID	DIG RESULTS										
	Anomaly Type ***	Approx. Weight (lbs-oz/kg-g)	Comments (e.g., response below 1 foot)	Offset Distance (ft)	Offset Direction (N, NE, etc.)	Orientation of Nose (Azimuth deg)	Inclination of Nose (deg)	Depth to Top of Item (in/~~cm~~)	Digital Photo Number	2006 Date	Team Leader
46	S	.8+	Wire LIP	0				>12"		13Feb06	
47	MD	.2	20mm	0				8.0		13Feb06	
48	S	1.5+	metal rod LIP	0				>12"		13Feb06	
49	MD	.3	20mm	0				6.0		14Feb06	
50	S	1.5+	metal rod LIP	0				>12"		13Feb06	
51	MD	.3	20mm	1.0	S			12.0		14Feb06	
52	HR	.4	hot rock	1.0				6.0		13Feb06	
53	MD	.3	20mm	0				10.0		13Feb06	
54	S	1.0	metal rod 12"	0				11.0		13Feb06	
55	MD	.3	20mm	0				6.0		13Feb06	
56	MD	.4	20mm	0				8.0		13Feb06	
57	S	.2	Scrap metal	0				8.0		14Feb06	
58	S	.8	Scrap metal	0				6.0		13Feb06	
59	S	.3	Scrap metal	0				6.0		13Feb06	
60	S	.4	wire	1.0				5.0		13Feb06	

Geophysical Dig Sheet and Target History

GRID 2C Unique Target ID	DIG RESULTS										
	Anomaly Type ***	Approx. Weight (lbs-oz/kg-g)	Comments (e.g., response below 1 foot)	Offset Distance (ft)	Offset Direction (N, NE, etc.)	Orientation of Nose (Azimuth deg)	Inclination of Nose (deg)	Depth to Top of Item (in/cm)	Digital Photo Number	2006 Date	Team Leader
61	MD	.5	20mm x2	0				10.0		13Feb06	
62	S	.2	Scrap metal	1.0				6.0		14Feb06	
63	S	2.5	metal rod 12"	0				10.0		13Feb06	
64	MD	.3	20mm	0				6.0		13Feb06	
65	S	.1	Scrapmetal	1.0				4.0		13Feb06	
66	MD	.3	20mm	0				8.0		14Feb06	
67	S	.1	Scrap metal	0				2.0		13 Feb06	
68	MD	.2	20mm	0				10.0		14 Feb06	
69	S	.2	Scrapmetal	0				10.0		14Feb06	
70	S	.1	Scrapmetal	1.0				3.0		13Feb06	
71	S	.1	Scrapmetal	0				6.0		13Feb06	
72	MD	.2	20 mm	0				5.0		13Feb06	
73	S	.2	nut	0				8.0		14 Feb06	
74	MD	.2	20mm	.5				6.0		14 Feb06	
75	S	.1	nail	1.0				5.0		13Feb06	

Geophysical Dig Sheet and Target History

GRID 2C Unique Target ID	DIG RESULTS										
	Anomaly Type ***	Approx. Weight (lbs/~~oz/kg/g~~)	Comments (e.g., response below 1 foot)	Offset Distance (ft)	Offset Direction (N, NE, etc.)	Orientation of Nose (Azimuth deg)	Inclination of Nose (deg)	Depth to Top of Item (in/~~cm~~)	Digital Photo Number	2006 Date	Team Leader
76	MD	.2	20mm	0				9.0		13Feb06	
77	S	.1	Scrap metal	1.0				2.0		14Feb06	
78	S	1.0	Scrap metal	0				8.0		13Feb06	
79	S	1.5	Scrap metal	0				6.0		13Feb06	
80	S	.1	Scrap metal	1.0				4.0		13Feb06	
81	S	2.0	metal rod 16"	0				5.0		13Feb06	
82	S	.8	metal plate 4"x5"	0				6.0		13Feb06	
83	S	.3	wire	.5				8.0		14Feb06	
84			LIP	0				>12.0"		14Feb06	
85			LIP	0				>12.0"		14Feb06	
86	~~S~~		LIP	0				>12"		13Feb06	
87			LIP	0				>12.0"		14Feb06	
88	S	.2	nail	0				6.0		14Feb06	
89	S		concrete LIP	0				>12"		13Feb06	
90	MD	.4	20mm	0				4.0		13Feb06	

Geophysical Dig Sheet and Target History

GRID 2C Unique Target ID	DIG RESULTS										
	Anomaly Type ***	Approx. Weight (lbs-oz/kg-g)	Comments (e.g., response below 1 foot)	Offset Distance (ft)	Offset Direction (N, NE, etc.)	Orientation of Nose (Azimuth deg)	Inclination of Nose (deg)	Depth to Top of Item (in/cm)	Digital Photo Number	2006 Date	Team Leader
91	S	.1	Scrap metal	1.0				5.0		13Feb06	
92	S	.1	Scrap metal	0				3.0		13Feb06	
93	S	2.0	metal bolt 12"	0				4.0		13Feb06	
94			LIP	0				>12.0"		13Feb06	
95	S	.2	Scrap metal	1.0				6.0		13Feb06	
96			LIP	0				>12.0"		13Feb06	
97			LIP	0				>12.0"		13Feb06	
98	S	.2	wire	1.0				5.0		14Feb06	
99	S	.2	nail	0				6.0		14Feb06	
100	S	.6	concrete	0				4.0		14Feb06	
101	S		LIP	0				>12"		13Feb06	
102	S	4.0	rebar (other end #104)	0				12.0		14Feb06	
103	MD	.3	20mm	0				11.0		14Feb06	
104	S	4.0	rebar (other end #102)	0				10.0		14Feb06	
105	S	.6	Scrap metal	0				7.0		13Feb06	

Geophysical Dig Sheet and Target History

GRID 2C Unique Target ID	DIG RESULTS Anomaly Type ***	Approx. Weight (lbs-~~oz/kg-g~~)	Comments (e.g., response below 1 foot)	Offset Distance (ft)	Offset Direction (N, NE, etc.)	Orientation of Nose (Azimuth deg)	Inclination of Nose (deg)	Depth to Top of Item (in/~~cm~~)	Digital Photo Number	2006 Date	Team Leader
106			LIP	0				>12.0"		13Feb06	
107	S	.4	U-bolt	0				8.0		13Feb06	
108	S	.3	wood with nails x3	0				8.0		14Feb06	
109	S	.2	nail	1.0				8.0		14Feb06	
110			LIP	0				>12.0"		14Feb06	
111	HR	.1	hot rock	1.0				4.0		13Feb06	
112			LIP	0				>12.0"		14Feb06	
113	S		wire LIP	0				>12.0"		13Feb06	
114			LIP	0				>12.0"		13Feb06	
115	S	.4	x2	0				7.0		14Feb06	
116	S	.3	nut	0				8.0		14Feb06	
117	HR	.2	hot rock	0				5.0		14Feb06	
118			LIP	0				>12.0"		13Feb06	
119	S	.1	nail	1.0				6.0		14Feb06	
120	S	.2	scrap metal	0				10.0		14Feb06	

Geophysical Dig Sheet and Target History

GRID 2C Unique Target ID	DIG RESULTS										
	Anomaly Type ***	Approx. Weight (lbs-oz/kg-g)	Comments (e.g., response below 1 foot)	Offset Distance (ft)	Offset Direction (N, NE, etc.)	Orientation of Nose (Azimuth deg)	Inclination of Nose (deg)	Depth to Top of Item (in/cm)	Digital Photo Number	2006 Date	Team Leader
121	S	.2	Scrap metal	1.0				10.0		14Feb06	
122			LIP	0				>12.0"		14Feb06	
123	MD	.2	20mm	.5	W			6.0		14Feb06	
124			LIP	0				>12.0"		14Feb06	
125	S	1.0+	metal post	0				2.0		13Feb06	

Geophysical Dig Sheet and Target History

GRID 2C Unique Target ID	DIG RESULTS										
	Anomaly Type ***	Approx. Weight (lbs-oz/kg-g)	Comments (e.g., response below 1 foot)	Offset Distance (ft)	Offset Direction (N, NE, etc.)	Orientation of Nose (Azimuth deg)	Inclination of Nose (deg)	Depth to Top of Item (in/cm)	Digital Photo Number	Date	Team Leader

Geophysical Dig Sheet and Target History

GRID 2C Unique Target ID	POST-DIG UXO QC RESULTS			POST-DIG PROJECT QC		
	Excavation Hole Cleared?	UXO QC Spec. Initials	Date	Agreement Between Dig Results & Geophysical Data? (G=good, P=poor, U=unacceptable)	Project QC Initials	Date
1	Yes	EMD	13Feb06	G	VAS	2-14-06
2						
3						
4						
5						
6						
7						
8						
9						
10	Yes	EMD	13Feb06	G	VAS	2-14-06
11						
12						
13						
14						
15						

Geophysical Dig Sheet and Target History

GRID 2C Unique Target ID	POST-DIG UXO QC RESULTS			POST-DIG PROJECT QC		
	Excavation Hole Cleared?	UXO QC Spec. Initials	Date	Agreement Between Dig Results & Geophysical Data? (G=good, P=poor, U=unacceptable)	Project QC Initials	Date
16						
17						
18						
19						
20	Yes	EMD	13Feb06	G	VAS	2-14-06
21						
22						
23						
24						
25						
26						
27						
28						
29						
30	Yes	EMD	13Feb06	G	VAS	2-14-06

Geophysical Dig Sheet and Target History

GRID 2C Unique Target ID	POST-DIG UXO QC RESULTS			POST-DIG PROJECT QC		
	Excavation Hole Cleared?	UXO QC Spec. Initials	Date	Agreement Between Dig Results & Geophysical Data? (G=good, P=poor, U=unacceptable)	Project QC Initials	Date
31						
32						
33						
34						
35						
36						
37						
38						
39						
40	Yes	EKD	13Feb06	G	VAS	2-14-06
41						
42						
43						
44						
45						

Geophysical Dig Sheet and Target History

GRID 2C Unique Target ID	POST-DIG UXO QC RESULTS			POST-DIG PROJECT QC		
	Excavation Hole Cleared?	UXO QC Spec. Initials	Date	Agreement Between Dig Results & Geophysical Data? (G=good, P=poor, U=unacceptable)	Project QC Initials	Date
46						
47						
48						
49						
50	NO, LID	EMD	2/13/06	G	VAS	2-14-06
51						
52						
53						
54						
55						
56						
57						
58						
59						
60	Yes	EMD	13 Feb 06	G	VAS	2-14-06

Geophysical Dig Sheet and Target History

GRID 2C Unique Target ID	POST-DIG UXO QC RESULTS			POST-DIG PROJECT QC		
	Excavation Hole Cleared?	UXO QC Spec. Initials	Date	Agreement Between Dig Results & Geophysical Data? (G=good, P=poor, U=unacceptable)	Project QC Initials	Date
61						
62						
63						
64						
65						
66						
67						
68						
69						
70	Yes	EHD	2/13/06	G	VAS	2-14-06
71						
72						
73						
74						
75						

Geophysical Dig Sheet and Target History

GRID 2C Unique Target ID	POST-DIG UXO QC RESULTS			POST-DIG PROJECT QC		
	Excavation Hole Cleared?	UXO QC Spec. Initials	Date	Agreement Between Dig Results & Geophysical Data? (G=good, P=poor, U=unacceptable)	Project QC Initials	Date
76						
77						
78						
79						
80	Yes	EMD	2/13/06	G	VAS	2-14-06
81						
82						
83						
84						
85						
86						
87						
88						
89						
90	Yes	EMD	2/13/06	G	VAS	2-14-06

Geophysical Dig Sheet and Target History

GRID 2C Unique Target ID	POST-DIG UXO QC RESULTS			POST-DIG PROJECT QC		
	Excavation Hole Cleared?	UXO QC Spec. Initials	Date	Agreement Between Dig Results & Geophysical Data? (G=good, P=poor, U=unacceptable)	Project QC Initials	Date
91						
92						
93						
94						
95						
96						
97						
98						
99						
100	Yes	EnD	2/14/06	G	VAS	2-14-06
101						
102						
103						
104						
105						

Geophysical Dig Sheet and Target History

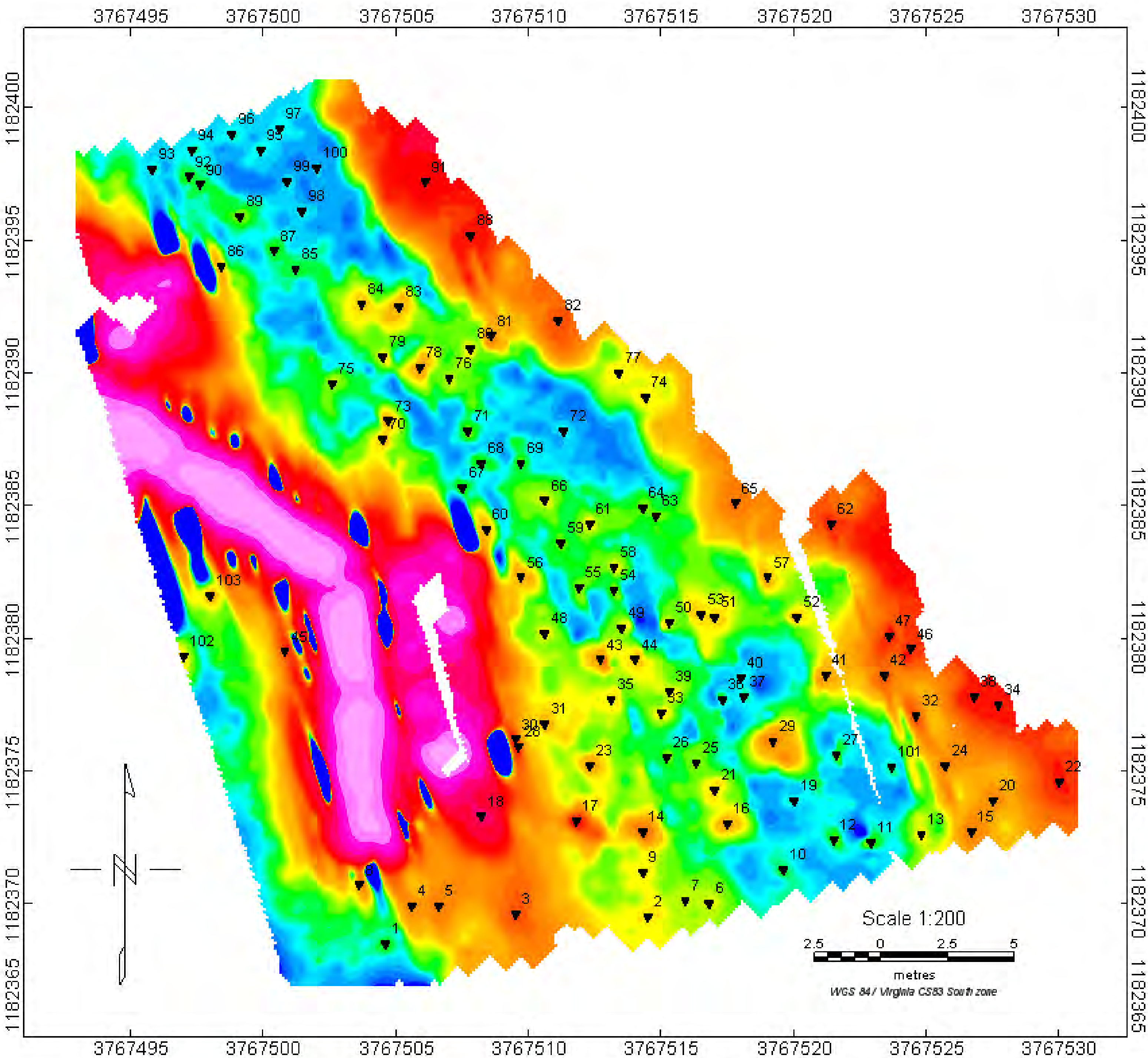
GRID 2C Unique Target ID	POST-DIG UXO QC RESULTS			POST-DIG PROJECT QC		
	Excavation Hole Cleared?	UXO QC Spec. Initials	Date	Agreement Between Dig Results & Geophysical Data? (G=good, P=poor, U=unacceptable)	Project QC Initials	Date
106						
107						
108						
109						
110	NO Below 12"	EMD	14Feb 06	G	VAS	2-14-06
111						
112						
113						
114						
115						
116						
117						
118						
119						
120	Yes	EMD	14 Feb 06	G	VAS	2-14-06

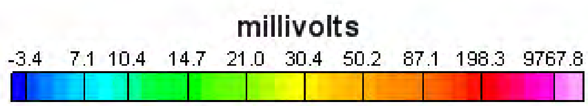
Geophysical Dig Sheet and Target History

GRID 2C Unique Target ID	POST-DIG UXO QC RESULTS			POST-DIG PROJECT QC		
	Excavation Hole Cleared?	UXO QC Spec. Initials	Date	Agreement Between Dig Results & Geophysical Data? (G=good, P=poor, U=unacceptable)	Project QC Initials	Date
121						
122						
123						
124						
125						

Geophysical Dig Sheet and Target History

	POST-DIG UXO QC RESULTS			POST-DIG PROJECT QC		
GRID 2C Unique Target ID	Excavation Hole Cleared?	UXO QC Spec. Initials	Date	Agreement Between Dig Results & Geophysical Data? (G=good, P=poor, U=unacceptable)	Project QC Initials	Date





NASA

Wallops Flight Center
EM61 MK2 Data
Grid 2D

February 8, 2006

Tetra Tech EM Inc.

Geophysical Dig Sheet and Target History

GRID 2D Unique Target ID	ORIGINAL SURVEY									
	Easting Coord. (m)	Northing Coord. (m)	Lat. Coord.	Long. Coord.	X - Local (Grid) Coord. (ft)	Y - Local (Grid) Coord. (ft)	Channel ID (i.e. C1, top senor, gradient)	Response Amplitude (mV)	Dig Priority	Date
1	3767504.6	1182368.5	37.56.15.90	-75.27.23.06	9.96	2.99	Z(1-4)	14		2/8/2006
2	3767514.5	1182369.5	37.56.15.92	-75.27.22.65	42.09	-1.68	Z(1-4)	32.3		2/8/2006
3	3767509.5	1182369.6	37.56.15.93	-75.27.22.85	26.49	2.54	Z(1-4)	111.7		2/8/2006
4	3767505.6	1182369.9	37.56.15.94	-75.27.23.01	14.55	6.51	Z(1-4)	65.5		2/8/2006
5	3767506.6	1182369.9	37.56.15.94	-75.27.22.97	17.69	5.73	Z(1-4)	77.9		2/8/2006
6	3767516.8	1182370	37.56.15.93	-75.27.22.55	49.83	-1.94	Z(1-4)	25.8		2/8/2006
7	3767515.9	1182370.1	37.56.15.94	-75.27.22.59	47.11	-0.93	Z(1-4)	24.3		2/8/2006
8	3767503.6	1182370.7	37.56.15.97	-75.27.23.09	9.1	10.53	Z(1-4)	63.3		2/8/2006
9	3767514.3	1182371.2	37.56.15.97	-75.27.22.65	43.22	3.7	Z(1-4)	32.5		2/8/2006
10	3767519.6	1182371.3	37.56.15.97	-75.27.22.44	59.97	-0.13	Z(1-4)	12.2		2/8/2006
11	3767522.9	1182372.3	37.56.16.00	-75.27.22.30	71.37	0.36	Z(1-4)	18.5		2/8/2006
12	3767521.5	1182372.4	37.56.16.01	-75.27.22.36	67.08	1.76	Z(1-4)	16.3		2/8/2006
13	3767524.8	1182372.6	37.56.16.01	-75.27.22.22	77.65	-0.2	Z(1-4)	32.8		2/8/2006
14	3767514.3	1182372.7	37.56.16.02	-75.27.22.65	44.77	8.32	Z(1-4)	101.8		2/8/2006
15	3767526.7	1182372.7	37.56.16.01	-75.27.22.14	83.72	-1.38	Z(1-4)	77.7		2/8/2006

Geophysical Dig Sheet and Target History

GRID 2D Unique Target ID	ORIGINAL SURVEY									
	Easting Coord. (m)	Northing Coord. (m)	Lat. Coord.	Long. Coord.	X - Local (Grid) Coord. (ft)	Y - Local (Grid) Coord. (ft)	Channel ID (i.e. C1, top senor, gradient)	Response Amplitude (mV)	Dig Priority	Date
16	3767517.5	1182373	37.56.16.03	-75.27.22.52	55.13	6.74	Z(1-4)	44.8		2/8/2006
17	3767511.8	1182373.1	37.56.16.04	-75.27.22.75	37.33	11.5	Z(1-4)	187.5		2/8/2006
18	3767508.2	1182373.3	37.56.16.05	-75.27.22.90	26.23	14.93	Z(1-4)	707.3		2/8/2006
19	3767520	1182373.9	37.56.16.06	-75.27.22.42	63.92	7.55	Z(1-4)	8.8		2/8/2006
20	3767527.5	1182373.9	37.56.16.05	-75.27.22.11	87.47	1.69	Z(1-4)	69.2		2/8/2006
21	3767517	1182374.3	37.56.16.07	-75.27.22.54	54.91	11.13	Z(1-4)	33.2		2/8/2006
22	3767530	1182374.6	37.56.16.07	-75.27.22.01	96.05	1.88	Z(1-4)	160.1		2/8/2006
23	3767512.3	1182375.2	37.56.16.11	-75.27.22.73	41.07	17.57	Z(1-4)	54.3		2/8/2006
24	3767525.7	1182375.2	37.56.16.09	-75.27.22.18	83.16	7.09	Z(1-4)	72.1		2/8/2006
25	3767516.3	1182375.3	37.56.16.11	-75.27.22.57	53.74	14.75	Z(1-4)	22.3		2/8/2006
26	3767515.2	1182375.5	37.56.16.11	-75.27.22.61	50.49	16.22	Z(1-4)	18.6		2/8/2006
27	3767521.6	1182375.6	37.56.16.11	-75.27.22.35	70.7	11.53	Z(1-4)	15.8		2/8/2006
28	3767509.6	1182375.9	37.56.16.13	-75.27.22.84	33.32	21.83	Z(1-4)	125.2		2/8/2006
29	3767519.2	1182376.1	37.56.16.13	-75.27.22.45	63.68	14.94	Z(1-4)	66.9		2/8/2006
30	3767509.5	1182376.2	37.56.16.14	-75.27.22.84	33.31	22.83	Z(1-4)	135.1		2/8/2006

Geophysical Dig Sheet and Target History

GRID 2D Unique Target ID	ORIGINAL SURVEY									
	Easting Coord. (m)	Northing Coord. (m)	Lat. Coord.	Long. Coord.	X - Local (Grid) Coord. (ft)	Y - Local (Grid) Coord. (ft)	Channel ID (i.e. C1, top senor, gradient)	Response Amplitude (mV)	Dig Priority	Date
31	3767510.6	1182376.8	37.56.16.16	-75.27.22.80	37.39	23.82	Z(1-4)	44.8		2/8/2006
32	3767524.6	1182377.1	37.56.16.16	-75.27.22.23	81.67	13.79	Z(1-4)	108.6		2/8/2006
33	3767515	1182377.2	37.56.16.17	-75.27.22.62	51.62	21.61	Z(1-4)	36		2/8/2006
34	3767527.7	1182377.5	37.56.16.16	-75.27.22.10	91.82	12.6	Z(1-4)	195		2/8/2006
35	3767513.1	1182377.7	37.56.16.19	-75.27.22.70	46.17	24.63	Z(1-4)	31.5		2/8/2006
36	3767517.3	1182377.7	37.56.16.18	-75.27.22.52	59.36	21.35	Z(1-4)	13.1		2/8/2006
37	3767518.1	1182377.8	37.56.16.18	-75.27.22.49	61.98	21.03	Z(1-4)	10.2		2/8/2006
38	3767526.8	1182377.8	37.56.16.18	-75.27.22.13	89.31	14.22	Z(1-4)	188.4		2/8/2006
39	3767515.3	1182378	37.56.16.19	-75.27.22.60	53.39	23.83	Z(1-4)	27.4		2/8/2006
40	3767518	1182378.5	37.56.16.21	-75.27.22.49	62.39	23.26	Z(1-4)	9.7		2/8/2006
41	3767521.2	1182378.6	37.56.16.21	-75.27.22.36	72.54	21.06	Z(1-4)	53.6		2/8/2006
42	3767523.4	1182378.6	37.56.16.21	-75.27.22.27	79.45	19.34	Z(1-4)	111.4		2/8/2006
43	3767512.7	1182379.2	37.56.16.24	-75.27.22.71	46.47	29.55	Z(1-4)	80.3		2/8/2006
44	3767514	1182379.2	37.56.16.23	-75.27.22.66	50.55	28.54	Z(1-4)	38.4		2/8/2006
45	3767500.8	1182379.5	37.56.16.26	-75.27.23.20	9.4	39.78	Z(1-4)	133.3		2/8/2006

Geophysical Dig Sheet and Target History

GRID 2D Unique Target ID	ORIGINAL SURVEY									
	Easting Coord. (m)	Northing Coord. (m)	Lat. Coord.	Long. Coord.	X - Local (Grid) Coord. (ft)	Y - Local (Grid) Coord. (ft)	Channel ID (i.e. C1, top senor, gradient)	Response Amplitude (mV)	Dig Priority	Date
46	3767524.4	1182379.6	37.56.16.24	-75.27.22.23	83.63	21.64	Z(1-4)	148.5		2/8/2006
47	3767523.6	1182380.1	37.56.16.25	-75.27.22.26	81.63	23.8	Z(1-4)	158.2		2/8/2006
48	3767510.6	1182380.2	37.56.16.27	-75.27.22.79	40.9	34.27	Z(1-4)	30.4		2/8/2006
49	3767513.5	1182380.4	37.56.16.27	-75.27.22.68	50.22	32.62	Z(1-4)	26.1		2/8/2006
50	3767515.3	1182380.6	37.56.16.28	-75.27.22.60	56.08	31.83	Z(1-4)	25.8		2/8/2006
51	3767517	1182380.8	37.56.16.28	-75.27.22.53	61.63	31.11	Z(1-4)	35.3		2/8/2006
52	3767520.1	1182380.8	37.56.16.28	-75.27.22.40	71.36	28.69	Z(1-4)	39.4		2/8/2006
53	3767516.5	1182380.9	37.56.16.29	-75.27.22.55	60.16	31.81	Z(1-4)	34.3		2/8/2006
54	3767513.2	1182381.8	37.56.16.32	-75.27.22.69	50.72	37.16	Z(1-4)	21.2		2/8/2006
55	3767511.9	1182381.9	37.56.16.32	-75.27.22.74	46.74	38.48	Z(1-4)	20.3		2/8/2006
56	3767509.7	1182382.3	37.56.16.34	-75.27.22.83	40.25	41.43	Z(1-4)	47.2		2/8/2006
57	3767519	1182382.3	37.56.16.33	-75.27.22.45	69.46	34.16	Z(1-4)	44.2		2/8/2006
58	3767513.2	1182382.7	37.56.16.35	-75.27.22.68	51.65	39.93	Z(1-4)	30.2		2/8/2006
59	3767511.2	1182383.6	37.56.16.38	-75.27.22.77	46.3	44.26	Z(1-4)	18.1		2/8/2006
60	3767508.4	1182384.1	37.56.16.40	-75.27.22.88	38.02	47.98	Z(1-4)	45.7		2/8/2006

Geophysical Dig Sheet and Target History

GRID 2D Unique Target ID	ORIGINAL SURVEY									
	Easting Coord. (m)	Northing Coord. (m)	Lat. Coord.	Long. Coord.	X - Local (Grid) Coord. (ft)	Y - Local (Grid) Coord. (ft)	Channel ID (i.e. C1, top senor, gradient)	Response Amplitude (mV)	Dig Priority	Date
61	3767512.3	1182384.3	37.56.16.40	-75.27.22.72	50.48	45.55	Z(1-4)	32.1		2/8/2006
62	3767521.4	1182384.3	37.56.16.39	-75.27.22.35	79.06	38.43	Z(1-4)	153.5		2/8/2006
63	3767514.8	1182384.6	37.56.16.41	-75.27.22.62	58.64	44.52	Z(1-4)	18.9		2/8/2006
64	3767514.3	1182384.9	37.56.16.42	-75.27.22.64	57.38	45.83	Z(1-4)	17.5		2/8/2006
65	3767517.8	1182385.1	37.56.16.42	-75.27.22.49	68.58	43.71	Z(1-4)	88.8		2/8/2006
66	3767510.6	1182385.2	37.56.16.43	-75.27.22.79	46.07	49.65	Z(1-4)	27.3		2/8/2006
67	3767507.5	1182385.7	37.56.16.45	-75.27.22.91	36.85	53.61	Z(1-4)	15.5		2/8/2006
68	3767508.2	1182386.6	37.56.16.48	-75.27.22.88	39.98	55.83	Z(1-4)	13.6		2/8/2006
69	3767509.7	1182386.6	37.56.16.48	-75.27.22.82	44.69	54.65	Z(1-4)	16.2		2/8/2006
70	3767504.5	1182387.5	37.56.16.51	-75.27.23.03	29.29	61.49	Z(1-4)	42.5		2/8/2006
71	3767507.7	1182387.8	37.56.16.52	-75.27.22.90	39.65	59.91	Z(1-4)	17.4		2/8/2006
72	3767511.3	1182387.8	37.56.16.52	-75.27.22.76	50.96	57.09	Z(1-4)	9.8		2/8/2006
73	3767504.7	1182388.2	37.56.16.54	-75.27.23.03	30.64	63.48	Z(1-4)	43.3		2/8/2006
74	3767514.4	1182389.1	37.56.16.55	-75.27.22.63	62.04	58.67	Z(1-4)	30.8		2/8/2006
75	3767502.6	1182389.6	37.56.16.58	-75.27.23.11	25.49	69.43	Z(1-4)	25.3		2/8/2006

Geophysical Dig Sheet and Target History

GRID 2D Unique Target ID	ORIGINAL SURVEY									
	Easting Coord. (m)	Northing Coord. (m)	Lat. Coord.	Long. Coord.	X - Local (Grid) Coord. (ft)	Y - Local (Grid) Coord. (ft)	Channel ID (i.e. C1, top senor, gradient)	Response Amplitude (mV)	Dig Priority	Date
76	3767507	1182389.8	37.56.16.59	-75.27.22.93	39.52	66.6	Z(1-4)	24.9		2/8/2006
77	3767513.4	1182390	37.56.16.59	-75.27.22.67	59.83	62.21	Z(1-4)	29.9		2/8/2006
78	3767505.9	1182390.2	37.56.16.60	-75.27.22.97	36.48	68.69	Z(1-4)	61.6		2/8/2006
79	3767504.5	1182390.6	37.56.16.61	-75.27.23.03	32.49	71.02	Z(1-4)	30.9		2/8/2006
80	3767507.8	1182390.9	37.56.16.62	-75.27.22.89	43.17	69.36	Z(1-4)	28.8		2/8/2006
81	3767508.6	1182391.4	37.56.16.64	-75.27.22.86	46.2	70.27	Z(1-4)	67.5		2/8/2006
82	3767511.1	1182392	37.56.16.65	-75.27.22.76	54.67	70.16	Z(1-4)	108.5		2/8/2006
83	3767505.1	1182392.5	37.56.16.67	-75.27.23.00	36.34	76.39	Z(1-4)	46.1		2/8/2006
84	3767503.7	1182392.6	37.56.16.68	-75.27.23.06	32.05	77.79	Z(1-4)	38		2/8/2006
85	3767501.2	1182393.9	37.56.16.72	-75.27.23.16	25.54	83.75	Z(1-4)	13.3		2/8/2006
86	3767498.4	1182394	37.56.16.73	-75.27.23.28	16.85	86.24	Z(1-4)	41.7		2/8/2006
87	3767500.4	1182394.6	37.56.16.75	-75.27.23.19	23.75	86.52	Z(1-4)	16.4		2/8/2006
88	3767507.8	1182395.2	37.56.16.76	-75.27.22.89	47.61	82.58	Z(1-4)	182.5		2/8/2006
89	3767499.1	1182395.9	37.56.16.79	-75.27.23.24	21.01	91.54	Z(1-4)	20.8		2/8/2006
90	3767497.6	1182397.1	37.56.16.83	-75.27.23.30	17.54	96.4	Z(1-4)	13.8		2/8/2006

Geophysical Dig Sheet and Target History

GRID 2D Unique Target ID	ORIGINAL SURVEY									
	Easting Coord. (m)	Northing Coord. (m)	Lat. Coord.	Long. Coord.	X - Local (Grid) Coord. (ft)	Y - Local (Grid) Coord. (ft)	Channel ID (i.e. C1, top senor, gradient)	Response Amplitude (mV)	Dig Priority	Date
91	3767506.1	1182397.2	37.56.16.83	-75.27.22.96	44.34	90.06	Z(1-4)	274.3		2/8/2006
92	3767497.2	1182397.4	37.56.16.84	-75.27.23.32	16.59	97.64	Z(1-4)	14.2		2/8/2006
93	3767495.8	1182397.7	37.56.16.85	-75.27.23.38	12.51	99.65	Z(1-4)	9		2/8/2006
94	3767497.3	1182398.4	37.56.16.87	-75.27.23.31	17.94	100.63	Z(1-4)	11.9		2/8/2006
95	3767499.9	1182398.4	37.56.16.87	-75.27.23.21	26.11	98.6	Z(1-4)	9.7		2/8/2006
96	3767498.8	1182399	37.56.16.89	-75.27.23.25	23.27	101.3	Z(1-4)	9.3		2/8/2006
97	3767500.6	1182399.2	37.56.16.90	-75.27.23.18	29.13	100.51	Z(1-4)	9		2/8/2006
98	3767501.44	1182396.11	37.56.16.80	-75.27.23.15	28.59	90.35	Z(1-4)	7.6		2/8/2006
99	3767500.89	1182397.22	37.56.16.83	-75.27.23.17	27.99	94.2	Z(1-4)	8.1		2/8/2006
100	3767502	1182397.72	37.56.16.85	-75.27.23.12	31.99	94.85	Z(1-4)	6.6		2/8/2006
101	3767523.68	1182375.17	37.56.16.09	-75.27.22.27	76.79	8.58	Z(1-4)	11		2/8/2006
102	3767497	1182379.31	37.56.16.26	-75.27.23.35	-2.75	42.17	Z(1-4)	30.1		2/8/2006
103	3767497.98	1182381.6	37.56.16.33	-75.27.23.31	2.72	48.42	Z(1-4)	41.7		2/8/2006

Note: *Fill in Acceptable Units (mV, nT/m, ppt, etc).

Geophysical Dig Sheet and Target History

GRID 2D Unique Target ID	ORIGINAL SURVEY									
	Easting Coord. (m)	Northing Coord. (m)	Lat. Coord.	Long. Coord.	X - Local (Grid) Coord. (ft)	Y - Local (Grid) Coord. (ft)	Channel ID (i.e. C1, top senor, gradient)	Response Amplitude (mV)	Dig Priority	Date

**Optional field – refer to SOW for applicability to specific project.

***For Anomaly type, U = UXO, F = frag, MD = munitions debris, S = scrap, A = small arms ammunition, NC = no contact, O = other.

Geophysical Dig Sheet and Target History

GRID 2D Unique Target ID	DIG RESULTS										
	Anomaly Type ***	Approx. Weight (lbs ~~oz/kg g~~)	Comments (e.g., response below 1 foot)	Offset Distance (ft)	Offset Direction (N, NE, etc.)	Orientation of Nose (Azimuth deg)	Inclination of Nose (deg)	Depth to Top of Item (in ~~/cm~~)	Digital Photo Number	2006 Date	Team Leader
1			LIP	0				>12.0"	NO PIC	14Feb06	W
2	S	.2	nut & bolt	1.0				6.0		14Feb06	W
3			LIP	0				>12.0"	NO PIC	14Feb06	W
4	MD	.2	20 mm	0				8.0		14Feb06	W
5			LIP	0				>12.0"	NO PIC	14Feb06	W
6			LIP	0				>12.0"	NO PIC	14Feb06	W
7			LIP	0				>12.0"	NO PIC	14Feb06	W
8	S	.1	scrap	1.0				5.0		14Feb06	W
9			LIP	0				>12.0"	NO PIC	14Feb06	W
10			LIP	0				>12.0"	NO PIC	14Feb06	W
11	MD	.3	20 mm	0				8.0		14Feb06	W
12	S	.2	scrap	0				10.0		14Feb06	W
13	MD	.4	20 mm	0				8.0		14Feb06	W
14	S	1.0	metal plate	0				6.0		14Feb06	W
15	MD	.4	20mm	0				10.0		14Feb06	W

Geophysical Dig Sheet and Target History

GRID 2D Unique Target ID	DIG RESULTS										
	Anomaly Type ***	Approx. Weight (lbs-~~oz/kg-g~~)	Comments (e.g., response below 1 foot)	Offset Distance (ft)	Offset Direction (N, NE, etc.)	Orientation of Nose (Azimuth deg)	Inclination of Nose (deg)	Depth to Top of Item (in/~~cm~~)	Digital Photo Number	2006 Date	Team Leader
16	S	.1	wire	1.0				4.0		14Feb06	
17	S	.2	nail	0				6.0		14Feb06	
18	S	.1	scrap	1.0				6.0		14Feb06	
19			LIP	0				>12.0"	NO PIC	14Feb06	
20	MD	.4	20mm	0				8.0		14Feb06	
21	S	.1	bolt	1.0				5.0		14Feb06	
22	MD	.4	20mm	0				10.0		14Feb06	
23	S	.1	scrap	1.0				4.0		14Feb06	
24	MD	.3	20mm	0				6.0		14Feb06	
25	S	.1	wire	0				4.0		14Feb06	
26			LIP	0				>12.0"	NO PIC	14Feb06	
27	S	.1	scrap	1.0				4.0		14Feb06	
28	S	.2	nail	0				5.0		14Feb06	
29	MD	.8	30mm	0				6.0		14Feb06	
30			LIP	0				>12.0"	NO PIC	14Feb06	

Geophysical Dig Sheet and Target History

GRID 2D Unique Target ID	DIG RESULTS										
	Anomaly Type ***	Approx. Weight (lbs-~~oz/kg-g~~)	Comments (e.g., response below 1 foot)	Offset Distance (ft)	Offset Direction (N, NE, etc.)	Orientation of Nose (Azimuth deg)	Inclination of Nose (deg)	Depth to Top of Item (in/~~cm~~)	Digital Photo Number	2006 Date	Team Leader
31	MD	.5	30 mm	0				8.0		14 Feb 06	[illegible]
32	MD	.4	20 mm	0				4.0		14 Feb 06	[illegible]
33	MD	.4	20 mm	0				8.0		14 Feb 06	[illegible]
34			LIP	0				>12.0"	NO PIC	14 Feb 06	[illegible]
35	MD	.4	20 mm	0				6.0		14 Feb 06	[illegible]
36			LIP	0				>12.0"	NO PIC	14 Feb 06	[illegible]
37			LIP	0				>12.0"	NO PIC	14 Feb 06	[illegible]
38	MD	.4	20 mm	0				5.0		14 Feb 06	[illegible]
39	S	.2	scrap	0				6.0		14 Feb 06	[illegible]
40			LIP	0				>12.0"	NO PIC	14 Feb 06	[illegible]
41	S	.1	scrap	1.0				4.0		14 Feb 06	[illegible]
42	MD	.4	20 mm	0				8.0		14 Feb 06	[illegible]
43	MD	.8	30 mm	0				8.0		14 Feb 06	[illegible]
44	MD	.4	20 mm	0				6.0		14 Feb 06	[illegible]
45	S	1.0	scrap	0				10.0		14 Feb 06	[illegible]

Geophysical Dig Sheet and Target History

GRID 2D Unique Target ID	DIG RESULTS										
	Anomaly Type ***	Approx. Weight (lbs ~~oz/kg-g~~)	Comments (e.g., response below 1 foot)	Offset Distance (ft)	Offset Direction (N, NE, etc.)	Orientation of Nose (Azimuth deg)	Inclination of Nose (deg)	Depth to Top of Item (in ~~/cm~~)	Digital Photo Number	2006 Date	Team Leader
46	MD	.3	30 mm	0				6.0		14 Feb 06	[illegible]
47	MD	.4	20 mm	0				8.0		14 Feb 06	[illegible]
48			LIP	0				>12.0"	NO PIC	14 Feb 06	[illegible]
49			LIP	0				>12.0"	NO PIC	14 Feb 06	[illegible]
50			LIP	0				>12.0"	NO PIC	14 Feb 06	[illegible]
51			LIP	0				>12.0"	NO PIC	14 Feb 06	[illegible]
52	MD	.3	20 mm	0				8.0		14 Feb 06	[illegible]
53			LIP	0				>12.0"	NO PIC	14 Feb 06	[illegible]
54	MD	.3	20 mm	0				5.0		14 Feb 06	[illegible]
55	S	.2	scrap	1.0				5.0		14 Feb 06	[illegible]
56			LIP	0				>12.0"	NO PIC	14 Feb 06	[illegible]
57	MD	.2	20 mm	0				6.0		14 Feb 06	[illegible]
58	MD	.2	20 mm	0				6.0		14 Feb 06	[illegible]
59			LIP	0				>12.0"	NO PIC	14 Feb 06	[illegible]
60			LIP	0				>12.0"	NO PIC	14 Feb 06	[illegible]

Geophysical Dig Sheet and Target History

GRID 2D Unique Target ID	DIG RESULTS										
	Anomaly Type ***	Approx. Weight (lbs-~~oz/kg-g~~)	Comments (e.g., response below 1 foot)	Offset Distance (ft)	Offset Direction (N, NE, etc.)	Orientation of Nose (Azimuth deg)	Inclination of Nose (deg)	Depth to Top of Item (in/~~cm~~)	Digital Photo Number	2006 Date	Team Leader
61	MD	.3	20mm	0				8.0		14Feb06	[illegible]
62	MD	.8	20mm carts x2	0				6.0		14Feb06	[illegible]
63			LIP	0				>12.0"	NO PIC	14Feb06	[illegible]
64			LIP	0				>12.0"	NO PIC	14Feb06	[illegible]
65			LIP	0				>12.0"	NO PIC	14Feb06	[illegible]
66			LIP	0				>12.0"	NO PIC	14Feb06	[illegible]
67			LIP	0				>12.0"	NO PIC	14Feb06	[illegible]
68			LIP	0				>12.0"	NO PIC	14Feb06	[illegible]
69	S	.1	scrap	1.0				6.0		14Feb06	[illegible]
70	MD	.4	20mm *see #73	0				8.0		14Feb06	[illegible]
71			LIP	0				>12.0"	NO PIC	14Feb06	[illegible]
72			LIP	0				>12.0"	NO PIC	14Feb06	[illegible]
73	MD	.4	20mm *same item as #70	.5	E			8.0	see #70	14Feb06	[illegible]
74	S	.2	Scrap	1.0				6.0		14Feb06	[illegible]
75			LIP	0				>12.0"	NO PIC	14Feb06	[illegible]

Geophysical Dig Sheet and Target History

GRID 2D Unique Target ID	DIG RESULTS Anomaly Type ***	Approx. Weight (lbs-~~oz/kg-g~~)	Comments (e.g., response below 1 foot)	Offset Distance (ft)	Offset Direction (N, NE, etc.)	Orientation of Nose (Azimuth deg)	Inclination of Nose (deg)	Depth to Top of Item (in/cm)	Digital Photo Number	2006 Date	Team Leader
76			LIP	0				>12.0"	NO PIC	14Feb06	
77			LIP	0				>12.0"	NO PIC	14Feb06	
78	MD	.2	20mm	0				6.0		14Feb06	
79			LIP	0				>12.0"	NO PIC	14Feb06	
80			LIP	0				>12.0"	NO PIC	14Feb06	
81	MD	.4	20mm	0				8.0		14Feb06	
82	S	.1	scrap	1.0				4.0		14Feb06	
83			LIP	0				>12.0"	NO PIC	14Feb06	
84			LIP	0				>12.0"	NO PIC	14Feb06	
85			LIP	0				>12.0"	NO PIC	14Feb06	
86			LIP	0				>12.0"	NO PIC	14Feb06	
87			LIP	0				>12.0"	NO PIC	14Feb06	
88	MD	.7	20mm x2	0				8.0		14Feb06	
89			LIP	0				>12.0"	NO PIC	14Feb06	
90			LIP	0				>12.0"	NO PIC	14Feb06	

Geophysical Dig Sheet and Target History

GRID 2D Unique Target ID	DIG RESULTS										
	Anomaly Type ***	Approx. Weight (lbs-~~oz/kg-g~~)	Comments (e.g., response below 1 foot)	Offset Distance (ft)	Offset Direction (N, NE, etc.)	Orientation of Nose (Azimuth deg)	Inclination of Nose (deg)	Depth to Top of Item (in/~~cm~~)	Digital Photo Number	2006 Date	Team Leader
91	S	.5	scrap x2	0				4.0		14 Feb 06	W
92	S	.5	spring * see #94	0				6.0		14 Feb 06	W
93			LIP	0				>12.0"	NO PIC	14 Feb 06	W
94	S	.5	spring * same as 92	.5	E			6.0		14 Feb 06	W
95	S	.1	scrap	1.0				3.0		14 Feb 06	W
96	S	.1	scrap	0				2.0		14 Feb 06	W
97	S	.1	scrap	1.0				2.0		14 Feb 06	W
98			LIP	0				>12.0"	NO PIC	14 Feb 06	W
99			LIP	0				>12.0"	NO PIC	14 Feb 06	W
100			LIP	0				>12.0"	NO PIC	14 Feb 06	W
101	MD	.4	20mm	0				8.0		14 Feb 06	W
102	HR ~~S~~ gpl	.1	~~S~~ gpl hotrock	1.0				4.0		14 Feb 06	W
103	S	.6	scrap	0				6.0		14 Feb 06	W

Geophysical Dig Sheet and Target History

GRID 2D Unique Target ID	DIG RESULTS										
	Anomaly Type ***	Approx. Weight (lbs-oz/kg-g)	Comments (e.g., response below 1 foot)	Offset Distance (ft)	Offset Direction (N, NE, etc.)	Orientation of Nose (Azimuth deg)	Inclination of Nose (deg)	Depth to Top of Item (in/~~cm~~)	Digital Photo Number	Date	Team Leader
104			LIP	0				>12.0"	NO PIC	14Feb06	

Geophysical Dig Sheet and Target History

GRID 2D Unique Target ID	POST-DIG UXO QC RESULTS			POST-DIG PROJECT QC		
	Excavation Hole Cleared?	UXO QC Spec. Initials	Date	Agreement Between Dig Results & Geophysical Data? (G=good, P=poor, U=unacceptable)	Project QC Initials	Date
1						
2	Yes	EMD	2/14/06	G	VAS	2-14-06
3						
4						
5						
6						
7						
8						
9						
10						
11	Yes	EMD	2/14/06	G	VAS	2-14-06
12						
13						
14						
15						

Geophysical Dig Sheet and Target History

GRID 2D Unique Target ID	POST-DIG UXO QC RESULTS			POST-DIG PROJECT QC		
	Excavation Hole Cleared?	UXO QC Spec. Initials	Date	Agreement Between Dig Results & Geophysical Data? (G=good, P=poor, U=unacceptable)	Project QC Initials	Date
16						
17						
18						
19						
20	Yes	EAD	2/14/06	G	VAS	2-14-06
21						
22						
23						
24						
25						
26						
27						
28						
29	Yes	EAD	2/14/06	G	VAS	2-14-06
30						

Geophysical Dig Sheet and Target History

GRID 2D Unique Target ID	POST-DIG UXO QC RESULTS			POST-DIG PROJECT QC		
	Excavation Hole Cleared?	UXO QC Spec. Initials	Date	Agreement Between Dig Results & Geophysical Data? (G=good, P=poor, U=unacceptable)	Project QC Initials	Date
31						
32						
33						
34						
35						
36						
37						
38						
39	Yes	EMD	2/14/06	G	VAS	2-14-06
40						
41						
42						
43						
44						
45						

Geophysical Dig Sheet and Target History

GRID 2D Unique Target ID	POST-DIG UXO QC RESULTS			POST-DIG PROJECT QC		
	Excavation Hole Cleared?	UXO QC Spec. Initials	Date	Agreement Between Dig Results & Geophysical Data? (G=good, P=poor, U=unacceptable)	Project QC Initials	Date
46						
47	Yes	ESD	2/14/06	G	VAS	2-14-06
48						
49						
50						
51						
52						
53						
54						
55						
56						
57						
58	Yes	ESD	2/14/06	G	VAS	2-14-06
59						
60						

Geophysical Dig Sheet and Target History

GRID 2D Unique Target ID	POST-DIG UXO QC RESULTS			POST-DIG PROJECT QC		
	Excavation Hole Cleared?	UXO QC Spec. Initials	Date	Agreement Between Dig Results & Geophysical Data? (G=good, P=poor, U=unacceptable)	Project QC Initials	Date
61						
62						
63						
64						
65						
66						
67						
68						
69						
70	Yes	EMD	2/14/06	G	VAS	2-14-06
71						
72						
73						
74						
75						

Geophysical Dig Sheet and Target History

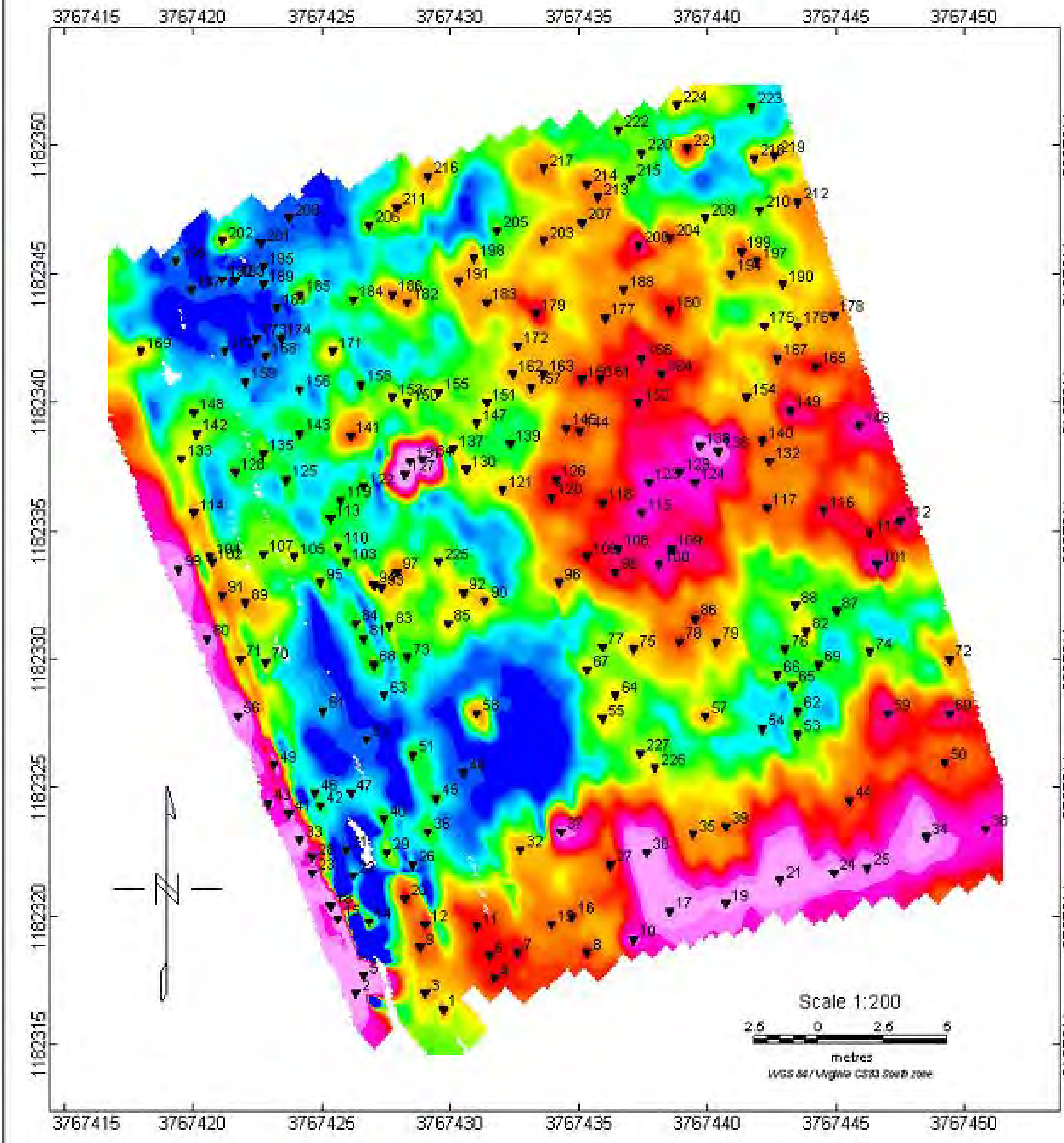
GRID 2D Unique Target ID	POST-DIG UXO QC RESULTS			POST-DIG PROJECT QC		
	Excavation Hole Cleared?	UXO QC Spec. Initials	Date	Agreement Between Dig Results & Geophysical Data? (G=good, P=poor, U=unacceptable)	Project QC Initials	Date
76						
77						
78						
79						
80						
81	Yes	EmD	2/14/06	G	VAS	2-14-06
82						
83						
84						
85						
86						
87						
88	Yes	EmD	2/14/06	G	VAS	2-14-06
89						
90						

Geophysical Dig Sheet and Target History

GRID 2D Unique Target ID	POST-DIG UXO QC RESULTS			POST-DIG PROJECT QC		
	Excavation Hole Cleared?	UXO QC Spec. Initials	Date	Agreement Between Dig Results & Geophysical Data? (G=good, P=poor, U=unacceptable)	Project QC Initials	Date
91						
92						
93						
94	Yes	EMD	2/14/06	G	VAS	2-14-06
95						
96						
97						
98						
99						
100						
101	Yes	EMD	2/14/06	G	VAS	2-14-06
102						
103						

Geophysical Dig Sheet and Target History

GRID 2D Unique Target ID	POST-DIG UXO QC RESULTS			POST-DIG PROJECT QC		
	Excavation Hole Cleared?	UXO QC Spec. Initials	Date	Agreement Between Dig Results & Geophysical Data? (G=good, P=poor, U=unacceptable)	Project QC Initials	Date



millivolts

13.6 39.6 60.2 80.4 109.7 181.9 360.8

NASA

Wallops Flight Center
EM61 MK2 Data
Grid 3A

February 9, 2006

Tetra Tech EM Inc.

Geophysical Dig Sheet and Target History

GRID 3A Unique Target ID	ORIGINAL SURVEY									
	Easting Coord. (m)	Northing Coord. (m)	Lat. Coord.	Long. Coord.	X - Local (Grid) Coord. (ft)	Y - Local (Grid) Coord. (ft)	Channel ID (i.e. C1, top senor, gradient)	Response Amplitude (mV)	Dig Priority	Date
1	3767429.7	1182316.4	37.56.14.29	-75.27.26.19	21.86	-3.16	Z(1-4)	163.6		2/9/2006
2	3767426.3	1182317	37.56.14.31	-75.27.26.33	11.99	1.44	Z(1-4)	12314		2/9/2006
3	3767429	1182317	37.56.14.31	-75.27.26.22	20.3	-0.7	Z(1-4)	153.5		2/9/2006
4	3767431.7	1182317.6	37.56.14.32	-75.27.26.11	29.19	-0.92	Z(1-4)	241.1		2/9/2006
5	3767426.6	1182317.7	37.56.14.33	-75.27.26.31	13.61	3.42	Z(1-4)	10269		2/9/2006
6	3767431.5	1182318.5	37.56.14.35	-75.27.26.11	29.47	2.09	Z(1-4)	251.5		2/9/2006
7	3767432.6	1182318.6	37.56.14.35	-75.27.26.07	32.95	1.54	Z(1-4)	282.6		2/9/2006
8	3767435.3	1182318.6	37.56.14.35	-75.27.25.96	41.26	-0.59	Z(1-4)	222.2		2/9/2006
9	3767428.8	1182318.8	37.56.14.37	-75.27.26.22	21.46	5.18	Z(1-4)	196.1		2/9/2006
10	3767437.1	1182319.1	37.56.14.37	-75.27.25.88	47.29	-0.42	Z(1-4)	848.7		2/9/2006
11	3767431	1182319.6	37.56.14.39	-75.27.26.13	29.02	5.98	Z(1-4)	232.4		2/9/2006
12	3767429	1182319.7	37.56.14.39	-75.27.26.21	22.97	7.88	Z(1-4)	221		2/9/2006
13	3767433.9	1182319.7	37.56.14.39	-75.27.26.01	38.04	4.01	Z(1-4)	194.3		2/9/2006
14	3767426.8	1182319.8	37.56.14.40	-75.27.26.30	16.3	9.94	Z(1-4)	82.6		2/9/2006
15	3767425.6	1182319.9	37.56.14.40	-75.27.26.35	12.71	11.2	Z(1-4)	2680		2/9/2006

Geophysical Dig Sheet and Target History

GRID 3A Unique Target ID	ORIGINAL SURVEY									
	Easting Coord. (m)	Northing Coord. (m)	Lat. Coord.	Long. Coord.	X - Local (Grid) Coord. (ft)	Y - Local (Grid) Coord. (ft)	Channel ID (i.e. C1, top senor, gradient)	Response Amplitude (mV)	Dig Priority	Date
16	3767434.7	1182320	37.56.14.40	-75.27.25.98	40.8	✓ 4.33	Z(1-4)	210		2/9/2006
17	3767438.5	1182320.2	37.56.14.40	-75.27.25.82	52.68	✓ 1.96	Z(1-4)	1690		2/9/2006
18	3767425.3	1182320.4	37.56.14.42	-75.27.26.36	12.28	✓ 13.03	Z(1-4)	3831		2/9/2006
19	3767440.7	1182320.5	37.56.14.41	-75.27.25.73	59.74	✓ 1.18	Z(1-4)	1318		2/9/2006
20	3767428.2	1182320.7	37.56.14.43	-75.27.26.25	21.5	✓ 11.69	Z(1-4)	240.2		2/9/2006
21	3767442.8	1182321.4	37.56.14.44	-75.27.25.65	67.09	✓ 2.38	Z(1-4)	2676		2/9/2006
22	3767426.2	1182321.6	37.56.14.46	-75.27.26.33	16.24	✓ 16.13	Z(1-4)	30		2/9/2006
23	3767424.6	1182321.7	37.56.14.46	-75.27.26.39	11.42	✓ 17.71	Z(1-4)	1328		2/9/2006
24	3767444.9	1182321.7	37.56.14.44	-75.27.25.56	73.85	✓ 1.67	Z(1-4)	1215		2/9/2006
25	3767446.2	1182321.9	37.56.14.45	-75.27.25.51	78.04	✓ 1.28	Z(1-4)	1060		2/9/2006
26	3767428.5	1182322	37.56.14.47	-75.27.26.23	23.71	✓ 15.58	Z(1-4)	51		2/9/2006
27	3767436.2	1182322	37.56.14.46	-75.27.25.92	47.39	✓ 9.5	Z(1-4)	221.5		2/9/2006
28	3767424.6	1182322.3	37.56.14.48	-75.27.26.39	12.01	✓ 19.62	Z(1-4)	1245		2/9/2006
29	3767427.5	1182322.5	37.56.14.49	-75.27.26.27	21.13	✓ 17.96	Z(1-4)	79.3		2/9/2006
30	3767437.6	1182322.5	37.56.14.48	-75.27.25.86	52.19	✓ 9.98	Z(1-4)	1781		2/9/2006

Geophysical Dig Sheet and Target History

GRID 3A Unique Target ID	ORIGINAL SURVEY									
	Easting Coord. (m)	Northing Coord. (m)	Lat. Coord.	Long. Coord.	X - Local (Grid) Coord. (ft)	Y - Local (Grid) Coord. (ft)	Channel ID (i.e. C1, top senor, gradient)	Response Amplitude (mV)	Dig Priority	Date
31	3767425.9	1182322.6	37.56.14.49	-75.27.26.34	16.31	✓19.55	Z(1-4)	8.3		2/9/2006
32	3767432.7	1182322.6	37.56.14.48	-75.27.26.06	37.22	✓14.17	Z(1-4)	131		2/9/2006
33	3767424.1	1182323	37.56.14.51	-75.27.26.41	11.17	✓22.24	Z(1-4)	2834		2/9/2006
34	3767448.5	1182323.1	37.56.14.48	-75.27.25.41	86.3	✓3.28	Z(1-4)	1413		2/9/2006
35	3767439.4	1182323.2	37.56.14.50	-75.27.25.78	58.42	✓10.78	Z(1-4)	152.6		2/9/2006
36	3767429.1	1182323.3	37.56.14.51	-75.27.26.21	26.84	✓19.24	Z(1-4)	61.6		2/9/2006
37	3767434.3	1182323.3	37.56.14.51	-75.27.25.99	42.83	✓15.13	Z(1-4)	860.3		2/9/2006
38	3767450.8	1182323.4	37.56.14.49	-75.27.25.32	93.67	✓2.41	Z(1-4)	624.6		2/9/2006
39	3767440.7	1182323.5	37.56.14.51	-75.27.25.73	62.71	✓10.71	Z(1-4)	200.4		2/9/2006
40	3767427.4	1182323.8	37.56.14.53	-75.27.26.27	22.11	✓22.17	Z(1-4)	61.7		2/9/2006
41	3767423.7	1182324	37.56.14.54	-75.27.26.43	10.93	✓25.73	Z(1-4)	940.1		2/9/2006
42	3767424.9	1182324.3	37.56.14.55	-75.27.26.38	14.92	✓25.74	Z(1-4)	44.6		2/9/2006
43	3767422.9	1182324.4	37.56.14.55	-75.27.26.46	8.86	✓27.64	Z(1-4)	730.9		2/9/2006
44	3767445.5	1182324.5	37.56.14.53	-75.27.25.53	78.46	✓10.1	Z(1-4)	209.2		2/9/2006
45	3767429.4	1182324.6	37.56.14.55	-75.27.26.19	29.05	✓23.13	Z(1-4)	48.9		2/9/2006

Geophysical Dig Sheet and Target History

GRID 3A Unique Target ID	ORIGINAL SURVEY									
	Easting Coord. (m)	Northing Coord. (m)	Lat. Coord.	Long. Coord.	X - Local (Grid) Coord. (ft)	Y - Local (Grid) Coord. (ft)	Channel ID (i.e. C1, top senor, gradient)	Response Amplitude (mV)	Dig Priority	Date
46	3767424.7	1182324.8	37.56.14.56	-75.27.26.38	14.8	27.48	Z(1-4)	43		2/9/2006
47	3767426.1	1182324.8	37.56.14.56	-75.27.26.33	19.1	26.38	Z(1-4)	32.4		2/9/2006
48	3767430.5	1182325.6	37.56.14.58	-75.27.26.14	33.42	25.44	Z(1-4)	8.1		2/9/2006
49	3767423.1	1182325.9	37.56.14.60	-75.27.26.45	10.96	32.24	Z(1-4)	1042		2/9/2006
50	3767449.2	1182326	37.56.14.58	-75.27.25.38	91.33	11.94	Z(1-4)	213.3		2/9/2006
51	3767428.5	1182326.3	37.56.14.61	-75.27.26.23	27.97	29.25	Z(1-4)	57		2/9/2006
52	3767426.7	1182326.9	37.56.14.63	-75.27.26.30	23.03	32.58	Z(1-4)	11.4		2/9/2006
53	3767443.5	1182327.1	37.56.14.62	-75.27.25.61	74.89	19.94	Z(1-4)	73		2/9/2006
54	3767442.1	1182327.3	37.56.14.63	-75.27.25.67	70.78	21.68	Z(1-4)	41		2/9/2006
55	3767435.9	1182327.7	37.56.14.65	-75.27.25.92	52.11	27.85	Z(1-4)	100.3		2/9/2006
56	3767421.7	1182327.8	37.56.14.66	-75.27.26.50	8.54	39.39	Z(1-4)	1271		2/9/2006
57	3767439.9	1182327.8	37.56.14.65	-75.27.25.76	64.51	25	Z(1-4)	163.4		2/9/2006
58	3767431	1182327.9	37.56.14.66	-75.27.26.12	37.24	32.36	Z(1-4)	141.5		2/9/2006
59	3767447	1182327.9	37.56.14.64	-75.27.25.47	86.44	19.71	Z(1-4)	381.5		2/9/2006
60	3767449.4	1182327.9	37.56.14.64	-75.27.25.37	93.82	17.82	Z(1-4)	368.4		2/9/2006

Geophysical Dig Sheet and Target History

GRID 3A Unique Target ID	ORIGINAL SURVEY									
	Easting Coord. (m)	Northing Coord. (m)	Lat. Coord.	Long. Coord.	X - Local (Grid) Coord. (ft)	Y - Local (Grid) Coord. (ft)	Channel ID (i.e. C1, top senor, gradient)	Response Amplitude (mV)	Dig Priority	Date
61	3767425	1182328	37.56.14.67	-75.27.26.37	18.89	✓ 37.41	Z(1-4)	21.6		2/9/2006
62	3767443.5	1182328	37.56.14.65	-75.27.25.61	75.78	✓ 22.8	Z(1-4)	53		2/9/2006
63	3767427.4	1182328.6	37.56.14.68	-75.27.26.27	26.86	✓ 37.42	Z(1-4)	30.3		2/9/2006
64	3767436.4	1182328.6	37.56.14.68	-75.27.25.90	54.54	✓ 30.31	Z(1-4)	100.4		2/9/2006
65	3767443.3	1182329	37.56.14.68	-75.27.25.62	76.15	✓ 26.13	Z(1-4)	85.3		2/9/2006
66	3767442.7	1182329.4	37.56.14.69	-75.27.25.64	74.7	✓ 27.88	Z(1-4)	81.2		2/9/2006
67	3767435.3	1182329.6	37.56.14.71	-75.27.25.94	52.15	✓ 34.36	Z(1-4)	88.4		2/9/2006
68	3767427	1182329.8	37.56.14.72	-75.27.26.28	26.82	✓ 41.55	Z(1-4)	66.7		2/9/2006
69	3767444.3	1182329.8	37.56.14.71	-75.27.25.57	80.02	✓ 27.88	Z(1-4)	62.2		2/9/2006
70	3767422.8	1182329.9	37.56.14.73	-75.27.26.45	14	✓ 45.19	Z(1-4)	81		2/9/2006
71	3767421.8	1182330	37.56.14.74	-75.27.26.50	11.03	✓ 46.3	Z(1-4)	140.7		2/9/2006
72	3767449.4	1182330	37.56.14.71	-75.27.25.37	95.9	✓ 24.49	Z(1-4)	148.3		2/9/2006
73	3767428.3	1182330.1	37.56.14.73	-75.27.26.23	31.11	✓ 41.48	Z(1-4)	57.2		2/9/2006
74	3767446.3	1182330.3	37.56.14.72	-75.27.25.49	86.67	✓ 27.89	Z(1-4)	75.3		2/9/2006
75	3767437.1	1182330.4	37.56.14.73	-75.27.25.87	58.47	✓ 35.48	Z(1-4)	117.8		2/9/2006

Geophysical Dig Sheet and Target History

GRID 3A Unique Target ID	ORIGINAL SURVEY									
	Easting Coord. (m)	Northing Coord. (m)	Lat. Coord.	Long. Coord.	X - Local (Grid) Coord. (ft)	Y - Local (Grid) Coord. (ft)	Channel ID (i.e. C1, top senor, gradient)	Response Amplitude (mV)	Dig Priority	Date
76	3767443	1182330.4	37.56.14.73	-75.27.25.63	76.62	30.82	Z(1-4)	60.2		2/9/2006
77	3767435.9	1182330.5	37.56.14.74	-75.27.25.92	54.88	36.74	Z(1-4)	75.6		2/9/2006
78	3767438.9	1182330.7	37.56.14.74	-75.27.25.79	64.31	35.01	Z(1-4)	221.3		2/9/2006
79	3767440.3	1182330.7	37.56.14.74	-75.27.25.74	68.61	33.9	Z(1-4)	145.8		2/9/2006
80	3767420.5	1182330.8	37.56.14.76	-75.27.26.55	7.82	49.87	Z(1-4)	956.3		2/9/2006
81	3767426.6	1182330.8	37.56.14.76	-75.27.26.30	26.58	45.05	Z(1-4)	60.5		2/9/2006
82	3767443.8	1182331.1	37.56.14.75	-75.27.25.59	79.77	32.41	Z(1-4)	106.8		2/9/2006
83	3767427.6	1182331.3	37.56.14.77	-75.27.26.26	30.15	45.84	Z(1-4)	85.5		2/9/2006
84	3767426.3	1182331.4	37.56.14.78	-75.27.26.31	26.25	47.19	Z(1-4)	61.7		2/9/2006
85	3767429.9	1182331.4	37.56.14.77	-75.27.26.16	37.32	44.34	Z(1-4)	104.3		2/9/2006
86	3767439.5	1182331.6	37.56.14.77	-75.27.25.77	67.04	37.39	Z(1-4)	217.8		2/9/2006
87	3767445	1182331.9	37.56.14.77	-75.27.25.54	84.25	34	Z(1-4)	55.8		2/9/2006
88	3767443.4	1182332.1	37.56.14.78	-75.27.25.61	79.53	35.9	Z(1-4)	88.9		2/9/2006
89	3767422	1182332.2	37.56.14.81	-75.27.26.48	13.82	53.13	Z(1-4)	148.6		2/9/2006
90	3767431.3	1182332.3	37.56.14.80	-75.27.26.10	42.52	46.1	Z(1-4)	136.4		2/9/2006

Geophysical Dig Sheet and Target History

GRID 3A	ORIGINAL SURVEY									
Unique Target ID	Easting Coord. (m)	Northing Coord. (m)	Lat. Coord.	Long. Coord.	X - Local (Grid) Coord. (ft)	Y - Local (Grid) Coord. (ft)	Channel ID (i.e. C1, top senor, gradient)	Response Amplitude (mV)	Dig Priority	Date
91	3767421.1	1182332.5	37.56.14.82	-75.27.26.52	11.35	54.79	Z(1-4)	194.1		2/9/2006
92	3767430.5	1182332.6	37.56.14.81	-75.27.26.14	40.35	47.68	Z(1-4)	121.4		2/9/2006
93	3767427.3	1182332.8	37.56.14.82	-75.27.26.27	30.71	50.85	Z(1-4)	127.8		2/9/2006
94	3767427	1182332.9	37.56.14.82	-75.27.26.28	29.89	51.4	Z(1-4)	142.2		2/9/2006
95	3767424.9	1182333	37.56.14.83	-75.27.26.36	23.53	53.38	Z(1-4)	83.3		2/9/2006
96	3767434.2	1182333	37.56.14.82	-75.27.25.98	52.13	46.03	Z(1-4)	149.9		2/9/2006
97	3767427.9	1182333.4	37.56.14.84	-75.27.26.24	33.15	52.28	Z(1-4)	158.9		2/9/2006
98	3767436.4	1182333.4	37.56.14.83	-75.27.25.89	59.29	45.56	Z(1-4)	287.9		2/9/2006
99	3767419.4	1182333.5	37.56.14.85	-75.27.26.59	7.11	59.31	Z(1-4)	1478		2/9/2006
100	3767438.1	1182333.7	37.56.14.84	-75.27.25.82	64.81	45.17	Z(1-4)	480.6		2/9/2006
101	3767446.6	1182333.7	37.56.14.83	-75.27.25.48	90.95	38.46	Z(1-4)	477.8		2/9/2006
102	3767420.7	1182333.8	37.56.14.86	-75.27.26.54	11.4	59.24	Z(1-4)	132.8		2/9/2006
103	3767425.9	1182333.8	37.56.14.85	-75.27.26.32	27.4	55.13	Z(1-4)	75.2		2/9/2006
104	3767420.6	1182334	37.56.14.87	-75.27.26.54	11.3	59.95	Z(1-4)	136		2/9/2006
105	3767423.9	1182334	37.56.14.86	-75.27.26.40	21.44	57.35	Z(1-4)	83.3		2/9/2006

Geophysical Dig Sheet and Target History

GRID 3A Unique Target ID	ORIGINAL SURVEY									
	Easting Coord. (m)	Northing Coord. (m)	Lat. Coord.	Long. Coord.	X - Local (Grid) Coord. (ft)	Y - Local (Grid) Coord. (ft)	Channel ID (i.e. C1, top senor, gradient)	Response Amplitude (mV)	Dig Priority	Date
106	3767435.3	1182334	37.56.14.85	-75.27.25.94	56.5	✓48.34	Z(1-4)	251.6		2/9/2006
107	3767422.7	1182334.1	37.56.14.87	-75.27.26.45	17.85	✓58.61	Z(1-4)	73.5		2/9/2006
108	3767436.5	1182334.3	37.56.14.86	-75.27.25.89	60.49	✓48.34	Z(1-4)	363.3		2/9/2006
109	3767438.6	1182334.3	37.56.14.86	-75.27.25.80	66.95	✓46.68	Z(1-4)	447.9		2/9/2006
110	3767425.6	1182334.4	37.56.14.87	-75.27.26.33	27.07	✓57.27	Z(1-4)	68.3		2/9/2006
111	3767446.3	1182334.9	37.56.14.87	-75.27.25.49	91.22	✓42.51	Z(1-4)	262.2		2/9/2006
112	3767447.5	1182335.4	37.56.14.88	-75.27.25.44	95.41	✓43.15	Z(1-4)	348.9		2/9/2006
113	3767425.3	1182335.5	37.56.14.91	-75.27.26.34	27.23	✓61.01	Z(1-4)	60.5		2/9/2006
114	3767420	1182335.7	37.56.14.92	-75.27.26.56	11.13	✓65.83	Z(1-4)	148		2/9/2006
115	3767437.4	1182335.7	37.56.14.90	-75.27.25.85	64.64	✓52.08	Z(1-4)	691		2/9/2006
116	3767444.5	1182335.8	37.56.14.90	-75.27.25.56	86.58	✓46.79	Z(1-4)	290.7		2/9/2006
117	3767442.3	1182335.9	37.56.14.91	-75.27.25.65	79.91	✓48.84	Z(1-4)	212		2/9/2006
118	3767435.9	1182336.1	37.56.14.92	-75.27.25.91	60.43	✓54.54	Z(1-4)	243.8		2/9/2006
119	3767425.7	1182336.2	37.56.14.93	-75.27.26.33	29.16	✓62.91	Z(1-4)	57		2/9/2006
120	3767433.9	1182336.3	37.56.14.93	-75.27.25.99	54.47	✓56.75	Z(1-4)	236.6		2/9/2006

Geophysical Dig Sheet and Target History

GRID 3A Unique Target ID	ORIGINAL SURVEY									
	Easting Coord. (m)	Northing Coord. (m)	Lat. Coord.	Long. Coord.	X - Local (Grid) Coord. (ft)	Y - Local (Grid) Coord. (ft)	Channel ID (i.e. C1, top senor, gradient)	Response Amplitude (mV)	Dig Priority	Date
121	3767432	1182336.6	37.56.14.94	-75.27.26.07	48.93	✓ 59.21	Z(1-4)	131.2		2/9/2006
122	3767426.6	1182336.7	37.56.14.95	-75.27.26.29	32.42	✓ 63.79	Z(1-4)	66.6		2/9/2006
123	3767437.7	1182336.9	37.56.14.94	-75.27.25.84	66.75	✓ 55.66	Z(1-4)	663.6		2/9/2006
124	3767439.5	1182336.9	37.56.14.94	-75.27.25.76	72.29	✓ 54.23	Z(1-4)	674.7		2/9/2006
125	3767423.6	1182337	37.56.14.96	-75.27.26.41	23.49	✓ 67.11	Z(1-4)	56.6		2/9/2006
126	3767434.1	1182337	37.56.14.95	-75.27.25.98	55.78	✓ 58.82	Z(1-4)	273.2		2/9/2006
127	3767428.2	1182337.2	37.56.14.96	-75.27.26.22	37.84	✓ 64.12	Z(1-4)	2156		2/9/2006
128	3767421.6	1182337.3	37.56.14.97	-75.27.26.49	17.64	✓ 69.65	Z(1-4)	61.8		2/9/2006
129	3767438.9	1182337.3	37.56.14.95	-75.27.25.79	70.84	✓ 55.98	Z(1-4)	599.2		2/9/2006
130	3767430.6	1182337.4	37.56.14.97	-75.27.26.13	45.41	✓ 62.85	Z(1-4)	103		2/9/2006
131	3767428.4	1182337.7	37.56.14.98	-75.27.26.21	38.95	✓ 65.55	Z(1-4)	2037		2/9/2006
132	3767442.4	1182337.7	37.56.14.96	-75.27.25.64	82	✓ 54.48	Z(1-4)	181.8		2/9/2006
133	3767419.5	1182337.8	37.56.14.99	-75.27.26.58	11.67	✓ 72.9	Z(1-4)	95.7		2/9/2006
134	3767428.9	1182337.8	37.56.14.98	-75.27.26.19	40.58	✓ 65.47	Z(1-4)	2022		2/9/2006
135	3767422.7	1182338	37.56.14.99	-75.27.26.45	21.71	✓ 71	Z(1-4)	64.3		2/9/2006

Geophysical Dig Sheet and Target History

GRID 3A Unique Target ID	ORIGINAL SURVEY									
	Easting Coord. (m)	Northing Coord. (m)	Lat. Coord.	Long. Coord.	X - Local (Grid) Coord. (ft)	Y - Local (Grid) Coord. (ft)	Channel ID (i.e. C1, top senor, gradient)	Response Amplitude (mV)	Dig Priority	Date
136	3767440.4	1182338.1	37.56.14.98	-75.27.25.72	76.24	57.34	Z(1-4)	1029		2/9/2006
137	3767430.1	1182338.2	37.56.14.99	-75.27.26.14	44.67	65.79	Z(1-4)	107		2/9/2006
138	3767439.7	1182338.3	37.56.14.99	-75.27.25.75	74.29	58.52	Z(1-4)	991		2/9/2006
139	3767432.3	1182338.4	37.56.15.00	-75.27.26.05	51.63	64.69	Z(1-4)	54.8		2/9/2006
140	3767442.1	1182338.5	37.56.14.99	-75.27.25.65	81.87	57.26	Z(1-4)	208.4		2/9/2006
141	3767426.1	1182338.7	37.56.15.01	-75.27.26.31	32.86	70.54	Z(1-4)	231.5		2/9/2006
142	3767420.1	1182338.8	37.56.15.02	-75.27.26.55	14.51	75.6	Z(1-4)	89.4		2/9/2006
143	3767424.1	1182338.8	37.56.15.02	-75.27.26.39	26.81	72.44	Z(1-4)	58.7		2/9/2006
144	3767435	1182338.9	37.56.15.01	-75.27.25.94	60.43	64.14	Z(1-4)	206.1		2/9/2006
145	3767434.5	1182339	37.56.15.01	-75.27.25.96	58.99	64.86	Z(1-4)	206.1		2/9/2006
146	3767445.9	1182339.1	37.56.15.01	-75.27.25.50	94.15	56.17	Z(1-4)	431.7		2/9/2006
147	3767431	1182339.2	37.56.15.02	-75.27.26.11	48.43	68.26	Z(1-4)	87.6		2/9/2006
148	3767420	1182339.6	37.56.15.05	-75.27.26.56	14.99	78.22	Z(1-4)	68.3		2/9/2006
149	3767443.2	1182339.7	37.56.15.03	-75.27.25.61	86.44	60.21	Z(1-4)	397.5		2/9/2006
150	3767428.3	1182340	37.56.15.05	-75.27.26.22	40.91	72.93	Z(1-4)	91.5		2/9/2006

Geophysical Dig Sheet and Target History

GRID 3A Unique Target ID	ORIGINAL SURVEY									
	Easting Coord. (m)	Northing Coord. (m)	Lat. Coord.	Long. Coord.	X - Local (Grid) Coord. (ft)	Y - Local (Grid) Coord. (ft)	Channel ID (i.e. C1, top senor, gradient)	Response Amplitude (mV)	Dig Priority	Date
151	3767431.4	1182340	37.56.15.05	-75.27.26.09	50.45	✓70.48	Z(1-4)	93.1		2/9/2006
152	3767437.3	1182340	37.56.15.04	-75.27.25.85	68.59	✓65.82	Z(1-4)	291.3		2/9/2006
153	3767427.7	1182340.2	37.56.15.06	-75.27.26.24	39.27	✓74.04	Z(1-4)	84.8		2/9/2006
154	3767441.5	1182340.2	37.56.15.05	-75.27.25.68	81.71	✓63.14	Z(1-4)	137.2		2/9/2006
155	3767429.5	1182340.4	37.56.15.06	-75.27.26.17	45	✓73.26	Z(1-4)	92.8		2/9/2006
156	3767424.1	1182340.5	37.56.15.07	-75.27.26.39	28.49	✓77.84	Z(1-4)	41.7		2/9/2006
157	3767433.1	1182340.6	37.56.15.07	-75.27.26.02	56.27	✓71.05	Z(1-4)	135.6		2/9/2006
158	3767426.5	1182340.7	37.56.15.08	-75.27.26.29	36.07	✓76.58	Z(1-4)	57.2		2/9/2006
159	3767422	1182340.8	37.56.15.09	-75.27.26.47	22.33	✓80.45	Z(1-4)	27.1		2/9/2006
160	3767435.1	1182340.9	37.56.15.08	-75.27.25.94	62.72	✓70.42	Z(1-4)	235.4		2/9/2006
161	3767435.8	1182340.9	37.56.15.07	-75.27.25.91	64.87	✓69.87	Z(1-4)	220.6		2/9/2006
162	3767432.4	1182341.1	37.56.15.08	-75.27.26.05	54.61	✓73.19	Z(1-4)	128.3		2/9/2006
163	3767433.6	1182341.1	37.56.15.08	-75.27.26.00	58.3	✓72.24	Z(1-4)	141		2/9/2006
164	3767438.2	1182341.1	37.56.15.08	-75.27.25.81	72.45	✓68.61	Z(1-4)	273.4		2/9/2006
165	3767444.2	1182341.4	37.56.15.08	-75.27.25.56	91.2	✓64.82	Z(1-4)	247.3		2/9/2006

Geophysical Dig Sheet and Target History

GRID 3A Unique Target ID	ORIGINAL SURVEY									
	Easting Coord. (m)	Northing Coord. (m)	Lat. Coord.	Long. Coord.	X - Local (Grid) Coord. (ft)	Y - Local (Grid) Coord. (ft)	Channel ID (i.e. C1, top senor, gradient)	Response Amplitude (mV)	Dig Priority	Date
166	3767437.4	1182341.7	37.56.15.10	-75.27.25.84	70.58	✓ 71.14	Z(1-4)	289.8		2/9/2006
167	3767442.7	1182341.7	37.56.15.09	-75.27.25.62	86.88	✓ 66.96	Z(1-4)	189.8		2/9/2006
168	3767422.8	1182341.8	37.56.15.12	-75.27.26.44	25.78	✓ 83	Z(1-4)	17.6		2/9/2006
169	3767417.9	1182342	37.56.15.13	-75.27.26.64	10.91	✓ 87.51	Z(1-4)	108.9		2/9/2006
170	3767421.2	1182342	37.56.15.13	-75.27.26.50	21.06	✓ 84.9	Z(1-4)	25.1		2/9/2006
171	3767425.4	1182342	37.56.15.12	-75.27.26.33	33.98	✓ 81.58	Z(1-4)	104.5		2/9/2006
172	3767432.6	1182342.2	37.56.15.12	-75.27.26.04	56.32	✓ 76.53	Z(1-4)	139.9		2/9/2006
173	3767422.4	1182342.5	37.56.15.14	-75.27.26.45	25.25	✓ 85.54	Z(1-4)	10.7		2/9/2006
174	3767423.4	1182342.5	37.56.15.14	-75.27.26.41	28.32	✓ 84.75	Z(1-4)	16.4		2/9/2006
175	3767442.2	1182343	37.56.15.14	-75.27.25.64	86.63	✓ 71.48	Z(1-4)	102		2/9/2006
176	3767443.5	1182343	37.56.15.13	-75.27.25.59	90.63	✓ 70.45	Z(1-4)	127.7		2/9/2006
177	3767436	1182343.3	37.56.15.15	-75.27.25.90	67.86	✓ 77.33	Z(1-4)	168.5		2/9/2006
178	3767444.9	1182343.4	37.56.15.15	-75.27.25.53	95.33	✓ 70.62	Z(1-4)	169		2/9/2006
179	3767433.3	1182343.5	37.56.15.16	-75.27.26.01	59.76	✓ 80.1	Z(1-4)	291.3		2/9/2006
180	3767438.5	1182343.6	37.56.15.16	-75.27.25.79	75.85	✓ 76.31	Z(1-4)	247.3		2/9/2006

Geophysical Dig Sheet and Target History

GRID 3A Unique Target ID	ORIGINAL SURVEY									
	Easting Coord. (m)	Northing Coord. (m)	Lat. Coord.	Long. Coord.	X - Local (Grid) Coord. (ft)	Y - Local (Grid) Coord. (ft)	Channel ID (i.e. C1, top senor, gradient)	Response Amplitude (mV)	Dig Priority	Date
181	3767423.2	1182343.7	37.56.15.18	-75.27.26.42	28.89	88.72	Z(1-4)	9		2/9/2006
182	3767428.3	1182343.9	37.56.15.18	-75.27.26.21	44.78	85.32	Z(1-4)	163.2		2/9/2006
183	3767431.4	1182343.9	37.56.15.18	-75.27.26.08	54.31	82.87	Z(1-4)	160.1		2/9/2006
184	3767426.2	1182344	37.56.15.19	-75.27.26.30	38.42	87.3	Z(1-4)	64.8		2/9/2006
185	3767424.1	1182344.2	37.56.15.19	-75.27.26.38	32.16	89.6	Z(1-4)	96.6		2/9/2006
186	3767427.7	1182344.2	37.56.15.19	-75.27.26.23	43.23	86.75	Z(1-4)	161.6		2/9/2006
187	3767419.9	1182344.4	37.56.15.20	-75.27.26.55	19.44	93.55	Z(1-4)	10.3		2/9/2006
188	3767436.7	1182344.4	37.56.15.19	-75.27.25.87	71.1	80.28	Z(1-4)	153.6		2/9/2006
189	3767422.7	1182344.6	37.56.15.21	-75.27.26.44	28.25	91.97	Z(1-4)	21.7		2/9/2006
190	3767442.9	1182344.6	37.56.15.19	-75.27.25.61	90.37	76.01	Z(1-4)	120.2		2/9/2006
191	3767430.3	1182344.7	37.56.15.20	-75.27.26.13	51.72	86.29	Z(1-4)	147.5		2/9/2006
192	3767421.1	1182344.8	37.56.15.22	-75.27.26.50	23.53	93.87	Z(1-4)	16.5		2/9/2006
193	3767421.6	1182344.8	37.56.15.22	-75.27.26.48	25.06	93.48	Z(1-4)	31.1		2/9/2006
194	3767440.9	1182345	37.56.15.20	-75.27.25.69	84.61	78.86	Z(1-4)	144.8		2/9/2006
195	3767422.7	1182345.3	37.56.15.23	-75.27.26.44	28.94	94.2	Z(1-4)	20.9		2/9/2006

Geophysical Dig Sheet and Target History

GRID 3A Unique Target ID	ORIGINAL SURVEY									
	Easting Coord. (m)	Northing Coord. (m)	Lat. Coord.	Long. Coord.	X - Local (Grid) Coord. (ft)	Y - Local (Grid) Coord. (ft)	Channel ID (i.e. C1, top senor, gradient)	Response Amplitude (mV)	Dig Priority	Date
196	3767419.3	1182345.5	37.56.15.24	-75.27.26.58	18.68	97.52	Z(1-4)	21.7		2/9/2006
197	3767441.9	1182345.5	37.56.15.22	-75.27.25.65	88.18	79.66	Z(1-4)	200.2		2/9/2006
198	3767430.9	1182345.6	37.56.15.23	-75.27.26.10	54.45	88.67	Z(1-4)	134.4		2/9/2006
199	3767441.3	1182345.9	37.56.15.23	-75.27.25.68	86.73	81.41	Z(1-4)	221.8		2/9/2006
200	3767437.3	1182346.1	37.56.15.24	-75.27.25.84	74.63	85.2	Z(1-4)	358.1		2/9/2006
201	3767422.6	1182346.2	37.56.15.26	-75.27.26.44	29.52	97.14	Z(1-4)	12.1		2/9/2006
202	3767421.1	1182346.3	37.56.15.26	-75.27.26.50	25.01	98.64	Z(1-4)	106.9		2/9/2006
203	3767433.6	1182346.3	37.56.15.25	-75.27.25.99	63.45	88.76	Z(1-4)	166.2		2/9/2006
204	3767438.5	1182346.4	37.56.15.25	-75.27.25.79	78.62	85.21	Z(1-4)	224.2		2/9/2006
205	3767431.8	1182346.7	37.56.15.27	-75.27.26.06	58.31	91.45	Z(1-4)	63.1		2/9/2006
206	3767426.8	1182346.9	37.56.15.28	-75.27.26.27	43.13	96.04	Z(1-4)	70.1		2/9/2006
207	3767435.1	1182347	37.56.15.27	-75.27.25.93	68.76	89.8	Z(1-4)	148.8		2/9/2006
208	3767423.7	1182347.2	37.56.15.29	-75.27.26.39	33.9	99.44	Z(1-4)	10.4		2/9/2006
209	3767439.9	1182347.2	37.56.15.27	-75.27.25.73	83.72	86.64	Z(1-4)	87		2/9/2006
210	3767442	1182347.5	37.56.15.28	-75.27.25.65	90.47	85.94	Z(1-4)	73.1		2/9/2006

Geophysical Dig Sheet and Target History

GRID 3A	ORIGINAL SURVEY									
Unique Target ID	Easting Coord. (m)	Northing Coord. (m)	Lat. Coord.	Long. Coord.	X - Local (Grid) Coord. (ft)	Y - Local (Grid) Coord. (ft)	Channel ID (i.e. C1, top senor, gradient)	Response Amplitude (mV)	Dig Priority	Date
211	3767427.9	1182347.6	37.56.15.30	-75.27.26.22	47.21	✓ 97.4	Z(1-4)	143.8		2/9/2006
212	3767443.5	1182347.8	37.56.15.29	-75.27.25.58	95.38	✓ 85.7	Z(1-4)	163.4		2/9/2006
213	3767435.7	1182348	37.56.15.30	-75.27.25.90	71.59	✓ 92.5	Z(1-4)	179.7		2/9/2006
214	3767435.3	1182348.5	37.56.15.32	-75.27.25.92	70.86	✓ 94.41	Z(1-4)	187.8		2/9/2006
215	3767437	1182348.7	37.56.15.33	-75.27.25.85	76.28	✓ 93.7	Z(1-4)	71.7		2/9/2006
216	3767429.1	1182348.8	37.56.15.34	-75.27.26.17	52.09	✓ 100.26	Z(1-4)	169.3		2/9/2006
217	3767433.6	1182349.1	37.56.15.34	-75.27.25.99	66.22	✓ 97.66	Z(1-4)	158.1		2/9/2006
218	3767441.8	1182349.5	37.56.15.35	-75.27.25.65	91.84	✓ 92.45	Z(1-4)	138.7		2/9/2006
219	3767442.6	1182349.6	37.56.15.35	-75.27.25.62	94.39	✓ 92.13	Z(1-4)	136		2/9/2006
220	3767437.4	1182349.7	37.56.15.36	-75.27.25.83	78.5	✓ 96.56	Z(1-4)	75.4		2/9/2006
221	3767439.2	1182349.9	37.56.15.36	-75.27.25.76	84.24	✓ 95.77	Z(1-4)	272.7		2/9/2006
222	3767436.5	1182350.6	37.56.15.39	-75.27.25.87	76.63	✓ 100.13	Z(1-4)	72.5		2/9/2006
223	3767441.7	1182351.5	37.56.15.41	-75.27.25.65	93.51	✓ 98.88	Z(1-4)	58.7		2/9/2006
224	3767438.8	1182351.6	37.56.15.42	-75.27.25.77	84.69	✓ 101.49	Z(1-4)	97.8		2/9/2006
225	3767429.52	1182333.8	37.56.14.85	-75.27.26.17	38.54	✓ 52.28	Z(1-4)	80.1		2/9/2006

Geophysical Dig Sheet and Target History

GRID 3A Unique Target ID	ORIGINAL SURVEY Easting Coord. (m)	Northing Coord. (m)	Lat. Coord.	Long. Coord.	X - Local (Grid) Coord. (ft)	Y - Local (Grid) Coord. (ft)	Channel ID (i.e. C1, top senor, gradient)	Response Amplitude (mV)	Dig Priority	Date
226	3767437.92	1182325.8	37.56.14.58	-75.27.25.84	56.45	20.2	Z(1-4)	100.3		2/9/2006
227	3767437.37	1182326.35	37.56.14.60	-75.27.25.86	55.29	22.41	Z(1-4)	84		2/9/2006

Note: *Fill in Acceptable Units (mV, nT/m, ppt, etc).

**Optional field – refer to SOW for applicability to specific project.

***For Anomaly type, U = UXO, F = frag, MD = munitions debris, S = scrap, A = small arms ammunition, NC = no contact, O = other.

Geophysical Dig Sheet and Target History

GRID 3A Unique Target ID	REACQUISITION SURVEY Geophysical Instrument **	GPS Instrument**	Date	Comment	Response Amplitude (units*)**
1	Schonstedt	NA	2-15-06	used X/Y coordinates to locate targets	NA
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					
14					
15					

Geophysical Dig Sheet and Target History

GRID 3A Unique Target ID	REACQUISITION SURVEY				
	Geophysical Instrument **	GPS Instrument**	Date	Comment	Response Amplitude (units*)**
16	Schondstedt	NA	2-15-06	used X/Y coordinates to locate Targets	NA
17					
18					
19					
20					
21					
22					
23					
24					
25					
26					
27					
28					
29					
30					

Geophysical Dig Sheet and Target History

GRID 3A Unique Target ID	REACQUISITION SURVEY				
	Geophysical Instrument **	GPS Instrument**	Date	Comment	Response Amplitude (units*)**
31	Schondstedt	NA	2-15-06	used x/y coordinates to locate targets	NA
32					
33					
34					
35					
36					
37					
38					
39					
40					
41					
42					
43					
44					
45					

Geophysical Dig Sheet and Target History

GRID 3A Unique Target ID	REACQUISITION SURVEY Geophysical Instrument **	GPS Instrument**	Date	Comment	Response Amplitude (units*)**
46	Schondstedt	NA	2-15-06	used x/y coordinates to locate targets	NA
47					
48					
49					
50					
51					
52					
53					
54					
55					
56					
57					
58					
59					
60					

Geophysical Dig Sheet and Target History

GRID 3A Unique Target ID	REACQUISITION SURVEY				
	Geophysical Instrument **	GPS Instrument**	Date	Comment	Response Amplitude (units*)**
61	Schondstedt	NA	2-15-06	used x/y coordinates to locate targets	NA
62					
63					
64					
65					
66					
67					
68					
69					
70					
71					
72					
73					
74					
75					

Geophysical Dig Sheet and Target History

GRID 3A Unique Target ID	REACQUISITION SURVEY Geophysical Instrument **	GPS Instrument**	Date	Comment	Response Amplitude (units*)**
76	Schondstedt	NA	2-15-06	used x/y coordinates to locate targets	NA
77					
78					
79					
80					
81					
82					
83					
84					
85					
86					
87					
88					
89					
90					

Geophysical Dig Sheet and Target History

GRID 3A Unique Target ID	REACQUISITION SURVEY				
	Geophysical Instrument **	GPS Instrument**	Date	Comment	Response Amplitude (units*)**
91	Schondstedt	NA	2-15-06	used x/y coordinates to locate targets	NA
92					
93					
94					
95					
96					
97					
98					
99					
100					
101					
102					
103					
104					
105					

Geophysical Dig Sheet and Target History

GRID 3A Unique Target ID	REACQUISITION SURVEY Geophysical Instrument **	GPS Instrument**	Date	Comment	Response Amplitude (units*)**
106	Schondstedt	NA	2-15-06	used x/y coordinates to locate targets	NA
107					
108					
109					
110					
111					
112					
113					
114					
115					
116					
117					
118					
119					
120					

Geophysical Dig Sheet and Target History

GRID 3A Unique Target ID	REACQUISITION SURVEY				
	Geophysical Instrument **	GPS Instrument**	Date	Comment	Response Amplitude (units*)**
121	Schonstedt	NA	2-15-06	used x/y coordinates to locate targets	NA
122					
123					
124					
125					
126					
127					
128					
129					
130					
131					
132					
133					
134					
135					

Geophysical Dig Sheet and Target History

GRID 3A Unique Target ID	REACQUISITION SURVEY				
	Geophysical Instrument **	GPS Instrument**	Date	Comment	Response Amplitude (units*)**
136	Schondstedt	NA	2-15-06	used x/y coordinates to locate targets	NA
137					
138					
139					
140					
141					
142					
143					
144					
145					
146					
147					
148					
149					
150					

Geophysical Dig Sheet and Target History

GRID 3A Unique Target ID	REACQUISITION SURVEY				
	Geophysical Instrument **	GPS Instrument**	Date	Comment	Response Amplitude (units*)**
151	Schondstedt	NA	2-15-06	used x/y coordinates to locate targets	NA
152					
153					
154					
155					
156					
157					
158					
159					
160					
161					
162					
163					
164					
165					

Geophysical Dig Sheet and Target History

GRID 3A Unique Target ID	REACQUISITION SURVEY Geophysical Instrument **	GPS Instrument**	Date	Comment	Response Amplitude (units*)**
166	Schondstedt	NA	2-15-06	used x/y coordinates to locate targets	NA
167					
168					
169					
170					
171					
172					
173					
174					
175					
176					
177					
178					
179					
180					

Geophysical Dig Sheet and Target History

GRID 3A Unique Target ID	REACQUISITION SURVEY				
	Geophysical Instrument **	GPS Instrument**	Date	Comment	Response Amplitude (units*)**
181	Schondstedt	NA	2-15-06	used x/y coordinates to locate targets	NA
182					
183					
184					
185					
186					
187					
188					
189					
190					
191					
192					
193					
194					
195					

Geophysical Dig Sheet and Target History

GRID 3A Unique Target ID	REACQUISITION SURVEY				
	Geophysical Instrument **	GPS Instrument**	Date	Comment	Response Amplitude (units*)**
196	Schondstedt	NA	2-15-06	used x/y coordinates to locate targets	NA
197					
198					
199					
200					
201					
202					
203					
204					
205					
206					
207					
208					
209					
210					

Geophysical Dig Sheet and Target History

GRID 3A	REACQUISITION SURVEY				
Unique Target ID	Geophysical Instrument **	GPS Instrument**	Date	Comment	Response Amplitude (units*)**
211	Schonstedt	NA	2-15-06	Used x/y coordinates to locate targets	NA
212					
213					
214					
215					
216					
217					
218					
219					
220					
221					
222					
223					
224					
225					

Geophysical Dig Sheet and Target History

GRID 3A Unique Target ID	REACQUISITION SURVEY Geophysical Instrument **	GPS Instrument**	Date	Comment	Response Amplitude (units*)**
226	Schonstedt	NA	2-15-06	used x/y coordinates to locate targets	NA
227	↓	↓	↓	↓	↓

Geophysical Dig Sheet and Target History

GRID 3A Unique Target ID	DIG RESULTS										
	Anomaly Type ***	Approx. Weight (lbs-~~oz/kg-g~~)	Comments (e.g., response below 1 foot)	Offset Distance (ft)	Offset Direction (N, NE, etc.)	Orientation of Nose (Azimuth deg)	Inclination of Nose (deg)	Depth to Top of Item (in/~~cm~~)	Digital Photo Number	2006 Date	Team Leader
1	MD	.5	20mm	0.5				4.0		15Feb06	
2			fence						NO PIC	15Feb06	
3	MD	.6	20mm x2	0				6.0		15Feb06	
4	MD	.8	20mm x2	0				6.0		15Feb06	
5	S		LIP - rebar	0				2.0	~~NO #~~	15Feb06	
6	MD	.7	20mm x2	0.5				8.0		15Feb06	
7	MD	1.0	20mm x4	0				6.0		15Feb06	
8	MD	.2	20 mm	0				4.0		15Feb06	
9	S	.2	Scrap	0				4.0		15Feb06	
10			LIP	0				>12.0"	NO PIC	15Feb06	
11	MD	.4	20mm	0.5				6.0		15Feb06	
12	S	2.2	scrap x2	0				5.0		15Feb06	
13	S	.1	Scrap	0				6.0		15Feb06	
14	S	.3	scrap	0				6.0		15Feb06	
15			fence						NO PIC	15Feb06	

Geophysical Dig Sheet and Target History

GRID 3A Unique Target ID	DIG RESULTS										
	Anomaly Type ***	Approx. Weight (lbs-~~oz/kg-g~~)	Comments (e.g., response below 1 foot)	Offset Distance (ft)	Offset Direction (N, NE, etc.)	Orientation of Nose (Azimuth deg)	Inclination of Nose (deg)	Depth to Top of Item (in/~~cm~~)	Digital Photo Number	2006 Date	Team Leader
16	S	.1	scrap	0.5				4.0		15Feb06	
17			LIP	0				>12.0"	NO PIC	15Feb06	
18			fence						NO PIC	15Feb06	
19			LIP	0				>12.0"	NO PIC	15Feb06	
20	MD	1.0	20mm X3	0				6.0		15Feb06	
21			LIP	0				>12.0"	NO PIC	15Feb06	
22	S	.1	scrap	0				5.0		15Feb06	
23	FP		no contact							15Feb06	
24			LIP	0				>12.0"	NO PIC	15Feb06	
25	MD	.3	20 mm					10.0		15Feb06	
26	MD	.7	20mm X2	0				8.0		15Feb06	
27			LIP	0				>12.0"	NO PIC	15Feb06	
28	FP		no contact							15Feb06	
29	S	.2	scrap	0.5				4.0		15Feb06	
30	MD	.5	20 mm	0				10.0		15Feb06	

Geophysical Dig Sheet and Target History

GRID 3A Unique Target ID	DIG RESULTS										
	Anomaly Type ***	Approx. Weight (lbs-~~oz/kg-g~~)	Comments (e.g., response below 1 foot)	Offset Distance (ft)	Offset Direction (N, NE, etc.)	Orientation of Nose (Azimuth deg)	Inclination of Nose (deg)	Depth to Top of Item (in/~~cm~~)	Digital Photo Number	2006 Date	Team Leader
31	S	.1	Scrap	0				4.0		15Feb06	W
32	MD	.3	20mm	0				6.0		15Feb06	W
33	FP		no contact							15Feb06	W
34			utility line	0					NO PIC	15Feb06	W
35			LIP	0				>12.0"	NO PIC	15Feb06	W
36	MD	.2	20mm	0				6.0		15Feb06	W
37	S	10.0	pipe	0				10.0		15Feb06	W
38			utility line	0					NO PIC	15Feb06	W
39			LIP	0				>12.0"	NO PIC	15Feb06	W
40	MD	.3	20mm	0				8.0		15Feb06	W
41	MD	.2	20mm	0				6.0		15Feb06	W
42	S	.2	Scrap	0.5				5.0		15Feb06	W
43			fence						NO PIC	15Feb06	W
44	MD	.6	30mm	0				10.0		15Feb06	W
45	S	.1	nail	1.0				4.0		15Feb06	W

✓

Geophysical Dig Sheet and Target History

GRID 3A Unique Target ID	DIG RESULTS										
	Anomaly Type ***	Approx. Weight (lbs/~~oz/kg g~~)	Comments (e.g., response below 1 foot)	Offset Distance (ft)	Offset Direction (N, NE, etc.)	Orientation of Nose (Azimuth deg)	Inclination of Nose (deg)	Depth to Top of Item (in/~~cm~~)	Digital Photo Number	2006 Date	Team Leader
46	MD	.3	20 mm	0				6.0		15Feb06	W
47	MD	.3	20 mm	0				6.0		15Feb06	W
48	MD	.3	20 mm	0.5				8.0		15Feb06	W
49			fence						NO PIC	15Feb06	W
50			LIP	0				>12.0"	NO PIC	15Feb06	W
51	S	.3	Scrap x2	0				6.0		15Feb06	W
52	MD	.5	30 mm	0				8.0		15Feb06	W
53	MD	.4	20 mm	0				10.0		15Feb06	W
54	MD	.7	20 mm x 2	0				10.0		15Feb06	W
55	S	.2	wire	0				4.0		15Feb06	W
56	MD	.4	20 mm	0				10.0		15Feb06	W
57	S	.5+	LIP - rebar	0				>12.0"		16Feb06	W
58	S	1.0	pipe	0				10.0		15Feb06	W
59	S	1.3	rebar	0				12.0		15Feb06	W
60	MD	.4	20 mm	0				6.0		15Feb06	W

Geophysical Dig Sheet and Target History

GRID 3A Unique Target ID	DIG RESULTS										
	Anomaly Type ***	Approx. Weight (lbs/~~oz/kg/g~~)	Comments (e.g., response below 1 foot)	Offset Distance (ft)	Offset Direction (N, NE, etc.)	Orientation of Nose (Azimuth deg)	Inclination of Nose (deg)	Depth to Top of Item (in/~~cm~~)	Digital Photo Number	2006 Date	Team Leader
61	S	.2	nail	1.0				4.0		15Feb06	W
62	S	1.2	rebar	0				12.0		15Feb06	W
63	MD	.3	20 mm	0				6.0		15Feb06	W
64	MD	.4	20 mm	0				6.0		15Feb06	W
65	S	1.0	railroad spike	0				10.0		15Feb06	W
66	MD	.5	20 mm	0				8.0		15Feb06	W
67	S	.1	wire	1.0				6.0		15Feb06	W
68	S	5.0	wood with nails	0				10.0		15Feb06	W
69	MD	.4	20 mm	0				4.0		15Feb06	W
70	S	.1	nail	1.0				6.0		15Feb06	W
71	MD	.4	20mm	0				4.0		15Feb06	W
72	MD	1.5	20 mm x 5	0				12.0		15Feb06	W
73	S	.2	scrap	0				8.0		15Feb06	W
74	MD	.4	20 mm	0				8.0		15Feb06	W
75	MD	.4	20 mm	0				4.0		15Feb06	W

Geophysical Dig Sheet and Target History

GRID 3A Unique Target ID	DIG RESULTS Anomaly Type ***	Approx. Weight (lbs/~~oz/kg-g~~)	Comments (e.g., response below 1 foot)	Offset Distance (ft)	Offset Direction (N, NE, etc.)	Orientation of Nose (Azimuth deg)	Inclination of Nose (deg)	Depth to Top of Item (in/~~cm~~)	Digital Photo Number	2006 Date	Team Leader
76	MD	.2	20 mm	0.5				4.0		15Feb06	W
77	MD	.9	20 mm x3	0				6.0		15Feb06	W
78	MD	.6	20 mm	0				6.0		15Feb06	W
79	MD	.7	20 mm	0				6.0		15Feb06	W
80	S	.2	Scrap	0				4.0		15Feb06	W
81	S	.3	wire	1.0				2.0		15Feb06	W
82	MD	.4	20mm	0				8.0		15Feb06	W
83	S	.3	Scrap	0				6.0		15Feb06	W
84	MD	.3	20mm	0.5				4.0		15Feb06	W
85	MD	1.0	20 mm X3	0				10.0		15Feb06	W
86	S	.8	Wire	0				4.0		15Feb06	W
87	MD	.9	20mm X 2	0				8.0		15Feb06	W
88	MD	.4	20 mm	0				6.0		15Feb06	W
89	MD	.3	20mm	0				6.0		15Feb06	W
90	S	.2	nail	1.0				4.0		15Feb06	W

Geophysical Dig Sheet and Target History

GRID 3A Unique Target ID	DIG RESULTS											
	Anomaly Type ***	Approx. Weight (lbs-~~oz/kg-g~~)	Comments (e.g., response below 1 foot)	Offset Distance (ft)	Offset Direction (N, NE, etc.)	Orientation of Nose (Azimuth deg)	Inclination of Nose (deg)	Depth to Top of Item (in/~~cm~~)	Digital Photo Number	2006 Date	Team Leader
91	S	.2	Scrap	0.5				6.0		15Feb06	W
92	MD	.4	20 mm	0				8.0		15Feb06	W
93	MD	.5	20 mm	0				8.0		15Feb06	W
94	S	.1	Scrap	0				4.0		15Feb06	W
95	S	.2	scrap	0.5				6.0		15Feb06	W
96	MD	.3	20 mm	0				4.0		15Feb06	W
97	S	.6	Scrap	0				10.0		15Feb06	W
98	MD	.4	20mm	0				8.0		15Feb06	W
99	S	.2	nail	0				6.0		15Feb06	W
100	MD	1.6	20mm X 7	0				12.0		15Feb06	W
101	MD	3.0	75mm	0				8.0		16Feb06	W
102	MD	.5	30mm	0				8.0		15Feb06	W
103	S	.2	nail	1.0				8.0		15Feb06	W
104	MD	.4	20 mm	0				6.0		15Feb06	W
105	MD	.4	20 mm	0				6.0		15Feb06	W

Geophysical Dig Sheet and Target History

GRID 3A Unique Target ID	DIG RESULTS										
	Anomaly Type ***	Approx. Weight (lbs-~~oz/kg-g~~)	Comments (e.g., response below 1 foot)	Offset Distance (ft)	Offset Direction (N, NE, etc.)	Orientation of Nose (Azimuth deg)	Inclination of Nose (deg)	Depth to Top of Item (in/~~cm~~)	Digital Photo Number	2006 Date	Team Leader
106	MD	.3	20 mm	0				4.0		15Feb06	W
107	S	.1	scrap	0				4.0		15Feb06	W
108	MD	.5	20 mm	0				6.0		15Feb06	W
109	MD	1.4	20 mm X6	0				4.0		15Feb06	W
110	MD	.4	20 mm	0				6.0		15Feb06	W
111	MD	.7	20 mm	0				10.0		15Feb06	W
112	MD	.7	20 mm X2	0				8.0		15Feb06	W
113	MD	.3	20 mm	0.5				6.0		15Feb06	W
114	MD	.4	20 mm	0				10.0		15Feb06	W
115	MD	1.0	20 mm X4	0				10.0		15Feb06	W
116	MD	1.6	20 mm X6	0				12.0		15Feb06	W
117	MD	.5	20 mm	0				8.0		15Feb06	W
118	MD	.4	20 mm	0				6.0		15Feb06	W
119	S	.2	nail	1.0				6.0		15Feb06	W
120	S	1.0	metal rod	0				8.0		15Feb06	W

Geophysical Dig Sheet and Target History

GRID 3A Unique Target ID	DIG RESULTS										
	Anomaly Type ***	Approx. Weight (lbs ~~oz/kg g~~)	Comments (e.g., response below 1 foot)	Offset Distance (ft)	Offset Direction (N, NE, etc.)	Orientation of Nose (Azimuth deg)	Inclination of Nose (deg)	Depth to Top of Item (in/~~cm~~)	Digital Photo Number	2006 Date	Team Leader
121	MD	.4	20mm	0.5				6.0		15Feb06	[illegible]
122	S	1.0	scrap	0				8.0		15Feb06	[illegible]
123	S	8.0	metal rod	0				12.0		15Feb06	[illegible]
124	MD	2.0	20mm x5	0				10.0		16Feb06	[illegible]
125	MD	.4	20mm	0				6.0		15Feb06	[illegible]
126	MD	.2	20mm	0.5				4.0		15Feb06	[illegible]
127			concrete cable splice box	0				0.0		15Feb06	[illegible]
128	MD	.6	20mm	0				8.0		15Feb06	[illegible]
129	MD	2.6	20mm x8	0				10.0		16Feb06	[illegible]
130	S	.3	nail	1.0				4.0		15Feb06	[illegible]
131			concrete cable splice box	0				0.0		15Feb06	[illegible]
132	MD	3.4	75mm + 20mm	0				8.0		16Feb06	[illegible]
133	MD	.4	20mm	0				8.0		15Feb06	[illegible]
134			concrete cable splice box	0				0.0		15Feb06	[illegible]
135	MD	.4	20mm	0				8.0		15Feb06	[illegible]

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Geophysical Dig Sheet and Target History

GRID 3A Unique Target ID	DIG RESULTS										
	Anomaly Type ***	Approx. Weight (lbs-~~oz/kg-g~~)	Comments (e.g., response below 1 foot)	Offset Distance (ft)	Offset Direction (N, NE, etc.)	Orientation of Nose (Azimuth deg)	Inclination of Nose (deg)	Depth to Top of Item (in/~~cm~~)	Digital Photo Number	2006 Date	Team Leader
136	MD	1.8	20mm x4	0					10.0	16Feb06	
137	S	1.0	metal bars x2	0					10.0	15Feb06	
138	MD	.3	20mm	0.5					6.0	16Feb06	
139	MD	.4	20mm	0					6.0	15Feb06	
140	MD	.8	30mm	0					10.0	16Feb06	
141	S	1.0	Scrap	0					8.0	15Feb06	
142	MD	.4	20mm	0					6.0	15Feb06	
143	S	.4	wire	1.0					6.0	15Feb06	
144	MD	.9	20mm x2	0					10.0	15Feb06	
145	MD	.8	20mm	0					8.0	15Feb06	
146	MD	2.4	20 mm x 7	0					8.0	16Feb06	
147	MD	.4	20mm	0.5					6.0	15Feb06	
148			LIP concrete culvert	0					6.0	15Feb06	
149	MD	1.5	20mm x4	0					12.0	16Feb06	
150	S	.4	nails x2	0.5					6.0	15Feb06	

Geophysical Dig Sheet and Target History

GRID 3A Unique Target ID	DIG RESULTS										
	Anomaly Type ***	Approx. Weight (lbs/~~oz/kg-g~~)	Comments (e.g., response below 1 foot)	Offset Distance (ft)	Offset Direction (N, NE, etc.)	Orientation of Nose (Azimuth deg)	Inclination of Nose (deg)	Depth to Top of Item (in/~~cm~~)	Digital Photo Number	2006 Date	Team Leader
151	MD	.6	20mm x2	0				6.0		15Feb06	[illegible]
152	MD	.7	20 mm x2	0				10.0		15Feb 06	[illegible]
153	MD	.4	20mm	0				6.0		15Feb06	[illegible]
154	MD	2.8	30 mm x1 20 mm x 10	0				12.0		16Feb06	[illegible]
155	MD	.8	20mm x3	0				8.0		15Feb06	[illegible]
156	S	.9	Scrap	0				8.0		15Feb06	[illegible]
157	MD	.4	20 mm	0.5				4.0		15Feb06	[illegible]
158	S	.3	wire	1.0				2.0		15Feb06	[illegible]
159	MD	.5	20 mm	0				4.0		15Feb06	[illegible]
160	MD	.8	20 mm x3	0				8.0		15Feb06	[illegible]
161	MD	.8	20 mm x2	0				10.0		15Feb06	[illegible]
162	MD	.6	20mm	0				6.0		15Feb06	[illegible]
163	MD	.4	20 mm	0				4.0		15Feb06	[illegible]
164	MD	2.4	20mm x7	0				10.0		16 Feb06	[illegible]
165	MD	1.3	20mm x3	0				10.0		16 Feb 06	[illegible]

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Geophysical Dig Sheet and Target History

GRID 3A Unique Target ID	Anomaly Type ***	Approx. Weight (lbs ~~oz/kg-g~~)	Comments (e.g., response below 1 foot)	Offset Distance (ft)	Offset Direction (N, NE, etc.)	Orientation of Nose (Azimuth deg)	Inclination of Nose (deg)	Depth to Top of Item (in ~~/cm~~)	Digital Photo Number	2006 Date	Team Leader
	DIG RESULTS										
166	MD	1.5	20mm x4	0				12.0		16Feb06	W
167	MD	.7	30mm x2	0				8.0		16Feb06	W
168	S	.2	Scrap	0.5				4.0		15Feb06	W
169	S	.2	bolt	0				4.0		15Feb06	W
170	MD	.4	20mm	0				4.0		15Feb06	W
171	S	.2	nail	1.0				6.0		15Feb06	W
172	S	1.0	rebar	0				8.0		15Feb06	W
173	S	.1	scrap	1.0				2.0		15Feb06	W
174	MD	.6	20mm	0				6.0		15Feb06	W
175	MD	.5	20mm	0				10.0		16Feb06	W
176	MD	1.1	20mm x3	0				8.0		16Feb06	W
177	S	.3	nail	1.0				4.0		15Feb06	W
178	MD	1.0	20mm x4	0				10.0		16Feb06	W
179	MD	.8	20mm x3	0				6.0		15Feb06	W
180	MD	.9	30mm	0				8.0		16Feb06	W

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Geophysical Dig Sheet and Target History

GRID 3A Unique Target ID	DIG RESULTS										
	Anomaly Type ***	Approx. Weight (lbs-oz/~~kg-g~~)	Comments (e.g., response below 1 foot)	Offset Distance (ft)	Offset Direction (N, NE, etc.)	Orientation of Nose (Azimuth deg)	Inclination of Nose (deg)	Depth to Top of Item (in/~~cm~~)	Digital Photo Number	2006 Date	Team Leader
181	S	2.0	scrap	0				8.0		15Feb06	
182	MD	.7	20mm x2	0				8.0		15Feb06	
183	MD	.8	30 mm	0				10.0		15Feb06	
184	MD	.3	20 mm	0				6.0		15Feb06	
185	S	.8	scrap	0				6.0		15Feb06	
186	MD	.3	20 mm	0				4.0		15Feb06	
187	S	.3	nail	1.0				4.0		15Feb06	
188	S	.8	scrap x4	0				8.0		15Feb06	
189	MD	.3	20 mm	0.5				4.0		15Feb06	
190	MD	.5	20 mm	0				10.0		16Feb06	
191	MD	.4	20 mm	0				8.0		15Feb06	
192	S	.3	bolt	0.5				6.0		15Feb06	
193	MD	.3	20 mm	0				4.0		15Feb06	
194	S	2.4	nail + scrap	0				10.0		16Feb06	
195	S	.1	nail	1.0				2.0		15Feb06	

Geophysical Dig Sheet and Target History

GRID 3A Unique Target ID	DIG RESULTS										
	Anomaly Type ***	Approx. Weight (lbs-~~oz/kg-g~~)	Comments (e.g., response below 1 foot)	Offset Distance (ft)	Offset Direction (N, NE, etc.)	Orientation of Nose (Azimuth deg)	Inclination of Nose (deg)	Depth to Top of Item (in/~~cm~~)	Digital Photo Number	2006 Date	Team Leader
196	MD	.4	20mm	0				4.0		15Feb06	[illegible]
197	S	3.0	rebar *see item #199	0				10.0		16Feb06	[illegible]
198	S	2.0	Scrap	0				10.0		15Feb06	[illegible]
199	S	3.0	rebar other end #197	0				8.0	Same as #197	16Feb06	[illegible]
200	MD	3.0	75mm	0				6.0		16Feb06	[illegible]
201	MD	.5	20 mm	0				6.0		15Feb06	[illegible]
202	MD	.5	20mm	0				6.0		15Feb06	[illegible]
203	MD	.8	30 mm	0				10.0		15Feb06	[illegible]
204	MD/S	2.0	30mm + Scrap	0				10.0		16Feb06	[illegible]
205	MD	.4	20 mm	0				6.0		15Feb06	[illegible]
206	MD	.6	20 mm	0				6.0		15Feb06	[illegible]
207	S	1.0	Scrap	0				8.0		15Feb06	[illegible]
208	S	.2	Scrap	0.5				4.0		15Feb06	[illegible]
209	MD	.5	20mm	0				4.0		16Feb06	[illegible]
210	MD	.6	20mm	0				6.0		15Feb06	[illegible]

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Geophysical Dig Sheet and Target History

GRID 3A Unique Target ID	DIG RESULTS Anomaly Type ***	Approx. Weight (lbs/~~oz/kg/g~~)	Comments (e.g., response below 1 foot)	Offset Distance (ft)	Offset Direction (N, NE, etc.)	Orientation of Nose (Azimuth deg)	Inclination of Nose (deg)	Depth to Top of Item (in/~~cm~~)	Digital Photo Number	2006 Date	Team Leader
211	MD	.6	20 mm	0				4.0		15Feb06	
212	MD	.9	20 mm x4	0				12.0		15Feb06	
213	MD	.5	20 mm	0				8.0		15Feb06	
214	MD	.9	20 mm x 3	0				8.0		15Feb06	
215	MD	.8	20 mm cart	0				8.0		15Feb06	
216	S	.8	scrap	0				10.0		15Feb06	
217	MD	1.2	20 mm X3	0				10.0		15Feb06	
218	MD	.4	20 mm	0				6.0		15Feb06	
219	MD	.4	20 mm	0				8.0		15Feb06	
220	MD	.7	20 mm	0				6.0		15Feb06	
221	S	.1	scrap	1.0				2.0		15Feb06	
222	MD	1.1	20mm X 3	0				8.0		15Feb06	
223	S	.2	wire	1.0				4.0		15Feb06	
224	MD	.6	20mm x 2	0				6.0		15Feb06	
225	S	.1	nail	1.0				4.0		15Feb06	

Geophysical Dig Sheet and Target History

GRID 3A Unique Target ID	DIG RESULTS										
	Anomaly Type ***	Approx. Weight (lbs ~~oz/kg g~~)	Comments (e.g., response below 1 foot)	Offset Distance (ft)	Offset Direction (N, NE, etc.)	Orientation of Nose (Azimuth deg)	Inclination of Nose (deg)	Depth to Top of Item (in/~~cm~~)	Digital Photo Number	2006 Date	Team Leader
226	MD	.4	20mm	0				8.0		15Feb06	W
227	S	.1	Scrap	1.0				2.0		15Feb06	W

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Geophysical Dig Sheet and Target History

GRID 3A Unique Target ID	POST-DIG UXO QC RESULTS			POST-DIG PROJECT QC		
	Excavation Hole Cleared?	UXO QC Spec. Initials	Date	Agreement Between Dig Results & Geophysical Data? (G=good, P=poor, U=unacceptable)	Project QC Initials	Date
1	Yes	EMD	2/15/06	G	VAS	2-15-06
2						
3						
4						
5						
6						
7						
8						
9						
10	NO, LIP	EMD	2/15/06	G	VAS	2-15-06
11						
12						
13						
14						
15						

Geophysical Dig Sheet and Target History

GRID 3A Unique Target ID	POST-DIG UXO QC RESULTS			POST-DIG PROJECT QC		
	Excavation Hole Cleared?	UXO QC Spec. Initials	Date	Agreement Between Dig Results & Geophysical Data? (G=good, P=poor, U=unacceptable)	Project QC Initials	Date
16						
17						
18						
19						
20	Yes	[illegible]	2/15/06	G	VAS	2-15-06
21						
22						
23						
24						
25						
26						
27						
28						
29						
30	Yes	[illegible]	2/15/06	G	VAS	2-15-06

Geophysical Dig Sheet and Target History

GRID 3A Unique Target ID	POST-DIG UXO QC RESULTS			POST-DIG PROJECT QC		
	Excavation Hole Cleared?	UXO QC Spec. Initials	Date	Agreement Between Dig Results & Geophysical Data? (G=good, P=poor, U=unacceptable)	Project QC Initials	Date
31						
32						
33						
34						
35						
36						
37						
38						
39						
40	Yes	[illegible]	2/15/06	G	VAS	2-15-06
41						
42						
43						
44						
45						

Geophysical Dig Sheet and Target History

GRID 3A Unique Target ID	POST-DIG UXO QC RESULTS			POST-DIG PROJECT QC		
	Excavation Hole Cleared?	UXO QC Spec. Initials	Date	Agreement Between Dig Results & Geophysical Data? (G=good, P=poor, U=unacceptable)	Project QC Initials	Date
46						
47						
48						
49						
50	NO, LIP	[illegible]	2/15/06	G	VAS	2-15-06
51						
52						
53						
54						
55						
56						
57						
58						
59						
60	Yes	[illegible]	2/15/06	G	VAS	2-15-06

Geophysical Dig Sheet and Target History

GRID 3A Unique Target ID	POST-DIG UXO QC RESULTS			POST-DIG PROJECT QC		
	Excavation Hole Cleared?	UXO QC Spec. Initials	Date	Agreement Between Dig Results & Geophysical Data? (G=good, P=poor, U=unacceptable)	Project QC Initials	Date
61						
62						
63						
64						
65						
66						
67						
68						
69						
70	Yes	EMD	2/15/06	G	WAS	2-15-06
71						
72						
73						
74						
75						

Geophysical Dig Sheet and Target History

GRID 3A Unique Target ID	POST-DIG UXO QC RESULTS			POST-DIG PROJECT QC		
	Excavation Hole Cleared?	UXO QC Spec. Initials	Date	Agreement Between Dig Results & Geophysical Data? (G=good, P=poor, U=unacceptable)	Project QC Initials	Date
76						
77						
78						
79						
80	Yes	EnD	2/15/06	G	VAS	2-15-06
81						
82						
83						
84						
85						
86						
87						
88						
89						
90	Yes	EnD	2/15/06	G	VAS	2-15-06

Geophysical Dig Sheet and Target History

GRID 3A Unique Target ID	POST-DIG UXO QC RESULTS			POST-DIG PROJECT QC		
	Excavation Hole Cleared?	UXO QC Spec. Initials	Date	Agreement Between Dig Results & Geophysical Data? (G=good, P=poor, U=unacceptable)	Project QC Initials	Date
91						
92						
93						
94						
95						
96						
97						
98						
99						
100	Yes	[illegible]	2/15/06	G	VAS	2-15-06
101						
102						
103						
104						
105						

Geophysical Dig Sheet and Target History

GRID 3A Unique Target ID	POST-DIG UXO QC RESULTS			POST-DIG PROJECT QC		
	Excavation Hole Cleared?	UXO QC Spec. Initials	Date	Agreement Between Dig Results & Geophysical Data? (G=good, P=poor, U=unacceptable)	Project QC Initials	Date
106						
107						
108						
109						
110	Yes	EAD	2/15/06	G	VAS	2-15-06
111						
112						
113						
114						
115						
116						
117						
118						
119						
120	Yes	EAD	2/15/06	G	VAS	2-15-06

Geophysical Dig Sheet and Target History

GRID 3A Unique Target ID	POST-DIG UXO QC RESULTS			POST-DIG PROJECT QC		
	Excavation Hole Cleared?	UXO QC Spec. Initials	Date	Agreement Between Dig Results & Geophysical Data? (G=good, P=poor, U=unacceptable)	Project QC Initials	Date
121						
122						
123						
124						
125						
126						
127						
128						
129						
130	Yes	EWD	2/15/06	G	VAS	2-15-06
131						
132						
133						
134						
135						

Geophysical Dig Sheet and Target History

GRID 3A Unique Target ID	POST-DIG UXO QC RESULTS			POST-DIG PROJECT QC		
	Excavation Hole Cleared?	UXO QC Spec. Initials	Date	Agreement Between Dig Results & Geophysical Data? (G=good, P=poor, U=unacceptable)	Project QC Initials	Date
136						
137						
138						
139						
140	Yes	EMD	2/15/06	G	VAS	2-15-06
141						
142						
143						
144						
145						
146						
147						
148						
149						
150	Yes	EMD	2/15/06	G	VAS	2-15-06

Geophysical Dig Sheet and Target History

GRID 3A Unique Target ID	POST-DIG UXO QC RESULTS			POST-DIG PROJECT QC		
	Excavation Hole Cleared?	UXO QC Spec. Initials	Date	Agreement Between Dig Results & Geophysical Data? (G=good, P=poor, U=unacceptable)	Project QC Initials	Date
151						
152						
153						
154						
155						
156						
157						
158						
159						
160	Yes	[illegible]	2/15/06	G	VAS	2-15-06
161						
162						
163						
164						
165						

Geophysical Dig Sheet and Target History

GRID 3A Unique Target ID	POST-DIG UXO QC RESULTS			POST-DIG PROJECT QC		
	Excavation Hole Cleared?	UXO QC Spec. Initials	Date	Agreement Between Dig Results & Geophysical Data? (G=good, P=poor, U=unacceptable)	Project QC Initials	Date
166						
167						
168						
169						
170	Yes	EMD	2/15/06	G	VAS	2-15-06
171						
172						
173						
174						
175						
176						
177						
178						
179						
180	Yes	EMD	2/15/06	G	VAS	2-15-06

Geophysical Dig Sheet and Target History

GRID 3A Unique Target ID	POST-DIG UXO QC RESULTS			POST-DIG PROJECT QC		
	Excavation Hole Cleared?	UXO QC Spec. Initials	Date	Agreement Between Dig Results & Geophysical Data? (G=good, P=poor, U=unacceptable)	Project QC Initials	Date
181						
182						
183						
184						
185						
186						
187						
188						
189						
190	Yes	EGD	2/15/06	G	VAS	2-15-06
191						
192						
193						
194						
195						

Geophysical Dig Sheet and Target History

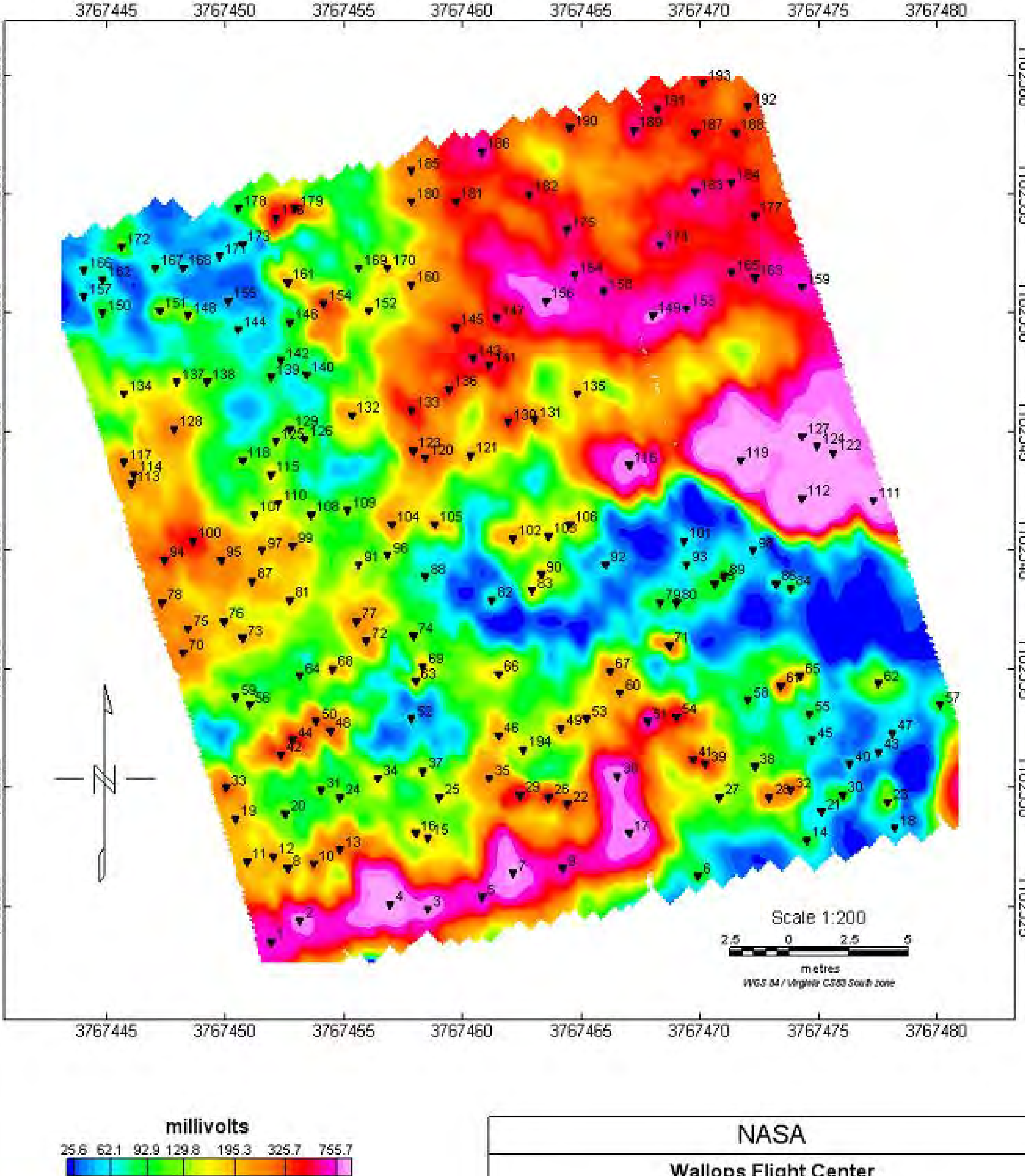
GRID 3A Unique Target ID	POST-DIG UXO QC RESULTS			POST-DIG PROJECT QC		
	Excavation Hole Cleared?	UXO QC Spec. Initials	Date	Agreement Between Dig Results & Geophysical Data? (G=good, P=poor, U=unacceptable)	Project QC Initials	Date
196						
197						
198						
199						
200	Yes	EMD	2/15/06	G	VAS	2-15-06
201						
202						
203						
204						
205						
206						
207						
208						
209						
210	Yes	EMD	2/15/06	G	VAS	2-15-06

Geophysical Dig Sheet and Target History

GRID 3A Unique Target ID	POST-DIG UXO QC RESULTS			POST-DIG PROJECT QC		
	Excavation Hole Cleared?	UXO QC Spec. Initials	Date	Agreement Between Dig Results & Geophysical Data? (G=good, P=poor, U=unacceptable)	Project QC Initials	Date
211						
212						
213						
214						
215						
216						
217						
218						
219						
220	Yes	EMD	2/15/06	G	VAS	2-15-06
221						
222						
223						
224						
225						

Geophysical Dig Sheet and Target History

GRID 3A Unique Target ID	POST-DIG UXO QC RESULTS			POST-DIG PROJECT QC		
	Excavation Hole Cleared?	UXO QC Spec. Initials	Date	Agreement Between Dig Results & Geophysical Data? (G=good, P=poor, U=unacceptable)	Project QC Initials	Date
226						
227	Yes	[illegible]	2/15/06	G	VAS	2-15-06



NASA

Wallops Flight Center
EM61 MK2 Data
Grid 3B

February 9, 2006

Tetra Tech EM Inc.

Geophysical Dig Sheet and Target History

GRID 3B Unique Target ID	ORIGINAL SURVEY								
	Easting Coord. (m)	Northing Coord. (m)	Lat. Coord.	Long. Coord.	X - Local (Grid) Coord. (ft)	Y - Local (Grid) Coord. (ft)	Channel ID (i.e. C1, top senor, gradient)	Response Amplitude (mV)	Dig Priority
181	3767459.7	1182354.7	37.56.15.50	-75.27.24.91	53.89	94.63	Z(1-4)	410.5	
182	3767462.8	1182355	37.56.15.50	-75.27.24.78	63.7	93.11	Z(1-4)	447.8	
183	3767469.8	1182355.1	37.56.15.50	-75.27.24.50	85.29	87.88	Z(1-4)	529.3	
184	3767471.3	1182355.5	37.56.15.51	-75.27.24.44	90.29	87.95	Z(1-4)	502.7	
185	3767457.8	1182356	37.56.15.54	-75.27.24.99	49.33	100.25	Z(1-4)	269.4	
186	3767460.8	1182356.8	37.56.15.56	-75.27.24.86	59.32	100.38	Z(1-4)	578.4	
187	3767469.8	1182357.6	37.56.15.58	-75.27.24.49	87.73	95.73	Z(1-4)	405.6	
188	3767471.5	1182357.6	37.56.15.58	-75.27.24.42	92.95	94.38	Z(1-4)	389.2	
189	3767467.2	1182357.7	37.56.15.59	-75.27.24.60	79.85	98.11	Z(1-4)	529.7	
190	3767464.5	1182357.8	37.56.15.59	-75.27.24.71	71.66	100.58	Z(1-4)	351.5	
191	3767468.2	1182358.6	37.56.15.61	-75.27.24.56	83.8	100.15	Z(1-4)	452.2	
192	3767472	1182358.7	37.56.15.61	-75.27.24.40	95.56	97.44	Z(1-4)	353.1	
193	3767470.1	1182359.7	37.56.15.65	-75.27.24.48	90.7	102.09	Z(1-4)	355.2	
194	3767462.53	1182331.61	37.56.14.75	-75.27.24.83	39.89	19.46	Z(1-4)	156.4	

Geophysical Dig Sheet and Target History

GRID 3B Unique Target ID	ORIGINAL SURVEY								
	Easting Coord. (m)	Northing Coord. (m)	Lat. Coord.	Long. Coord.	X - Local (Grid) Coord. (ft)	Y - Local (Grid) Coord. (ft)	Channel ID (i.e. C1, top senor, gradient)	Response Amplitude (mV)	Dig Priority

Note: *Fill in Acceptable Units (mV, nT/m, ppt, etc).

**Optional field – refer to SOW for applicability to specific project.

***For Anomaly type, U = UXO, F = frag, MD = munitions debris, S = scrap, A = small arms ammunition, NC = no contact, O =

Geophysical Dig Sheet and Target History

GRID 3B Unique Target ID	ORIGINAL SURVEY								
	Easting Coord. (m)	Northing Coord. (m)	Lat. Coord.	Long. Coord.	X - Local (Grid) Coord. (ft)	Y - Local (Grid) Coord. (ft)	Channel ID (i.e. C1, top senor, gradient)	Response Amplitude (mV)	Dig Priority
1	3767451.9	1182323.5	37.56.14.49	-75.27.25.27	-0.85	✓ 1.85	Z(1-4)	685.3	
2	3767453.1	1182324.4	37.56.14.52	-75.27.25.22	3.74	✓ 3.8	Z(1-4)	859.2	
3	3767458.5	1182324.9	37.56.14.53	-75.27.25.00	20.86	✓ 1.27	Z(1-4)	975.2	
4	3767456.9	1182325.1	37.56.14.54	-75.27.25.06	16.13	✓ 3.12	Z(1-4)	1755	
5	3767460.8	1182325.4	37.56.14.55	-75.27.24.90	28.44	✓ 1.1	Z(1-4)	750.8	
6	3767469.9	1182326.3	37.56.14.57	-75.27.24.53	57.37	✓ -2.95	Z(1-4)	108.6	
7	3767462.1	1182326.4	37.56.14.58	-75.27.24.85	33.43	✓ 3.28	Z(1-4)	1237	
8	3767452.6	1182326.6	37.56.14.59	-75.27.25.24	4.38	✓ 11.18	Z(1-4)	217.5	
9	3767464.2	1182326.6	37.56.14.58	-75.27.24.76	40.1	✓ 2.32	Z(1-4)	598	
10	3767453.7	1182326.8	37.56.14.60	-75.27.25.19	7.96	✓ 10.97	Z(1-4)	286.1	
11	3767450.9	1182326.9	37.56.14.60	-75.27.25.31	-0.55	✓ 13.44	Z(1-4)	207.4	
12	3767452	1182327.1	37.56.14.61	-75.27.25.26	3.03	✓ 13.23	Z(1-4)	230.3	
13	3767454.8	1182327.4	37.56.14.62	-75.27.25.15	11.94	✓ 12.03	Z(1-4)	292	
14	3767474.5	1182327.8	37.56.14.61	-75.27.24.34	73.03	✓ -1.7	Z(1-4)	95.9	
15	3767458.5	1182327.9	37.56.14.63	-75.27.25.00	23.83	✓ 10.79	Z(1-4)	186.7	

Geophysical Dig Sheet and Target History

GRID 3B Unique Target ID	ORIGINAL SURVEY								
	Easting Coord. (m)	Northing Coord. (m)	Lat. Coord.	Long. Coord.	X - Local (Grid) Coord. (ft)	Y - Local (Grid) Coord. (ft)	Channel ID (i.e. C1, top senor, gradient)	Response Amplitude (mV)	Dig Priority
16	3767458	1182328.1	37.56.14.64	-75.27.25.02	22.49	11.8	Z(1-4)	185.7	
17	3767467	1182328.1	37.56.14.63	-75.27.24.65	50.21	4.94	Z(1-4)	1130	
18	3767478.2	1182328.3	37.56.14.62	-75.27.24.19	84.93	-2.92	Z(1-4)	68.3	
19	3767450.4	1182328.7	37.56.14.66	-75.27.25.33	-0.31	19.55	Z(1-4)	215	
20	3767452.5	1182328.9	37.56.14.67	-75.27.25.24	6.35	18.57	Z(1-4)	124.3	
21	3767475.1	1182329	37.56.14.65	-75.27.24.31	76.05	1.63	Z(1-4)	70.5	
22	3767464.4	1182329.3	37.56.14.67	-75.27.24.75	43.38	10.71	Z(1-4)	352.8	
23	3767477.9	1182329.4	37.56.14.66	-75.27.24.20	85.08	0.78	Z(1-4)	151.6	
24	3767454.8	1182329.6	37.56.14.69	-75.27.25.14	14.12	19.02	Z(1-4)	123.9	
25	3767459	1182329.6	37.56.14.68	-75.27.24.97	27.05	15.8	Z(1-4)	160.7	
26	3767463.6	1182329.6	37.56.14.68	-75.27.24.78	41.21	12.27	Z(1-4)	383.1	
27	3767470.8	1182329.6	37.56.14.67	-75.27.24.49	63.39	6.79	Z(1-4)	150	
28	3767472.9	1182329.6	37.56.14.67	-75.27.24.40	69.86	5.19	Z(1-4)	264	
29	3767462.4	1182329.7	37.56.14.68	-75.27.24.83	37.61	13.51	Z(1-4)	476.7	
30	3767476	1182329.7	37.56.14.67	-75.27.24.28	79.52	3.16	Z(1-4)	112.1	

Geophysical Dig Sheet and Target History

GRID 3B Unique Target ID	ORIGINAL SURVEY								
	Easting Coord. (m)	Northing Coord. (m)	Lat. Coord.	Long. Coord.	X - Local (Grid) Coord. (ft)	Y - Local (Grid) Coord. (ft)	Channel ID (i.e. C1, top senor, gradient)	Response Amplitude (mV)	Dig Priority
31	3767454	1182329.9	37.56.14.70	-75.27.25.18	11.95	20.59	Z(1-4)	112.4	
32	3767473.8	1182329.9	37.56.14.68	-75.27.24.37	72.93	5.45	Z(1-4)	309.3	
33	3767450	1182330	37.56.14.71	-75.27.25.34	-0.25	24	Z(1-4)	335.8	
34	3767456.4	1182330.4	37.56.14.71	-75.27.25.08	19.83	20.33	Z(1-4)	174	
35	3767461.1	1182330.4	37.56.14.71	-75.27.24.89	34.3	16.72	Z(1-4)	246.5	
36	3767466.5	1182330.5	37.56.14.71	-75.27.24.66	51.03	12.9	Z(1-4)	871.5	
37	3767458.3	1182330.7	37.56.14.72	-75.27.25.00	25.98	19.82	Z(1-4)	150.1	
38	3767472.3	1182330.9	37.56.14.71	-75.27.24.43	69.29	9.75	Z(1-4)	138.9	
39	3767470.2	1182331	37.56.14.72	-75.27.24.51	62.92	11.66	Z(1-4)	355.1	
40	3767476.3	1182331	37.56.14.71	-75.27.24.26	81.71	7.02	Z(1-4)	56.2	
41	3767469.7	1182331.2	37.56.14.72	-75.27.24.53	61.57	12.67	Z(1-4)	398.1	
42	3767452.3	1182331.4	37.56.14.75	-75.27.25.24	8.21	26.67	Z(1-4)	356.6	
43	3767477.5	1182331.5	37.56.14.73	-75.27.24.21	85.9	7.69	Z(1-4)	63.3	
44	3767452.8	1182332	37.56.14.77	-75.27.25.22	10.34	28.19	Z(1-4)	369.2	
45	3767474.7	1182332	37.56.14.75	-75.27.24.33	77.76	11.39	Z(1-4)	77.5	

Geophysical Dig Sheet and Target History

GRID 3B Unique Target ID	ORIGINAL SURVEY								
	Easting Coord. (m)	Northing Coord. (m)	Lat. Coord.	Long. Coord.	X - Local (Grid) Coord. (ft)	Y - Local (Grid) Coord. (ft)	Channel ID (i.e. C1, top senor, gradient)	Response Amplitude (mV)	Dig Priority
46	3767461.5	1182332.2	37.56.14.77	-75.27.24.87	37.31	22.11	Z(1-4)	226.2	
47	3767478.1	1182332.3	37.56.14.75	-75.27.24.19	88.54	9.75	Z(1-4)	59.1	
48	3767454.4	1182332.4	37.56.14.78	-75.27.25.16	15.66	28.22	Z(1-4)	327.2	
49	3767464.1	1182332.5	37.56.14.77	-75.27.24.76	45.61	21.07	Z(1-4)	230.4	
50	3767453.8	1182332.8	37.56.14.79	-75.27.25.18	14.21	29.96	Z(1-4)	322.9	
51	3767467.8	1182332.8	37.56.14.78	-75.27.24.61	57.29	19.18	Z(1-4)	658.9	
52	3767457.8	1182332.9	37.56.14.79	-75.27.25.02	26.61	27.18	Z(1-4)	56.1	
53	3767465.2	1182332.9	37.56.14.78	-75.27.24.71	49.39	21.49	Z(1-4)	199.6	
54	3767469	1182333	37.56.14.78	-75.27.24.56	61.19	18.89	Z(1-4)	452.4	
55	3767474.6	1182333.1	37.56.14.78	-75.27.24.33	78.53	14.93	Z(1-4)	88.3	
56	3767451	1182333.5	37.56.14.82	-75.27.25.30	6.29	34.35	Z(1-4)	138.4	
57	3767480.1	1182333.5	37.56.14.79	-75.27.24.10	95.88	12.01	Z(1-4)	94.6	
58	3767472	1182333.7	37.56.14.80	-75.27.24.44	71.11	18.81	Z(1-4)	106.5	
59	3767450.4	1182333.8	37.56.14.83	-75.27.25.32	4.74	35.77	Z(1-4)	135.7	
60	3767466.6	1182334	37.56.14.82	-75.27.24.66	54.78	23.89	Z(1-4)	225.5	

Geophysical Dig Sheet and Target History

GRID 3B Unique Target ID	ORIGINAL SURVEY								
	Easting Coord. (m)	Northing Coord. (m)	Lat. Coord.	Long. Coord.	X - Local (Grid) Coord. (ft)	Y - Local (Grid) Coord. (ft)	Channel ID (i.e. C1, top senor, gradient)	Response Amplitude (mV)	Dig Priority
61	3767473.4	1182334.3	37.56.14.82	-75.27.24.38	76.01	19.63	Z(1-4)	318.8	
62	3767477.5	1182334.4	37.56.14.82	-75.27.24.21	88.74	16.82	Z(1-4)	146.2	
63	3767458	1182334.5	37.56.14.84	-75.27.25.01	28.8	32.1	Z(1-4)	162.1	
64	3767453.1	1182334.7	37.56.14.86	-75.27.25.21	13.93	36.53	Z(1-4)	109.8	
65	3767474.2	1182334.7	37.56.14.83	-75.27.24.34	78.87	20.28	Z(1-4)	198.1	
66	3767461.5	1182334.8	37.56.14.85	-75.27.24.86	39.87	30.34	Z(1-4)	175.5	
67	3767466.2	1182334.9	37.56.14.85	-75.27.24.67	54.43	27.04	Z(1-4)	261.3	
68	3767454.5	1182335	37.56.14.86	-75.27.25.15	18.53	36.4	Z(1-4)	207	
69	3767458.3	1182335.1	37.56.14.86	-75.27.24.99	30.32	33.77	Z(1-4)	195.2	
70	3767448.2	1182335.7	37.56.14.89	-75.27.25.41	-0.15	43.52	Z(1-4)	276.2	
71	3767468.7	1182336	37.56.14.88	-75.27.24.57	63.21	28.59	Z(1-4)	299.5	
72	3767455.9	1182336.2	37.56.14.90	-75.27.25.09	24.02	39.11	Z(1-4)	227.9	
73	3767450.7	1182336.3	37.56.14.91	-75.27.25.30	8.13	43.48	Z(1-4)	203.7	
74	3767457.9	1182336.4	37.56.14.91	-75.27.25.01	30.37	38.2	Z(1-4)	129.5	
75	3767448.4	1182336.7	37.56.14.93	-75.27.25.40	1.46	46.55	Z(1-4)	269.9	

Geophysical Dig Sheet and Target History

GRID 3B Unique Target ID	ORIGINAL SURVEY								
	Easting Coord. (m)	Northing Coord. (m)	Lat. Coord.	Long. Coord.	X - Local (Grid) Coord. (ft)	Y - Local (Grid) Coord. (ft)	Channel ID (i.e. C1, top senor, gradient)	Response Amplitude (mV)	Dig Priority
76	3767449.9	1182337	37.56.14.93	-75.27.25.34	6.36	✓46.33	Z(1-4)	194.7	
77	3767455.5	1182337	37.56.14.93	-75.27.25.11	23.58	✓41.96	Z(1-4)	240	
78	3767447.3	1182337.8	37.56.14.96	-75.27.25.44	-0.83	✓50.91	Z(1-4)	267.2	
79	3767468.3	1182337.8	37.56.14.94	-75.27.24.58	63.74	✓34.58	Z(1-4)	90.2	
80	3767469	1182337.8	37.56.14.94	-75.27.24.55	65.9	✓34.04	Z(1-4)	93.9	
81	3767452.7	1182337.9	37.56.14.96	-75.27.25.22	15.86	✓ 47	Z(1-4)	183.7	
82	3767461.2	1182337.9	37.56.14.95	-75.27.24.87	42	✓40.38	Z(1-4)	81.1	
83	3767462.9	1182338.3	37.56.14.96	-75.27.24.80	47.62	✓40.33	Z(1-4)	176.2	
84	3767473.8	1182338.4	37.56.14.95	-75.27.24.36	81.26	✓32.23	Z(1-4)	96.2	
85	3767470.6	1182338.6	37.56.14.96	-75.27.24.49	71.61	✓35.33	Z(1-4)	104.2	
86	3767473.2	1182338.6	37.56.14.96	-75.27.24.38	79.61	✓33.33	Z(1-4)	80.9	
87	3767451.1	1182338.7	37.56.14.99	-75.27.25.28	11.73	✓50.79	Z(1-4)	230.4	
88	3767458.4	1182338.9	37.56.14.99	-75.27.24.99	34.37	✓45.72	Z(1-4)	82.6	
89	3767471	1182338.9	37.56.14.97	-75.27.24.47	73.13	✓35.96	Z(1-4)	106.4	
90	3767463.3	1182339	37.56.14.98	-75.27.24.78	49.54	✓ 42.23	Z(1-4)	187.1	

Geophysical Dig Sheet and Target History

GRID 3B Unique Target ID	ORIGINAL SURVEY								
	Easting Coord. (m)	Northing Coord. (m)	Lat. Coord.	Long. Coord.	X - Local (Grid) Coord. (ft)	Y - Local (Grid) Coord. (ft)	Channel ID (i.e. C1, top senor, gradient)	Response Amplitude (mV)	Dig Priority
91	3767455.6	1182339.4	37.56.15.01	-75.27.25.10	26.25	49.49	Z(1-4)	153	
92	3767466	1182339.4	37.56.14.99	-75.27.24.67	58.24	41.4	Z(1-4)	61.1	
93	3767469.4	1182339.4	37.56.14.99	-75.27.24.53	68.7	38.77	Z(1-4)	75.5	
94	3767447.4	1182339.6	37.56.15.02	-75.27.25.43	1.25	56.55	Z(1-4)	341.1	
95	3767449.8	1182339.6	37.56.15.02	-75.27.25.34	8.63	54.67	Z(1-4)	274.8	
96	3767456.8	1182339.8	37.56.15.02	-75.27.25.05	30.34	49.82	Z(1-4)	151.4	
97	3767451.5	1182340	37.56.15.03	-75.27.25.27	14.24	54.6	Z(1-4)	222.1	
98	3767472.2	1182340	37.56.15.01	-75.27.24.42	77.91	38.5	Z(1-4)	60.8	
99	3767452.8	1182340.2	37.56.15.03	-75.27.25.21	18.44	54.22	Z(1-4)	243.3	
100	3767448.6	1182340.4	37.56.15.04	-75.27.25.38	5.73	58.15	Z(1-4)	395.7	
101	3767469.3	1182340.4	37.56.15.02	-75.27.24.54	69.37	42	Z(1-4)	64.4	
102	3767462.1	1182340.5	37.56.15.03	-75.27.24.83	47.32	47.91	Z(1-4)	212.8	
103	3767463.6	1182340.6	37.56.15.04	-75.27.24.77	52.03	47.06	Z(1-4)	176.8	
104	3767457	1182341.1	37.56.15.06	-75.27.25.04	32.23	53.78	Z(1-4)	235.7	
105	3767458.8	1182341.1	37.56.15.06	-75.27.24.97	37.77	52.38	Z(1-4)	215.9	

Geophysical Dig Sheet and Target History

GRID 3B Unique Target ID	ORIGINAL SURVEY								
	Easting Coord. (m)	Northing Coord. (m)	Lat. Coord.	Long. Coord.	X - Local (Grid) Coord. (ft)	Y - Local (Grid) Coord. (ft)	Channel ID (i.e. C1, top senor, gradient)	Response Amplitude (mV)	Dig Priority
106	3767464.5	1182341.1	37.56.15.05	-75.27.24.73	55.29	✓ 47.93	Z(1-4)	195.9	
107	3767451.2	1182341.5	37.56.15.08	-75.27.25.28	14.8	✓ 59.6	Z(1-4)	159.4	
108	3767453.6	1182341.5	37.56.15.08	-75.27.25.18	22.18	✓ 57.71	Z(1-4)	144.8	
109	3767455.1	1182341.7	37.56.15.08	-75.27.25.12	26.98	✓ 57.17	Z(1-4)	136.4	
110	3767452.2	1182342	37.56.15.09	-75.27.25.23	18.37	✓ 60.4	Z(1-4)	165.9	
111	3767477.3	1182342.1	37.56.15.07	-75.27.24.21	95.66	✓ 41.18	Z(1-4)	1550	
112	3767474.3	1182342.2	37.56.15.08	-75.27.24.33	86.52	✓ 43.81	Z(1-4)	3227	
113	3767446	1182342.8	37.56.15.13	-75.27.25.49	0.12	✓ 67.82	Z(1-4)	232.6	
114	3767446.1	1182343.2	37.56.15.14	-75.27.25.48	0.82	✓ 69.02	Z(1-4)	233.6	
115	3767451.9	1182343.2	37.56.15.13	-75.27.25.25	18.63	✓ 64.44	Z(1-4)	171.6	
116	3767467	1182343.6	37.56.15.13	-75.27.24.63	65.43	✓ 53.88	Z(1-4)	1054	
117	3767445.7	1182343.7	37.56.15.15	-75.27.25.50	0.09	✓ 70.92	Z(1-4)	255.1	
118	3767450.7	1182343.8	37.56.15.15	-75.27.25.29	15.54	✓ 67.29	Z(1-4)	123.1	
119	3767471.7	1182343.8	37.56.15.13	-75.27.24.43	80.09	✓ 50.85	Z(1-4)	2244	
120	3767458.4	1182343.9	37.56.15.15	-75.27.24.98	39.29	✓ 61.55	Z(1-4)	320.7	

Geophysical Dig Sheet and Target History

GRID 3B Unique Target ID	ORIGINAL SURVEY								
	Easting Coord. (m)	Northing Coord. (m)	Lat. Coord.	Long. Coord.	X - Local (Grid) Coord. (ft)	Y - Local (Grid) Coord. (ft)	Channel ID (i.e. C1, top senor, gradient)	Response Amplitude (mV)	Dig Priority
121	3767460.3	1182344	37.56.15.15	-75.27.24.90	45.23	✓ 60.37	Z(1-4)	204.4	
122	3767475.6	1182344.1	37.56.15.14	-75.27.24.27	92.38	✓ 48.77	Z(1-4)	1901	
123	3767457.9	1182344.2	37.56.15.16	-75.27.25.00	38.05	✓ 62.89	Z(1-4)	331	
124	3767474.9	1182344.4	37.56.15.15	-75.27.24.30	90.52	✓ 50.26	Z(1-4)	1904	
125	3767452.1	1182344.6	37.56.15.18	-75.27.25.24	20.63	✓ 68.72	Z(1-4)	141.9	
126	3767453.3	1182344.7	37.56.15.18	-75.27.25.19	24.41	✓ 68.09	Z(1-4)	134.8	
127	3767474.3	1182344.8	37.56.15.16	-75.27.24.33	89.06	✓ 51.98	Z(1-4)	2124	
128	3767447.8	1182345.1	37.56.15.20	-75.27.25.41	7.92	✓ 73.7	Z(1-4)	274.2	
129	3767452.7	1182345.1	37.56.15.19	-75.27.25.21	22.96	✓ 69.83	Z(1-4)	129.5	
130	3767461.9	1182345.4	37.56.15.19	-75.27.24.83	51.52	✓ 63.54	Z(1-4)	379.7	
131	3767463	1182345.5	37.56.15.20	-75.27.24.79	55	✓ 62.99	Z(1-4)	292.5	
132	3767455.3	1182345.7	37.56.15.21	-75.27.25.10	31.54	✓ 69.68	Z(1-4)	218.5	
133	3767457.8	1182345.9	37.56.15.21	-75.27.25.00	39.41	✓ 68.34	Z(1-4)	388.6	
134	3767445.7	1182346.6	37.56.15.25	-75.27.25.49	2.95	✓ 80.13	Z(1-4)	174.3	
135	3767464.8	1182346.6	37.56.15.23	-75.27.24.71	61.61	✓ 65.06	Z(1-4)	199.3	

Geophysical Dig Sheet and Target History

GRID 3B Unique Target ID	ORIGINAL SURVEY								
	Easting Coord. (m)	Northing Coord. (m)	Lat. Coord.	Long. Coord.	X - Local (Grid) Coord. (ft)	Y - Local (Grid) Coord. (ft)	Channel ID (i.e. C1, top senor, gradient)	Response Amplitude (mV)	Dig Priority
136	3767459.4	1182346.8	37.56.15.24	-75.27.24.93	45.21	✓ 69.93	Z(1-4)	357.2	
137	3767447.9	1182347.1	37.56.15.26	-75.27.25.40	10.2	✓ 79.97	Z(1-4)	174.3	
138	3767449.2	1182347.1	37.56.15.26	-75.27.25.35	14.19	✓ 78.94	Z(1-4)	121.7	
139	3767451.9	1182347.3	37.56.15.27	-75.27.25.24	22.67	✓ 77.43	Z(1-4)	88.2	
140	3767453.4	1182347.4	37.56.15.27	-75.27.25.18	27.38	✓ 76.56	Z(1-4)	94.4	
141	3767461.1	1182347.8	37.56.15.27	-75.27.24.86	51.42	✓ 71.75	Z(1-4)	425.8	
142	3767452.3	1182348	37.56.15.29	-75.27.25.22	24.59	✓ 79.33	Z(1-4)	88.8	
143	3767460.4	1182348.1	37.56.15.28	-75.27.24.89	49.56	✓ 73.25	Z(1-4)	460.9	
144	3767450.5	1182349.3	37.56.15.33	-75.27.25.29	20.34	✓ 84.88	Z(1-4)	72.8	
145	3767459.7	1182349.4	37.56.15.33	-75.27.24.92	48.69	✓ 77.9	Z(1-4)	359.6	
146	3767452.7	1182349.6	37.56.15.34	-75.27.25.20	27.39	✓ 84.08	Z(1-4)	106.3	
147	3767461.4	1182349.8	37.56.15.34	-75.27.24.85	54.3	✓ 77.82	Z(1-4)	483	
148	3767448.4	1182349.9	37.56.15.35	-75.27.25.38	14.49	✓ 88.46	Z(1-4)	150.9	
149	3767468	1182349.9	37.56.15.33	-75.27.24.58	74.68	✓ 72.94	Z(1-4)	797.5	
150	3767444.8	1182350	37.56.15.36	-75.27.25.53	3.55	✓ 91.65	Z(1-4)	94	

Geophysical Dig Sheet and Target History

GRID 3B Unique Target ID	ORIGINAL SURVEY								
	Easting Coord. (m)	Northing Coord. (m)	Lat. Coord.	Long. Coord.	X - Local (Grid) Coord. (ft)	Y - Local (Grid) Coord. (ft)	Channel ID (i.e. C1, top senor, gradient)	Response Amplitude (mV)	Dig Priority
151	3767447.2	1182350.1	37.56.15.36	-75.27.25.43	11.01	✓ 90.05	Z(1-4)	141.6	
152	3767456	1182350.1	37.56.15.35	-75.27.25.07	38.01	✓ 83.04	Z(1-4)	182.5	
153	3767469.4	1182350.2	37.56.15.34	-75.27.24.52	79.28	✓ 72.79	Z(1-4)	768	
154	3767454.1	1182350.4	37.56.15.36	-75.27.25.15	32.48	✓ 85.5	Z(1-4)	343.7	
155	3767450.1	1182350.5	37.56.15.37	-75.27.25.31	20.3	✓ 89	Z(1-4)	51.8	
156	3767463.5	1182350.5	37.56.15.36	-75.27.24.76	61.44	✓ 78.37	Z(1-4)	1021	
157	3767444	1182350.7	37.56.15.38	-75.27.25.56	1.78	✓ 94.51	Z(1-4)	71.5	
158	3767465.9	1182350.9	37.56.15.37	-75.27.24.66	69.2	✓ 77.74	Z(1-4)	568.1	
159	3767474.3	1182351.1	37.56.15.36	-75.27.24.32	95.22	✓ 71.77	Z(1-4)	611.4	
160	3767457.8	1182351.2	37.56.15.39	-75.27.24.99	44.62	✓ 85.09	Z(1-4)	228.3	
161	3767452.6	1182351.3	37.56.15.39	-75.27.25.21	28.76	✓ 89.54	Z(1-4)	207.5	
162	3767444.8	1182351.4	37.56.15.41	-75.27.25.53	4.93	✓ 96.09	Z(1-4)	82.3	
163	3767472.3	1182351.5	37.56.15.38	-75.27.24.40	89.46	✓ 74.6	Z(1-4)	520.5	
164	3767464.7	1182351.6	37.56.15.39	-75.27.24.71	66.2	✓ 80.89	Z(1-4)	640.7	
165	3767471.3	1182351.7	37.56.15.39	-75.27.24.44	86.58	✓ 76.01	Z(1-4)	501.1	

Geophysical Dig Sheet and Target History

GRID 3B Unique Target ID	ORIGINAL SURVEY								
	Easting Coord. (m)	Northing Coord. (m)	Lat. Coord.	Long. Coord.	X - Local (Grid) Coord. (ft)	Y - Local (Grid) Coord. (ft)	Channel ID (i.e. C1, top senor, gradient)	Response Amplitude (mV)	Dig Priority
166	3767444	1182351.8	37.56.15.42	-75.27.25.56	2.87	✓98.01	Z(1-4)	83.8	
167	3767447	1182351.9	37.56.15.42	-75.27.25.43	12.17	✓95.92	Z(1-4)	77.9	
168	3767448.2	1182351.9	37.56.15.42	-75.27.25.39	15.85	✓94.96	Z(1-4)	57	
169	3767455.6	1182351.9	37.56.15.41	-75.27.25.08	38.56	✓89.05	Z(1-4)	128.9	
170	3767456.8	1182351.9	37.56.15.41	-75.27.25.03	42.24	✓88.1	Z(1-4)	195.8	
171	3767449.7	1182352.4	37.56.15.43	-75.27.25.32	20.94	✓95.34	Z(1-4)	67.2	
172	3767445.6	1182352.8	37.56.15.45	-75.27.25.49	8.76	✓99.89	Z(1-4)	123.4	
173	3767450.7	1182352.9	37.56.15.45	-75.27.25.28	24.5	✓96.12	Z(1-4)	72.6	
174	3767468.3	1182352.9	37.56.15.43	-75.27.24.56	78.54	✓82.15	Z(1-4)	522.6	
175	3767464.4	1182353.5	37.56.15.45	-75.27.24.72	67.14	✓87.12	Z(1-4)	516.7	
176	3767452.1	1182354	37.56.15.48	-75.27.25.22	29.88	✓98.49	Z(1-4)	448.6	
177	3767472.3	1182354.1	37.56.15.46	-75.27.24.40	92	✓82.76	Z(1-4)	435.1	
178	3767450.5	1182354.4	37.56.15.50	-75.27.25.29	25.36	✓101.03	Z(1-4)	107.9	
179	3767452.9	1182354.4	37.56.15.49	-75.27.25.19	32.73	✓99.11	Z(1-4)	476.6	
180	3767457.8	1182354.7	37.56.15.50	-75.27.24.99	48.06	✓96.14	Z(1-4)	272.2	

Geophysical Dig Sheet and Target History

		REACQUISITION SURVEY			
GRID 3B Unique Target ID	Date	Geophysical Instrument **	GPS Instrument**	Date	Comment
1	2/9/2006	Schondstedt	NA	2-15-06	used x/y coordinates to locate targets
2	2/9/2006				
3	2/9/2006				
4	2/9/2006				
5	2/9/2006				
6	2/9/2006				
7	2/9/2006				
8	2/9/2006				
9	2/9/2006				
10	2/9/2006				
11	2/9/2006				
12	2/9/2006				
13	2/9/2006				
14	2/9/2006				
15	2/9/2006				

Geophysical Dig Sheet and Target History

GRID 3B Unique Target ID	Date	REACQUISITION SURVEY			
		Geophysical Instrument **	GPS Instrument**	Date	Comment
16	2/9/2006	Schondstedt	NA	2-15-06	used x/y coordinates to locate targets
17	2/9/2006				
18	2/9/2006				
19	2/9/2006				
20	2/9/2006				
21	2/9/2006				
22	2/9/2006				
23	2/9/2006				
24	2/9/2006				
25	2/9/2006				
26	2/9/2006				
27	2/9/2006				
28	2/9/2006				
29	2/9/2006				
30	2/9/2006				

Geophysical Dig Sheet and Target History

GRID 3B Unique Target ID	Date	REACQUISITION SURVEY Geophysical Instrument **	GPS Instrument**	Date	Comment
31	2/9/2006	Schondstedt	NA	2-15-06	used x/y coordinates to locate targets
32	2/9/2006				
33	2/9/2006				
34	2/9/2006				
35	2/9/2006				
36	2/9/2006				
37	2/9/2006				
38	2/9/2006				
39	2/9/2006				
40	2/9/2006				
41	2/9/2006				
42	2/9/2006				
43	2/9/2006				
44	2/9/2006				
45	2/9/2006				

Geophysical Dig Sheet and Target History

GRID 3B Unique Target ID	Date	REACQUISITION SURVEY Geophysical Instrument **	GPS Instrument**	Date	Comment
46	2/9/2006	Schondstedt	NA	2-15-06	used x / y coordinates to locate targets
47	2/9/2006				
48	2/9/2006				
49	2/9/2006				
50	2/9/2006				
51	2/9/2006				
52	2/9/2006				
53	2/9/2006				
54	2/9/2006				
55	2/9/2006				
56	2/9/2006				
57	2/9/2006				
58	2/9/2006				
59	2/9/2006				
60	2/9/2006				

Geophysical Dig Sheet and Target History

GRID 3B Unique Target ID	Date	REACQUISITION SURVEY Geophysical Instrument **	GPS Instrument**	Date	Comment
61	2/9/2006	Schonstedt	NA	2-15-06	used x/y coordinates to locate targets
62	2/9/2006				
63	2/9/2006				
64	2/9/2006				
65	2/9/2006				
66	2/9/2006				
67	2/9/2006				
68	2/9/2006				
69	2/9/2006				
70	2/9/2006				
71	2/9/2006				
72	2/9/2006				
73	2/9/2006				
74	2/9/2006				
75	2/9/2006				

Geophysical Dig Sheet and Target History

GRID 3B Unique Target ID	Date	REACQUISITION SURVEY			
		Geophysical Instrument **	GPS Instrument**	Date	Comment
76	2/9/2006	Schondstedt	NA	2-15-06	used x/y coordinates to locate targets
77	2/9/2006				
78	2/9/2006				
79	2/9/2006				
80	2/9/2006				
81	2/9/2006				
82	2/9/2006				
83	2/9/2006				
84	2/9/2006				
85	2/9/2006				
86	2/9/2006				
87	2/9/2006				
88	2/9/2006				
89	2/9/2006				
90	2/9/2006				

Geophysical Dig Sheet and Target History

GRID 3B Unique Target ID	Date	REACQUISITION SURVEY			
		Geophysical Instrument **	GPS Instrument**	Date	Comment
91	2/9/2006	Schondstedt	NA	2-15-06	used x/y coordinate to locate targets
92	2/9/2006				
93	2/9/2006				
94	2/9/2006				
95	2/9/2006				
96	2/9/2006				
97	2/9/2006				
98	2/9/2006				
99	2/9/2006				
100	2/9/2006				
101	2/9/2006				
102	2/9/2006				
103	2/9/2006				
104	2/9/2006				
105	2/9/2006				

Geophysical Dig Sheet and Target History

GRID 3B Unique Target ID	Date	REACQUISITION SURVEY Geophysical Instrument **	GPS Instrument**	Date	Comment
106	2/9/2006	Schondstedt	NA	2-15-06	used x/y coordinates to locate targets
107	2/9/2006				
108	2/9/2006				
109	2/9/2006				
110	2/9/2006				
111	2/9/2006				
112	2/9/2006				
113	2/9/2006				
114	2/9/2006				
115	2/9/2006				
116	2/9/2006				
117	2/9/2006				
118	2/9/2006				
119	2/9/2006				
120	2/9/2006				

Geophysical Dig Sheet and Target History

GRID 3B Unique Target ID	Date	REACQUISITION SURVEY Geophysical Instrument **	GPS Instrument**	Date	Comment
121	2/9/2006	Schonstedt	NA	2-15-06	used x/y coordinates to locate targets
122	2/9/2006				
123	2/9/2006				
124	2/9/2006				
125	2/9/2006				
126	2/9/2006				
127	2/9/2006				
128	2/9/2006				
129	2/9/2006				
130	2/9/2006				
131	2/9/2006				
132	2/9/2006				
133	2/9/2006				
134	2/9/2006				
135	2/9/2006				

Geophysical Dig Sheet and Target History

GRID 3B Unique Target ID	Date	REACQUISITION SURVEY			
		Geophysical Instrument **	GPS Instrument**	Date	Comment
136	2/9/2006	Schondstedt	NA	2-15-06	used x/y coordinates to locate targets
137	2/9/2006				
138	2/9/2006				
139	2/9/2006				
140	2/9/2006				
141	2/9/2006				
142	2/9/2006				
143	2/9/2006				
144	2/9/2006				
145	2/9/2006				
146	2/9/2006				
147	2/9/2006				
148	2/9/2006				
149	2/9/2006				
150	2/9/2006				

Geophysical Dig Sheet and Target History

GRID 3B Unique Target ID	Date	REACQUISITION SURVEY			
		Geophysical Instrument **	GPS Instrument**	Date	Comment
151	2/9/2006	Schondstedt	NA	2-15-06	used x/y coordinates to locate targets
152	2/9/2006				
153	2/9/2006				
154	2/9/2006				
155	2/9/2006				
156	2/9/2006				
157	2/9/2006				
158	2/9/2006				
159	2/9/2006				
160	2/9/2006				
161	2/9/2006				
162	2/9/2006				
163	2/9/2006				
164	2/9/2006				
165	2/9/2006				

Geophysical Dig Sheet and Target History

GRID 3B Unique Target ID	Date	REACQUISITION SURVEY Geophysical Instrument **	GPS Instrument**	Date	Comment
166	2/9/2006	Schonstedt	NA	2-15-06	used x/y coordinates to locate targets
167	2/9/2006				
168	2/9/2006				
169	2/9/2006				
170	2/9/2006				
171	2/9/2006				
172	2/9/2006				
173	2/9/2006				
174	2/9/2006				
175	2/9/2006				
176	2/9/2006				
177	2/9/2006				
178	2/9/2006				
179	2/9/2006				
180	2/9/2006				

Geophysical Dig Sheet and Target History

GRID 3B Unique Target ID	Date	REACQUISITION SURVEY			
		Geophysical Instrument **	GPS Instrument**	Date	Comment
181	2/9/2006	Schondstedt	NA	2-15-06	used x/y coordinates to locate targets
182	2/9/2006				
183	2/9/2006				
184	2/9/2006				
185	2/9/2006				
186	2/9/2006				
187	2/9/2006				
188	2/9/2006				
189	2/9/2006				
190	2/9/2006				
191	2/9/2006				
192	2/9/2006				
193	2/9/2006				
194	2/9/2006				

Geophysical Dig Sheet and Target History

GRID 3B Unique Target ID		REACQUISITION SURVEY			
	Date	Geophysical Instrument **	GPS Instrument**	Date	Comment

= other.

Geophysical Dig Sheet and Target History

GRID 3B Unique Target ID	Response Amplitude (units*)**	DIG RESULTS Anomaly Type ***	Approx. Weight (lbs-~~oz/kg-g~~)	Comments (e.g., response below 1 foot)	Offset Distance (ft)	Offset Direction (N, NE, etc.)	Orientation of Nose (Azimuth deg)	Inclination of Nose (deg)	Depth to Top of Item (in/~~cm~~)	Digital Photo Number	2006 Date
1				LIP	0				>12"		2/15/06
2				LIP	0				>12"		2/15/06
3				LIP	0				>12"		2/16/06
4				LIP	0				>12"		2/16/06
5				LIP	0				>12"		2/16/06
6				LIP	0				> 12"		"
7				LIP	0				> 12"		"
8		MD	.2	20MM	0.5				4		2/16/06
9		S	3.0	REBAR	0				6.0		"
10		MD	.3	20MM	0				7		2/16/06
11		MD	.1	20MM	0.5				8		2/15/06
12		MD	.1	20MM	0				4		2/15/05
13		S	1.2	REBAR	0				7		2/16/06
14		MD	.3	20 MM	1.0				6.0		2/16/05
15		S	1.5	REBAR	0				8		2/16/06

Geophysical Dig Sheet and Target History

GRID 3B Unique Target ID	Response Amplitude (units*)**	DIG RESULTS Anomaly Type ***	Approx. Weight (lbs-~~oz/kg-g~~)	Comments (e.g., response below 1 foot)	Offset Distance (ft)	Offset Direction (N, NE, etc.)	Orientation of Nose (Azimuth deg)	Inclination of Nose (deg)	Depth to Top of Item (in/~~cm~~)	Digital Photo Number	2006 Date
16		MD	.4	20MM	0				8		2/16/06
17				LIP	0				>12"		11
18		MD	.3	20 mm	0.5				7.0		11
19		MD	3.2	20MM x 9	0				12		2/16/06
20		MD	.4	20MM	0				8		2/16/06
21		MD	.4	20MM	0				6.0		2/16/06
22		S	4.0	REBAR	0				6.0		11
23		MD	.6	20MM (2)	0				7.0		2/16/06
24		S	.5	SCRAP	0				6		2/16/06
25				LIP	0				>12"		2/16/06
26		S	4.0	REBAR	0				6.0		11
27		MD	.4	20 mm	0.5				6.0		2/16/06
28		MD	.4	20 mm	0				6.0		2/16/06
29		S	12.0	CONCRETE/REBAR	0				4.0		11
30		MD	.5	30 MM	0				7.0		11

Geophysical Dig Sheet and Target History

GRID 3B Unique Target ID	Response Amplitude (units*)**						DIG RESULTS				
		Anomaly Type ***	Approx. Weight (lbs/~~oz/kg/g~~)	Comments (e.g., response below 1 foot)	Offset Distance (ft)	Offset Direction (N, NE, etc.)	Orientation of Nose (Azimuth deg)	Inclination of Nose (deg)	Depth to Top of Item (in/~~cm~~)	Digital Photo Number	2006 Date
31		MD	.6	20MM X 2	0				10		2/16/06
32		S	3.0	PIPE	0				6.0		"
33		MD	.4	20MM	0				8		2/16/06
34		MD	.3	20MM	0				10		2/16/06
35		MD	.3	20MM	1.0				6.0		2/16/06
36				LIP	0				> 12"		"
37		S	2.0	SCRAP	0				10		2/16/06
38		S	.2	NAIL	1.0				6.0		2/16/06
39		S	3.0	REBAR					7.0		"
40		MD	~~.50~~ .3	20 MM	1.0				6.0		2/16/06
41		S	3.0	REBAR	0				7.0		"
42		MD	.6	20MM	0				7		2/16/06
43		MD	.3	20 MM	6.5				6.0		2/16/06
44		MD	.5	20MM	0				4		2/16/06
45		MD	.3	20 MM	0				7.0		"

Geophysical Dig Sheet and Target History

GRID 3B Unique Target ID	Response Amplitude (units*)**	DIG RESULTS Anomaly Type ***	Approx. Weight (lbs/~~oz/kg/g~~)	Comments (e.g., response below 1 foot)	Offset Distance (ft)	Offset Direction (N, NE, etc.)	Orientation of Nose (Azimuth deg)	Inclination of Nose (deg)	Depth to Top of Item (in/~~cm~~)	Digital Photo Number	2006 Date
46		MD	.3	20 mm	0.5				6.0		2/16/06
47		MD	.6	20 mm (2)	0				4.0		2/16/06
48		S	1.5	SCRAP	0				8		2/16/06
49				LIP	0			>12"	~~7~~		11
50		S	1.2	SCRAP	0				5		2/16/06
51		S	8.0	REBAR	0				8.0		11
52		S	.3	SCRAP	1.0				6.0		11
53				LIP	0				>12"		11
54		S	8.0	REBAR	0				6.0		11
55		MD	.3	20mm	0				6.0		11
56		MD	.4	20MM	0				4		2/16/06
57		MD	.3	20 MM	1.0				7.0		2/16/06
58		MD	.4	20 MM CART	0				6.0		2/16/06
59		MD	.1	20MM	0.5				5		2/16/06
60				LIP	0			~~>~~	>12"		11

Geophysical Dig Sheet and Target History

GRID 3B Unique Target ID	Response Amplitude (units*)**	Anomaly Type ***	Approx. Weight (lbs-~~oz/kg-g~~)	Comments (e.g., response below 1 foot)	Offset Distance (ft)	Offset Direction (N, NE, etc.)	Orientation of Nose (Azimuth deg)	Inclination of Nose (deg)	Depth to Top of Item (in/~~cm~~)	Digital Photo Number	2006 Date
		DIG RESULTS									
61		MD	.3	20 MM	0.5				6.0		2/16/06
62				LIP	0				> 12"		"
63		S	.8	REBAR	0				7.0		2/16/06
64		MD	~~MD~~ .4	20 MM	0				7		2/16/06
65		MD	.4	SCRAP	1.0				4.0		"
66		S	.6	SCRAP	0				8.0		"
67				LIP	0				> 12"		"
68		MD	.5	20 MM	0				9		2/16/06
69		S	.6	METAL ROD	0				6.0		2/16/06
70		MD	.4	20 MM	0				4		2/16/06
71		S	.3	TENT STAKE	0				6.0		"
72		MD	.4	20 MM	0				6		2/16/06
73		MD	.3	20 MM	0				7.0		2/16/06
74		MD	.4	30 MM	0				7		2/16/06
75		MD	.8	20 MM x 2	0				4		2/16/06

W
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Geophysical Dig Sheet and Target History

GRID 3B Unique Target ID	Response Amplitude (units*)**	DIG RESULTS Anomaly Type ***	Approx. Weight (lbs ~~oz/kg g~~)	Comments (e.g., response below 1 foot)	Offset Distance (ft)	Offset Direction (N, NE, etc.)	Orientation of Nose (Azimuth deg)	Inclination of Nose (deg)	Depth to Top of Item (in ~~cm~~)	Digital Photo Number	2006 Date
76		MD	.4	20MM	0				4		2/16/06
77		MD	.6	20MM	0				7		2/16/06
78		MD	1.0	20MM x 3	0				8		2/16/06
79		MD	.3	20MM	0				6.0		2/16/06
80		S	.1	NAIL	1.0				7.0		11
81		MD	.4	20MM	0				5		2/16/06
82		MD	.3	20MM	0				8		2/16/06
83		MD	.4	20 mm	0				6.0		2/16/06
84		MD	.3	20 MM	0				6.0		2/16/06
85		S	.1	SCRAP	1.0				4.0		2/16/06
86		MD	.3	20 MM	0.5				6.0		2/16/06
87		MD	.7	20MM	0				9		2/16/06
88		MD	.4	20MM	0				8		2/16/06
89		MD	.3	20MM	0				4.0		11
90		MD	.6	20 MM (2)	0				6.0		2/16/06

Geophysical Dig Sheet and Target History

GRID 3B Unique Target ID	Response Amplitude (units*)**	DIG RESULTS									
		Anomaly Type ***	Approx. Weight (lbs-~~oz/kg-g~~)	Comments (e.g., response below 1 foot)	Offset Distance (ft)	Offset Direction (N, NE, etc.)	Orientation of Nose (Azimuth deg)	Inclination of Nose (deg)	Depth to Top of Item (in/~~cm~~)	Digital Photo Number	2006 Date
91		MD	.2	20mm	0				3		2/15/06
92		MD	.3	20 mm	1.0				6.0		2/16/06
93		MD	.3	20 mm	0.5				4.0		2/16/06
94		MD	.5	20mm	0				4		2/15/05
95		MD	1.2	20mm x 3	0				9		2/15/06
96		MD	.8	30mm	0				5		2/15/06
97		MD	.6	20mm	0				8		2/15/06
98		MD	.3	20 mm	1.0				7.0		2/16/06
99		MD	.8	20mm	0				4		2/15/06
100		MD	4	20mm x 9	0				12		2/16/06
101		S	.3	Concrete/wire	0.5				6.0		2/16/06
102				LIP	0				7/12"		2/15/06
103		MD	1.2	20mm x 4	0				8		2/15/06
104		S	1	WIRE IN CONCRETE	0				10		2/16/06
105		MD	.3	20mm	0				7		2/16/06

Geophysical Dig Sheet and Target History

GRID 3B Unique Target ID	Response Amplitude (units*)**	DIG RESULTS Anomaly Type ***	Approx. Weight (lbs-~~oz/kg-g~~)	Comments (e.g., response below 1 foot)	Offset Distance (ft)	Offset Direction (N, NE, etc.)	Orientation of Nose (Azimuth deg)	Inclination of Nose (deg)	Depth to Top of Item (in/~~cm~~)	Digital Photo Number	2006 Date
106		MD	.4	20 mm (2)	0				6.0		2/15/06
107		MD	.5	20MM	0				6		2/16/06
108		S	.3	SCRAP	0.5				7		2/16/06
109		MD	.6	20MM	0				8		2/16/06
110		MD	.6	30MM	0				11		2/16/06
111				LIP (Burn Pit)					>12"		
112				LIP (Burn Pit)					>12"		
113		MD	.7	20MM x 2	0				11		2/15/06
114		S	.9	SCRAP	0				2		2/16/06
115		S	.6	NAIL	0.5				10		2/16/06
116		MD	.9	20MMx2	0				2		2/16/06
117		MD	.4	20MM	0				7		2/16/06
118		MD	.2	20MM	0				8		2/16/06
119		MD	1.5	20MM x 4	0				6		2/16/06
120		MD	.8	20MM x 2	0				10		2/16/06

Geophysical Dig Sheet and Target History

GRID 3B Unique Target ID	Response Amplitude (units*)**	DIG RESULTS									
		Anomaly Type ***	Approx. Weight (lbs-~~oz/kg-g~~)	Comments (e.g., response below 1 foot)	Offset Distance (ft)	Offset Direction (N, NE, etc.)	Orientation of Nose (Azimuth deg)	Inclination of Nose (deg)	Depth to Top of Item (in/~~cm~~)	Digital Photo Number	2006 Date
121		MD	.5	20MM	0				4		2/15/06
122		MD	.3	20 MM	0.5				7.0		2/16/06
123		MD	.5	20MM	0				8		2/15/06
124				LIP	0				>12"		2/15/06
125		MD	.3	20MM	0				9		2/15/06
126		S	.1	NAIL	1.0				5		2/15/06
127				LIP	0				>12"		2/15/06
128		S	.4	WIRE	0				8		2/15/06
129		MD	.5	20MM	0				5		2/15/06
130		MD	1.1	20MM x 3	0				4		2/15/06
131		S	.7	SCRAP-ROD	0				5		2/15/06
132		S	1	ROD	0				8		2/15/06
133		MD	1.2	20MM	0				2		2/15/06
134		MD	.4	20MM	0				3		2/15/06
135		MD	.3	20MM	0				2		2/15/06

Geophysical Dig Sheet and Target History

GRID 3B Unique Target ID	Response Amplitude (units*)**	DIG RESULTS Anomaly Type ***	Approx. Weight (lbs ~~oz/kg g~~)	Comments (e.g., response below 1 foot)	Offset Distance (ft)	Offset Direction (N, NE, etc.)	Orientation of Nose (Azimuth deg)	Inclination of Nose (deg)	Depth to Top of Item (in ~~/cm~~)	Digital Photo Number	2006 Date
136		MD	.5	20MM	0				8		2/16/06
137		MD	.4	20mm	0				5		2/16/06
138		MD	.4	20MM	0				4		2/16/06
139		MD	.5	20MM	0				3		2/16/06
140		MM	.4	30MM	0				5		2/16/06
141		S	.3	SCRAP	0.5				4		2/16/06
142		S	.4	SCRAP	0				2		2/16/06
143		MD	.5	20MM	0				9		2/16/06
144		S	.1	Scrap	1.0				4.0		2/16/06
145		MD	.3	20MM	0				9		2/16/06
146		MD	.8	20mm X 2	0				4		2/16/06
147		MD	.4	20MM	0				5		2/16/06
148		MD	.3	20 MM	0.5				5.0		11
149		MD	.5	20MM	0				4		2/16/06
150		MD	.7	20 mm X 2	0				5		2/16/06

Geophysical Dig Sheet and Target History

GRID 3B Unique Target ID	Response Amplitude (units*)**	DIG RESULTS Anomaly Type ***	Approx. Weight (lbs-~~oz/kg-g~~)	Comments (e.g., response below 1 foot)	Offset Distance (ft)	Offset Direction (N, NE, etc.)	Orientation of Nose (Azimuth deg)	Inclination of Nose (deg)	Depth to Top of Item (in/cm)	Digital Photo Number	2006 Date
151		MD	.7	20mm x2	0				8.0		16Feb06
152		MD	.4	20mm							
153		MD	.3	20MM	0				4		2/16/06
154		S	1	PIPE	0						
155		MD	.4	20mm	0				6		2/15/05
156		MD	1.8	20MM x 5	0				12		2/15/06
157		S	.2	SCRAP	0.5				7		2/15/06
158		MD	1.4	20MM x 4	0				8		2/15/06
159		S	.9	SCRAP-NUT	0				3		2/15/06
160		MD	.8	20MM	0				9		2/16/06
161		S	.5	HINGE	0				6.0		2/15/06
162		S ~~MD~~	.2	SCRAP	1.0				7.		2/15/06
163		MD	.4	20MM	0				3		2/15/06
164		MD	.5	20MM	0				9		2/16/06
165		S	1.2	PIPE	0				3		2/15/06

Geophysical Dig Sheet and Target History

GRID 3B Unique Target ID	Response Amplitude (units*)**	DIG RESULTS Anomaly Type ***	Approx. Weight (lbs-~~oz/kg-g~~)	Comments (e.g., response below 1 foot)	Offset Distance (ft)	Offset Direction (N, NE, etc.)	Orientation of Nose (Azimuth deg)	Inclination of Nose (deg)	Depth to Top of Item (in/~~cm~~)	Digital Photo Number	2006 Date
166		S	.3	NAIL	0				8		2/16/06
167		S	.2	Scrap	1.0				10.0		
168		S	.4	ROD	0				8		2/16/05
169				LIP	0				>12.0"		16Feb06
170		MD	.9	30MM	0				5		2/16/06
171		MD	.5	20mm	0				8.0		16Feb
172		MD	.8	20 mm x3	0						
173		S	.4	SCRAP	0				4		2/15/06
174		MD	1.5	20MM x 4	0				11		2/16/06
175		MD	2.1	20MM x 6	0				12		2/15/06
176	8 gld	S		LIP -rod	0				12.0"		16Feb06
177		MD	.4	20MM	0				8		2/15/06
178		S	.3	scrap	0.5						
179		S	.3	scrap	0						
180		MD	.5	20MM	0				4		2/16/06

Geophysical Dig Sheet and Target History

GRID 3B Unique Target ID	Response Amplitude (units*)**	DIG RESULTS: Anomaly Type ***	Approx. Weight (lbs ~~oz/kg-g~~)	Comments (e.g., response below 1 foot)	Offset Distance (ft)	Offset Direction (N, NE, etc.)	Orientation of Nose (Azimuth deg)	Inclination of Nose (deg)	Depth to Top of Item (in/~~cm~~)	Digital Photo Number	2006 Date
181		MD	.5	20mm	0				7		2/16/06
182		MD	.9	20MM	0				8		2/16/06
183		MD	1.2	20mm x 3	0				11		2/16/03
184		MD	.6	20mm	0				3		2/16/06
185		MD	.7	20mm x 2	0				2		2/16/06
186		MD	.6	20mm x 2	0				8		2/16/06
187		MD	.6	20mm	0				4		2/16/06
188		MD	1.0	20mm	0				9		2/16/06
189		MD	.4	20mm	0				7		2/16/06
190		MD	1.1	20mm x 3	0				11		2/16/06
191		MD	1.0	20mm x 3	0				4		2/16/06
192		MD	.8	20mm	0				3		2/16/06
193		MD	.9	20mm	0				5		2/16/06
194		5	3.0	pipe	0				6.0		11

Geophysical Dig Sheet and Target History

GRID 3B Unique Target ID		DIG RESULTS									
	Response Amplitude (units*)**	Anomaly Type ***	Approx. Weight (lbs-oz/kg-g)	Comments (e.g., response below 1 foot)	Offset Distance (ft)	Offset Direction (N, NE, etc.)	Orientation of Nose (Azimuth deg)	Inclination of Nose (deg)	Depth to Top of Item (in/cm)	Digital Photo Number	Date

Geophysical Dig Sheet and Target History

GRID 3B Unique Target ID	Team Leader	POST-DIG UXO QC RESULTS Excavation Hole Cleared?	UXO QC Spec. Initials	Date	POST-DIG PROJECT QC Agreement Between Dig Results & Geophysical Data? (G=good, P=poor, U=unacceptable)	Project QC Initials	Date
1							
2							
3							
4							
5							
6							
7							
8		Yes	EMD	2/16/06	G	VAS	2-16-06
9							
10							
11							
12							
13							
14							
15							

Geophysical Dig Sheet and Target History

GRID 3B Unique Target ID	Team Leader	POST-DIG UXO QC RESULTS Excavation Hole Cleared?	UXO QC Spec. Initials	Date	POST-DIG PROJECT QC Agreement Between Dig Results & Geophysical Data? (G=good, P=poor, U=unacceptable)	Project QC Initials	Date
16							
17							
18							
19							
20		Yes	EMD	2/16/06	G	VAS	2-16-06
21							
22							
23							
24							
25							
26							
27							
28							
29							
30		Yes	EMD	2/16/06	G	VAS	2-16-06

Geophysical Dig Sheet and Target History

GRID 3B Unique Target ID	Team Leader	POST-DIG UXO QC RESULTS Excavation Hole Cleared?	UXO QC Spec. Initials	Date	POST-DIG PROJECT QC Agreement Between Dig Results & Geophysical Data? (G=good, P=poor, U=unacceptable)	Project QC Initials	Date
31							
32							
33							
34							
35							
36							
37							
38							
39							
40		Yes	[illegible]	2/10/06	G	VAS	2-16-06
41							
42							
43							
44							
45							

Geophysical Dig Sheet and Target History

GRID 3B Unique Target ID	Team Leader	POST-DIG UXO QC RESULTS			POST-DIG PROJECT QC		
		Excavation Hole Cleared?	UXO QC Spec. Initials	Date	Agreement Between Dig Results & Geophysical Data? (G=good, P=poor, U=unacceptable)	Project QC Initials	Date
46							
47							
48							
49							
50		Yes	EMD	2/16/06	G	VAS	2-16-06
51							
52							
53							
54							
55							
56							
57							
58							
59							
60		NO, Deeper than 12"	EMD	2/16/06	G	VAS	2-16-06

Geophysical Dig Sheet and Target History

GRID 3B Unique Target ID	Team Leader	POST-DIG UXO QC RESULTS Excavation Hole Cleared?	UXO QC Spec. Initials	Date	POST-DIG PROJECT QC Agreement Between Dig Results & Geophysical Data? (G=good, P=poor, U=unacceptable)	Project QC Initials	Date
61							
62							
63							
64							
65							
66							
67							
68							
69							
70	o	Yes	EMD	2/16/06	G	VAS	2-16-06
71							
72							
73							
74							
75							

Geophysical Dig Sheet and Target History

GRID 3B Unique Target ID	Team Leader	POST-DIG UXO QC RESULTS			POST-DIG PROJECT QC		
		Excavation Hole Cleared?	UXO QC Spec. Initials	Date	Agreement Between Dig Results & Geophysical Data? (G=good, P=poor, U=unacceptable)	Project QC Initials	Date
76							
77							
78							
79							
80		Yes	EMD	2/16/06	G	VAS	2-16-06
81							
82							
83							
84							
85							
86							
87							
88							
89							
90		Yes	EMD	2/16/06	G	VAS	2-16-06

Geophysical Dig Sheet and Target History

GRID 3B Unique Target ID	Team Leader	POST-DIG UXO QC RESULTS Excavation Hole Cleared?	UXO QC Spec. Initials	Date	POST-DIG PROJECT QC Agreement Between Dig Results & Geophysical Data? (G=good, P=poor, U=unacceptable)	Project QC Initials	Date
91							
92							
93							
94							
95							
96							
97							
98							
99							
100		[illegible] Yes	[illegible]	2/16/06	G	VAS	2-16-06
101							
102							
103							
104							
105		Yes	[illegible]	2/16/06	G	VAS	2-16-06

Geophysical Dig Sheet and Target History

GRID 3B Unique Target ID	Team Leader	POST-DIG UXO QC RESULTS			POST-DIG PROJECT QC		
		Excavation Hole Cleared?	UXO QC Spec. Initials	Date	Agreement Between Dig Results & Geophysical Data? (G=good, P=poor, U=unacceptable)	Project QC Initials	Date
106							
107							
108							
109							
110		Yes	EKD	2/16/06	G	VAS	2-16-06
111							
112							
113							
114							
115							
116							
117							
118							
119							
120		Yes	EKD	2/16/06	G	VAS	2-16-06

Geophysical Dig Sheet and Target History

GRID 3B Unique Target ID		POST-DIG UXO QC RESULTS			POST-DIG PROJECT QC		
	Team Leader	Excavation Hole Cleared?	UXO QC Spec. Initials	Date	Agreement Between Dig Results & Geophysical Data? (G=good, P=poor, U=unacceptable)	Project QC Initials	Date
121							
122							
123							
124							
125							
126							
127							
128							
129							
130		Yes	[illegible]	2/16/06	G	VAS	2-16-06
131							
132							
133							
134							
135							

Geophysical Dig Sheet and Target History

GRID 3B Unique Target ID	Team Leader	POST-DIG UXO QC RESULTS Excavation Hole Cleared?	UXO QC Spec. Initials	Date	POST-DIG PROJECT QC Agreement Between Dig Results & Geophysical Data? (G=good, P=poor, U=unacceptable)	Project QC Initials	Date
136							
137							
138							
139							
140		Yes	EMD	2/16/06	G	VAS	2-16-06
141							
142							
143							
144							
145							
146							
147							
148							
149							
150		Yes	EMD	2/16/06	G	VAS	2-16-06

Geophysical Dig Sheet and Target History

GRID 3B Unique Target ID	Team Leader	POST-DIG UXO QC RESULTS Excavation Hole Cleared?	UXO QC Spec. Initials	Date	POST-DIG PROJECT QC Agreement Between Dig Results & Geophysical Data? (G=good, P=poor, U=unacceptable)	Project QC Initials	Date
151							
152							
153							
154							
155							
156							
157							
158							
159							
160		Yes	[illegible]	2/16/06	G	VAS	2-16-06
161							
162							
163							
164							
165							

Geophysical Dig Sheet and Target History

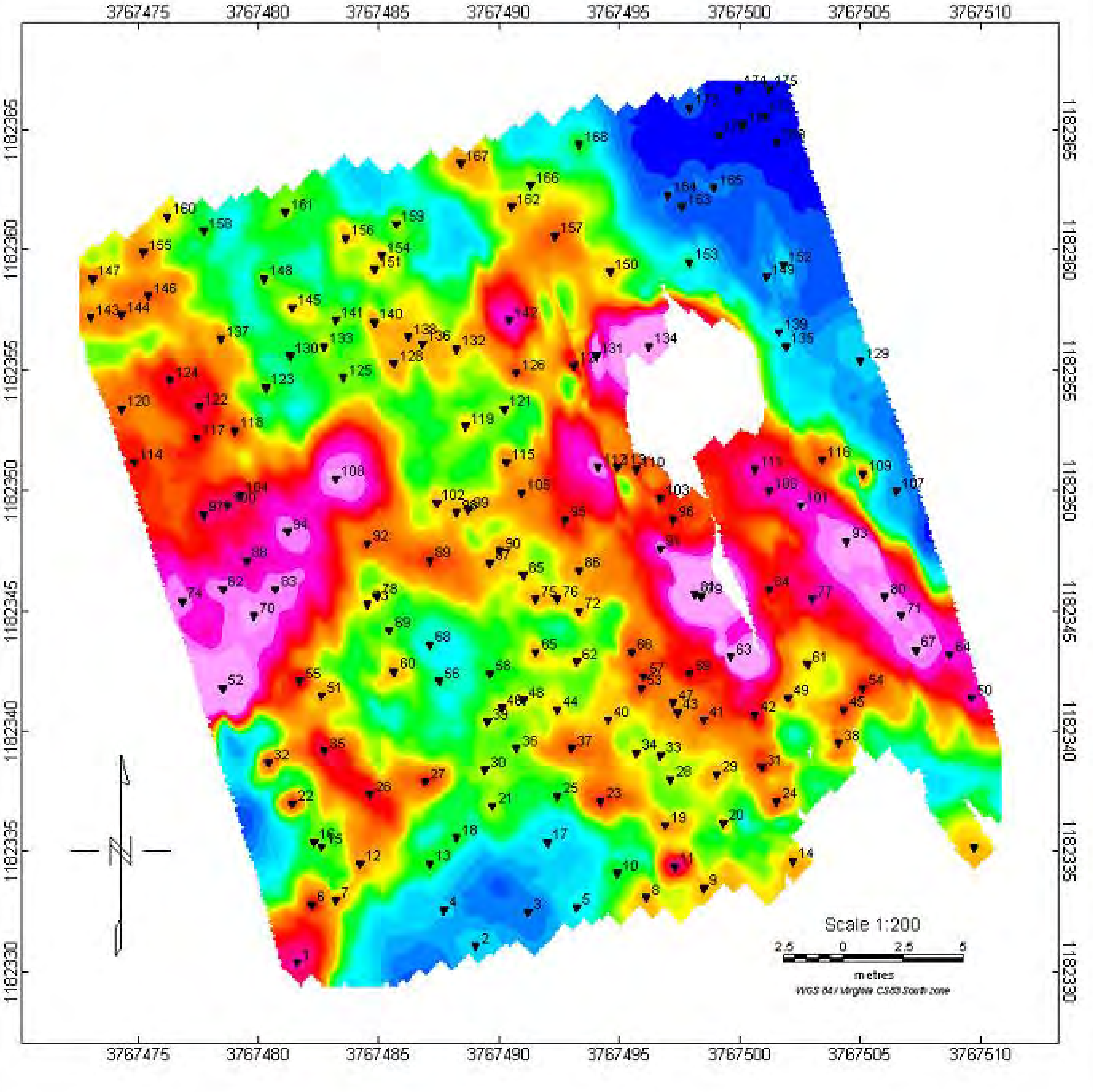
GRID 3B		POST-DIG UXO QC RESULTS			POST-DIG PROJECT QC		
Unique Target ID	Team Leader	Excavation Hole Cleared?	UXO QC Spec. Initials	Date	Agreement Between Dig Results & Geophysical Data? (G=good, P=poor, U=unacceptable)	Project QC Initials	Date
166							
167							
168							
169							
170		Yes	EJD	2/16/06	G	VAS	2-16-06
171							
172							
173							
174							
175							
176							
177							
178							
179							
180		Yes	EJD	2/16/06	G	VAS	2-16-06

Geophysical Dig Sheet and Target History

GRID 3B Unique Target ID	Team Leader	POST-DIG UXO QC RESULTS: Excavation Hole Cleared?	UXO QC Spec. Initials	Date	POST-DIG PROJECT QC: Agreement Between Dig Results & Geophysical Data? (G=good, P=poor, U=unacceptable)	Project QC Initials	Date
181							
182							
183							
184							
185							
186							
187							
188							
189							
190		Yes	EGD	2/16/06	G	VAS	2-16-06
191							
192							
193							
194					G	VAS	2-16-06
		Yes	EGD	2/16/06			

Geophysical Dig Sheet and Target History

GRID 3B Unique Target ID	Team Leader	POST-DIG UXO QC RESULTS			POST-DIG PROJECT QC		
		Excavation Hole Cleared?	UXO QC Spec. Initials	Date	Agreement Between Dig Results & Geophysical Data? (G=good, P=poor, U=unacceptable)	Project QC Initials	Date



NASA

Wallops Flight Center
EM61 MK2 Data
Grid 3C

February 9, 2006

Tetra Tech EM Inc.

Geophysical Dig Sheet and Target History

GRID 3C Unique Target ID	ORIGINAL SURVEY									
	Easting Coord. (m)	Northing Coord. (m)	Lat. Coord.	Long. Coord.	X - Local (Grid) Coord. (ft)	Y - Local (Grid) Coord. (ft)	Channel ID (i.e. C1, top senor, gradient)	Response Amplitude (mV)	Dig Priority	Date
1	3767481.6	1182330.4	37.56.14.69	-75.27.24.05	-0.53	1.13	Z(1-4)	709.6		2/9/2006
2	3767489	1182331.1	37.56.14.70	-75.27.23.74	22.68	-2.24	Z(1-4)	122.9		2/9/2006
3	3767491.2	1182332.5	37.56.14.74	-75.27.23.65	30.74	0.5	Z(1-4)	77.3		2/9/2006
4	3767487.7	1182332.6	37.56.14.75	-75.27.23.79	20.19	3.45	Z(1-4)	110.5		2/9/2006
5	3767493.2	1182332.7	37.56.14.75	-75.27.23.57	37.01	-0.37	Z(1-4)	175.4		2/9/2006
6	3767482.2	1182332.8	37.56.14.76	-75.27.24.02	3.63	8.22	Z(1-4)	526.4		2/9/2006
7	3767483.2	1182333	37.56.14.77	-75.27.23.98	6.87	8.1	Z(1-4)	384.1		2/9/2006
8	3767496.1	1182333.1	37.56.14.76	-75.27.23.45	46.22	-1.3	Z(1-4)	340.7		2/9/2006
9	3767498.5	1182333.5	37.56.14.77	-75.27.23.35	53.9	-1.84	Z(1-4)	337.3		2/9/2006
10	3767494.9	1182334.1	37.56.14.79	-75.27.23.50	43.56	2.74	Z(1-4)	241.2		2/9/2006
11	3767497.3	1182334.4	37.56.14.80	-75.27.23.40	51.15	1.88	Z(1-4)	724.6		2/9/2006
12	3767484.2	1182334.5	37.56.14.82	-75.27.23.94	11.37	12.06	Z(1-4)	370.7		2/9/2006
13	3767487.1	1182334.5	37.56.14.81	-75.27.23.82	20.21	9.87	Z(1-4)	254.8		2/9/2006
14	3767502.2	1182334.6	37.56.14.80	-75.27.23.20	66.22	-1.17	Z(1-4)	365.7		2/9/2006
15	3767482.6	1182335.2	37.56.14.84	-75.27.24.00	7.17	15.47	Z(1-4)	272.2		2/9/2006

Geophysical Dig Sheet and Target History

GRID 3C Unique Target ID	ORIGINAL SURVEY									
	Easting Coord. (m)	Northing Coord. (m)	Lat. Coord.	Long. Coord.	X - Local (Grid) Coord. (ft)	Y - Local (Grid) Coord. (ft)	Channel ID (i.e. C1, top senor, gradient)	Response Amplitude (mV)	Dig Priority	Date
16	3767482.3	1182335.4	37.56.14.85	-75.27.24.01	6.45	✓16.32	Z(1-4)	269.1		2/9/2006
17	3767492	1182335.4	37.56.14.84	-75.27.23.61	36.01	✓ 9.01	Z(1-4)	146.4		2/9/2006
18	3767488.2	1182335.6	37.56.14.85	-75.27.23.77	24.64	✓ 12.5	Z(1-4)	233.4		2/9/2006
19	3767496.9	1182336.1	37.56.14.86	-75.27.23.41	51.61	✓ 7.52	Z(1-4)	375.6		2/9/2006
20	3767499.3	1182336.2	37.56.14.86	-75.27.23.31	59	✓ 6.02	Z(1-4)	343.3		2/9/2006
21	3767489.7	1182336.9	37.56.14.89	-75.27.23.71	30.48	✓15.45	Z(1-4)	291.9		2/9/2006
22	3767481.4	1182337	37.56.14.90	-75.27.24.05	5.26	✓22.04	Z(1-4)	488.8		2/9/2006
23	3767494.2	1182337.1	37.56.14.89	-75.27.23.52	44.38	✓12.69	Z(1-4)	473.7		2/9/2006
24	3767501.5	1182337.1	37.56.14.88	-75.27.23.22	66.58	✓7.19	Z(1-4)	446		2/9/2006
25	3767492.4	1182337.3	37.56.14.90	-75.27.23.60	39.1	✓14.67	Z(1-4)	244.4		2/9/2006
26	3767484.6	1182337.4	37.56.14.91	-75.27.23.91	15.42	✓20.87	Z(1-4)	567.9		2/9/2006
27	3767486.9	1182337.9	37.56.14.92	-75.27.23.82	22.93	✓20.71	Z(1-4)	488		2/9/2006
28	3767497.1	1182338	37.56.14.92	-75.27.23.40	54.1	✓13.32	Z(1-4)	298.5		2/9/2006
29	3767499	1182338.2	37.56.14.92	-75.27.23.32	60.08	✓12.52	Z(1-4)	359.7		2/9/2006
30	3767489.4	1182338.4	37.56.14.94	-75.27.23.72	31.04	✓20.39	Z(1-4)	293.5		2/9/2006

Geophysical Dig Sheet and Target History

GRID 3C Unique Target ID	ORIGINAL SURVEY									
	Easting Coord. (m)	Northing Coord. (m)	Lat. Coord.	Long. Coord.	X - Local (Grid) Coord. (ft)	Y - Local (Grid) Coord. (ft)	Channel ID (i.e. C1, top senor, gradient)	Response Amplitude (mV)	Dig Priority	Date
31	3767500.9	1182338.5	37.56.14.93	-75.27.23.25	66.15	12.03	Z(1-4)	504.8		2/9/2006
32	3767480.4	1182338.7	37.56.14.96	-75.27.24.09	3.86	28.14	Z(1-4)	449.5		2/9/2006
33	3767496.7	1182339	37.56.14.95	-75.27.23.42	53.87	16.76	Z(1-4)	306.6		2/9/2006
34	3767495.7	1182339.1	37.56.14.95	-75.27.23.46	50.93	17.83	Z(1-4)	305.7		2/9/2006
35	3767482.7	1182339.2	37.56.14.97	-75.27.23.99	11.37	27.97	Z(1-4)	594.9		2/9/2006
36	3767490.7	1182339.3	37.56.14.97	-75.27.23.66	35.89	22.23	Z(1-4)	287.3		2/9/2006
37	3767493	1182339.3	37.56.14.96	-75.27.23.57	42.9	20.49	Z(1-4)	463.6		2/9/2006
38	3767504.1	1182339.5	37.56.14.96	-75.27.23.11	76.87	12.76	Z(1-4)	443.7		2/9/2006
39	3767489.5	1182340.4	37.56.15.00	-75.27.23.71	33.31	26.59	Z(1-4)	291.6		2/9/2006
40	3767494.5	1182340.5	37.56.15.00	-75.27.23.51	48.66	23.13	Z(1-4)	336.8		2/9/2006
41	3767498.5	1182340.5	37.56.15.00	-75.27.23.34	60.84	20.11	Z(1-4)	456.2		2/9/2006
42	3767500.6	1182340.7	37.56.15.00	-75.27.23.26	67.43	19.15	Z(1-4)	667.1		2/9/2006
43	3767497.4	1182340.8	37.56.15.01	-75.27.23.39	57.79	21.88	Z(1-4)	397.8		2/9/2006
44	3767492.4	1182340.9	37.56.15.02	-75.27.23.59	42.65	25.97	Z(1-4)	326.9		2/9/2006
45	3767504.3	1182340.9	37.56.15.00	-75.27.23.10	78.88	16.99	Z(1-4)	476.6		2/9/2006

Geophysical Dig Sheet and Target History

GRID 3C Unique Target ID	ORIGINAL SURVEY									
	Easting Coord. (m)	Northing Coord. (m)	Lat. Coord.	Long. Coord.	X - Local (Grid) Coord. (ft)	Y - Local (Grid) Coord. (ft)	Channel ID (i.e. C1, top senor, gradient)	Response Amplitude (mV)	Dig Priority	Date
46	3767490.1	1182341	37.56.15.02	-75.27.23.68	35.73	✓28.02	Z(1-4)	318.2		2/9/2006
47	3767497.2	1182341.2	37.56.15.02	-75.27.23.39	57.58	✓23.28	Z(1-4)	395.6		2/9/2006
48	3767491	1182341.3	37.56.15.03	-75.27.23.65	38.78	✓28.28	Z(1-4)	301.1		2/9/2006
49	3767502	1182341.4	37.56.15.02	-75.27.23.20	72.39	✓20.29	Z(1-4)	391.9		2/9/2006
50	3767509.6	1182341.4	37.56.15.01	-75.27.22.89	95.48	✓14.57	Z(1-4)	742.5		2/9/2006
51	3767482.6	1182341.5	37.56.15.05	-75.27.23.99	13.31	✓35.27	Z(1-4)	360.4		2/9/2006
52	3767478.5	1182341.8	37.56.15.06	-75.27.24.16	1.06	✓39.33	Z(1-4)	3071		2/9/2006
53	3767495.9	1182341.8	37.56.15.04	-75.27.23.45	54.21	✓26.15	Z(1-4)	479.9		2/9/2006
54	3767505.1	1182341.8	37.56.15.03	-75.27.23.07	82.22	✓19.21	Z(1-4)	512.6		2/9/2006
55	3767481.7	1182342.1	37.56.15.07	-75.27.24.03	11.14	✓37.84	Z(1-4)	580.8		2/9/2006
56	3767487.5	1182342.1	37.56.15.06	-75.27.23.79	28.88	✓33.44	Z(1-4)	209.4		2/9/2006
57	3767496	1182342.3	37.56.15.06	-75.27.23.44	55.01	✓27.64	Z(1-4)	472		2/9/2006
58	3767489.6	1182342.4	37.56.15.07	-75.27.23.70	35.59	✓32.79	Z(1-4)	254.1		2/9/2006
59	3767497.9	1182342.4	37.56.15.06	-75.27.23.36	60.9	✓26.52	Z(1-4)	536.6		2/9/2006
60	3767485.6	1182342.5	37.56.15.07	-75.27.23.87	23.46	✓36.14	Z(1-4)	334.2		2/9/2006

Geophysical Dig Sheet and Target History

GRID 3C Unique Target ID	ORIGINAL SURVEY									
	Easting Coord. (m)	Northing Coord. (m)	Lat. Coord.	Long. Coord.	X - Local (Grid) Coord. (ft)	Y - Local (Grid) Coord. (ft)	Channel ID (i.e. C1, top senor, gradient)	Response Amplitude (mV)	Dig Priority	Date
61	3767502.8	1182342.8	37.56.15.07	-75.27.23.16	76.22	✓24.07	Z(1-4)	328.8		2/9/2006
62	3767493.2	1182342.9	37.56.15.08	-75.27.23.56	47.07	✓31.64	Z(1-4)	329		2/9/2006
63	3767499.6	1182343.1	37.56.15.08	-75.27.23.29	66.78	✓27.43	Z(1-4)	2812		2/9/2006
64	3767508.7	1182343.2	37.56.15.07	-75.27.22.92	94.56	✓20.88	Z(1-4)	906.2		2/9/2006
65	3767491.5	1182343.3	37.56.15.09	-75.27.23.62	42.28	✓34.18	Z(1-4)	336.3		2/9/2006
66	3767495.5	1182343.3	37.56.15.09	-75.27.23.46	54.48	✓31.15	Z(1-4)	459.3		2/9/2006
67	3767507.3	1182343.4	37.56.15.08	-75.27.22.98	90.51	✓22.56	Z(1-4)	1189		2/9/2006
68	3767487.1	1182343.6	37.56.15.11	-75.27.23.80	29.13	✓38.45	Z(1-4)	193.3		2/9/2006
69	3767485.4	1182344.2	37.56.15.13	-75.27.23.87	24.52	✓41.63	Z(1-4)	266.2		2/9/2006
70	3767479.8	1182344.8	37.56.15.15	-75.27.24.10	7.96	✓47.77	Z(1-4)	1214		2/9/2006
71	3767506.7	1182344.8	37.56.15.13	-75.27.23.00	90.1	✓27.39	Z(1-4)	1153		2/9/2006
72	3767493.3	1182345	37.56.15.15	-75.27.23.55	49.46	✓38.15	Z(1-4)	340.9		2/9/2006
73	3767484.5	1182345.3	37.56.15.17	-75.27.23.91	22.85	✓45.77	Z(1-4)	312.2		2/9/2006
74	3767476.8	1182345.4	37.56.15.18	-75.27.24.22	-0.65	✓51.94	Z(1-4)	965.4		2/9/2006
75	3767491.5	1182345.5	37.56.15.17	-75.27.23.62	44.45	✓41.08	Z(1-4)	348.8		2/9/2006

Geophysical Dig Sheet and Target History

GRID 3C Unique Target ID	ORIGINAL SURVEY									
	Easting Coord. (m)	Northing Coord. (m)	Lat. Coord.	Long. Coord.	X - Local (Grid) Coord. (ft)	Y - Local (Grid) Coord. (ft)	Channel ID (i.e. C1, top senor, gradient)	Response Amplitude (mV)	Dig Priority	Date
76	3767492.4	1182345.5	37.56.15.16	-75.27.23.58	47.2	✓ 40.4	Z(1-4)	347.1		2/9/2006
77	3767503	1182345.5	37.56.15.15	-75.27.23.15	79.54	✓ 32.38	Z(1-4)	744.9		2/9/2006
78	3767484.9	1182345.6	37.56.15.18	-75.27.23.89	24.36	✓ 46.4	Z(1-4)	312.2		2/9/2006
79	3767498.4	1182345.6	37.56.15.16	-75.27.23.34	65.62	✓ 36.17	Z(1-4)	2574		2/9/2006
80	3767506	1182345.6	37.56.15.15	-75.27.23.03	88.77	✓ 30.43	Z(1-4)	1419		2/9/2006
81	3767498.1	1182345.7	37.56.15.16	-75.27.23.35	64.8	✓ 36.71	Z(1-4)	2583		2/9/2006
82	3767478.5	1182345.9	37.56.15.19	-75.27.24.15	5.05	✓ 52.21	Z(1-4)	1043		2/9/2006
83	3767480.7	1182345.9	37.56.15.19	-75.27.24.06	11.79	✓ 50.54	Z(1-4)	1133		2/9/2006
84	3767501.2	1182345.9	37.56.15.17	-75.27.23.22	74.45	✓ 34.99	Z(1-4)	595.7		2/9/2006
85	3767491	1182346.5	37.56.15.20	-75.27.23.64	43.91	✓ 44.6	Z(1-4)	323		2/9/2006
86	3767493.3	1182346.7	37.56.15.20	-75.27.23.55	51.14	✓ 43.48	Z(1-4)	381.2		2/9/2006
87	3767489.6	1182347	37.56.15.22	-75.27.23.70	40.13	✓ 47.23	Z(1-4)	355.2		2/9/2006
88	3767479.5	1182347.1	37.56.15.23	-75.27.24.11	9.29	✓ 55.22	Z(1-4)	793		2/9/2006
89	3767487.1	1182347.1	37.56.15.22	-75.27.23.80	32.58	✓ 49.44	Z(1-4)	479.5		2/9/2006
90	3767490	1182347.5	37.56.15.23	-75.27.23.68	41.85	✓ 48.49	Z(1-4)	376.9		2/9/2006

Geophysical Dig Sheet and Target History

GRID 3C Unique Target ID	ORIGINAL SURVEY									
	Easting Coord. (m)	Northing Coord. (m)	Lat. Coord.	Long. Coord.	X - Local (Grid) Coord. (ft)	Y - Local (Grid) Coord. (ft)	Channel ID (i.e. C1, top senor, gradient)	Response Amplitude (mV)	Dig Priority	Date
91	3767496.7	1182347.6	37.56.15.23	-75.27.23.41	62.42	✓43.72	Z(1-4)	1090		2/9/2006
92	3767484.5	1182347.8	37.56.15.25	-75.27.23.91	25.3	✓53.62	Z(1-4)	446.2		2/9/2006
93	3767504.4	1182347.9	37.56.15.23	-75.27.23.09	86.22	✓38.83	Z(1-4)	1460		2/9/2006
94	3767481.2	1182348.3	37.56.15.27	-75.27.24.04	15.68	✓57.7	Z(1-4)	1097		2/9/2006
95	3767492.7	1182348.8	37.56.15.27	-75.27.23.57	51.4	✓50.52	Z(1-4)	508.6		2/9/2006
96	3767497.2	1182348.8	37.56.15.27	-75.27.23.38	65.15	✓47.11	Z(1-4)	502.8		2/9/2006
97	3767477.7	1182349	37.56.15.29	-75.27.24.18	5.62	✓62.57	Z(1-4)	667.6		2/9/2006
98	3767488.2	1182349.1	37.56.15.29	-75.27.23.75	37.92	✓54.88	Z(1-4)	336.5		2/9/2006
99	3767488.7	1182349.2	37.56.15.29	-75.27.23.73	39.55	✓54.82	Z(1-4)	341.7		2/9/2006
100	3767478.7	1182349.4	37.56.15.31	-75.27.24.14	9.08	✓63.06	Z(1-4)	652.5		2/9/2006
101	3767502.5	1182349.4	37.56.15.28	-75.27.23.17	81.93	✓44.97	Z(1-4)	944.4		2/9/2006
102	3767487.4	1182349.5	37.56.15.30	-75.27.23.78	35.87	✓56.75	Z(1-4)	333.1		2/9/2006
103	3767496.7	1182349.7	37.56.15.30	-75.27.23.40	64.52	✓50.3	Z(1-4)	543.3		2/9/2006
104	3767479.2	1182349.8	37.56.15.32	-75.27.24.12	11.01	✓63.94	Z(1-4)	661.3		2/9/2006
105	3767490.9	1182349.9	37.56.15.31	-75.27.23.64	46.98	✓55.34	Z(1-4)	422.2		2/9/2006

Geophysical Dig Sheet and Target History

GRID 3C Unique Target ID	ORIGINAL SURVEY									
	Easting Coord. (m)	Northing Coord. (m)	Lat. Coord.	Long. Coord.	X - Local (Grid) Coord. (ft)	Y - Local (Grid) Coord. (ft)	Channel ID (i.e. C1, top senor, gradient)	Response Amplitude (mV)	Dig Priority	Date
106	3767501.2	1182350	37.56.15.30	-75.27.23.22	78.57	✓47.83	Z(1-4)	799.8		2/9/2006
107	3767506.5	1182350	37.56.15.30	-75.27.23.00	94.74	✓43.82	Z(1-4)	90.8		2/9/2006
108	3767483.2	1182350.5	37.56.15.34	-75.27.23.95	23.98	✓63.08	Z(1-4)	1212		2/9/2006
109	3767505.1	1182350.7	37.56.15.32	-75.27.23.06	91.17	✓47.07	Z(1-4)	411.3		2/9/2006
110	3767495.7	1182350.9	37.56.15.34	-75.27.23.44	62.67	✓54.82	Z(1-4)	462.7		2/9/2006
111	3767500.6	1182350.9	37.56.15.33	-75.27.23.24	77.64	✓51.11	Z(1-4)	794.3		2/9/2006
112	3767494.1	1182351	37.56.15.34	-75.27.23.51	57.87	✓56.35	Z(1-4)	1121		2/9/2006
113	3767494.9	1182351	37.56.15.34	-75.27.23.48	60.32	✓55.75	Z(1-4)	503.4		2/9/2006
114	3767474.8	1182351.2	37.56.15.37	-75.27.24.30	-1.15	✓71.7	Z(1-4)	515.7		2/9/2006
115	3767490.3	1182351.2	37.56.15.35	-75.27.23.66	46.44	✓59.87	Z(1-4)	377.3		2/9/2006
116	3767503.4	1182351.3	37.56.15.34	-75.27.23.13	86.59	✓50.23	Z(1-4)	458.9		2/9/2006
117	3767477.4	1182352.2	37.56.15.40	-75.27.24.19	7.83	✓72.85	Z(1-4)	541.2		2/9/2006
118	3767479	1182352.5	37.56.15.41	-75.27.24.12	13.04	✓72.57	Z(1-4)	478.4		2/9/2006
119	3767488.6	1182352.7	37.56.15.40	-75.27.23.73	42.72	✓65.87	Z(1-4)	320.9		2/9/2006
120	3767474.3	1182353.4	37.56.15.44	-75.27.24.32	-0.54	✓79	Z(1-4)	434.9		2/9/2006

Geophysical Dig Sheet and Target History

GRID 3C Unique Target ID	ORIGINAL SURVEY									
	Easting Coord. (m)	Northing Coord. (m)	Lat. Coord.	Long. Coord.	X - Local (Grid) Coord. (ft)	Y - Local (Grid) Coord. (ft)	Channel ID (i.e. C1, top senor, gradient)	Response Amplitude (mV)	Dig Priority	Date
121	3767490.2	1182353.4	37.56.15.42	-75.27.23.66	48.32	66.85	Z(1-4)	295.8		2/9/2006
122	3767477.5	1182353.5	37.56.15.44	-75.27.24.18	9.41	76.86	Z(1-4)	617.5		2/9/2006
123	3767480.3	1182354.3	37.56.15.46	-75.27.24.07	18.81	77.23	Z(1-4)	272.5		2/9/2006
124	3767476.3	1182354.6	37.56.15.48	-75.27.24.23	6.79	81.24	Z(1-4)	571.1		2/9/2006
125	3767483.5	1182354.7	37.56.15.47	-75.27.23.94	29.04	76.04	Z(1-4)	278.3		2/9/2006
126	3767490.7	1182354.9	37.56.15.47	-75.27.23.64	51.35	71.17	Z(1-4)	462.5		2/9/2006
127	3767493.1	1182355.2	37.56.15.48	-75.27.23.54	59	70.28	Z(1-4)	653.7		2/9/2006
128	3767485.6	1182355.3	37.56.15.49	-75.27.23.85	36.09	76.32	Z(1-4)	352.4		2/9/2006
129	3767505	1182355.4	37.56.15.47	-75.27.23.06	95.63	61.85	Z(1-4)	118.6		2/9/2006
130	3767481.3	1182355.6	37.56.15.50	-75.27.24.03	23.17	80.55	Z(1-4)	230.4		2/9/2006
131	3767494	1182355.6	37.56.15.49	-75.27.23.51	62.16	70.85	Z(1-4)	1458		2/9/2006
132	3767488.2	1182355.9	37.56.15.51	-75.27.23.74	44.67	76.21	Z(1-4)	335.1		2/9/2006
133	3767482.7	1182356	37.56.15.51	-75.27.23.97	27.87	80.73	Z(1-4)	303.1		2/9/2006
134	3767496.2	1182356	37.56.15.50	-75.27.23.42	69.31	70.42	Z(1-4)	2373		2/9/2006
135	3767501.9	1182356	37.56.15.49	-75.27.23.18	86.76	66.08	Z(1-4)	153.8		2/9/2006

Geophysical Dig Sheet and Target History

GRID 3C Unique Target ID	ORIGINAL SURVEY									
	Easting Coord. (m)	Northing Coord. (m)	Lat. Coord.	Long. Coord.	X - Local (Grid) Coord. (ft)	Y - Local (Grid) Coord. (ft)	Channel ID (i.e. C1, top senor, gradient)	Response Amplitude (mV)	Dig Priority	Date
136	3767486.8	1182356.1	37.56.15.51	-75.27.23.80	40.57	77.91	Z(1-4)	353.7		2/9/2006
137	3767478.4	1182356.3	37.56.15.53	-75.27.24.14	14.93	84.97	Z(1-4)	378.9		2/9/2006
138	3767486.2	1182356.4	37.56.15.52	-75.27.23.82	39.02	79.31	Z(1-4)	365.7		2/9/2006
139	3767501.6	1182356.6	37.56.15.51	-75.27.23.19	86.45	68.19	Z(1-4)	146.2		2/9/2006
140	3767484.8	1182357	37.56.15.55	-75.27.23.88	35.32	82.26	Z(1-4)	377.4		2/9/2006
141	3767483.2	1182357.1	37.56.15.55	-75.27.23.95	30.49	83.8	Z(1-4)	283		2/9/2006
142	3767490.4	1182357.1	37.56.15.54	-75.27.23.65	52.62	78.29	Z(1-4)	895.4		2/9/2006
143	3767473	1182357.2	37.56.15.56	-75.27.24.36	-0.83	91.94	Z(1-4)	404.5		2/9/2006
144	3767474.3	1182357.3	37.56.15.57	-75.27.24.31	3.28	91.26	Z(1-4)	435.4		2/9/2006
145	3767481.4	1182357.6	37.56.15.57	-75.27.24.02	25.45	86.75	Z(1-4)	320.1		2/9/2006
146	3767475.4	1182358.1	37.56.15.59	-75.27.24.26	7.45	92.92	Z(1-4)	456.3		2/9/2006
147	3767473.1	1182358.8	37.56.15.62	-75.27.24.36	1.04	96.89	Z(1-4)	415.5		2/9/2006
148	3767480.2	1182358.8	37.56.15.61	-75.27.24.07	22.94	91.44	Z(1-4)	281.4		2/9/2006
149	3767501.1	1182358.9	37.56.15.59	-75.27.23.21	87.24	75.77	Z(1-4)	109.6		2/9/2006
150	3767494.6	1182359.1	37.56.15.60	-75.27.23.48	67.52	81.35	Z(1-4)	328.7		2/9/2006

Geophysical Dig Sheet and Target History

GRID 3C Unique Target ID	ORIGINAL SURVEY									
	Easting Coord. (m)	Northing Coord. (m)	Lat. Coord.	Long. Coord.	X - Local (Grid) Coord. (ft)	Y - Local (Grid) Coord. (ft)	Channel ID (i.e. C1, top senor, gradient)	Response Amplitude (mV)	Dig Priority	Date
151	3767484.8	1182359.2	37.56.15.62	-75.27.23.88	37.5	89.16	Z(1-4)	317.7		2/9/2006
152	3767501.8	1182359.4	37.56.15.61	-75.27.23.18	89.9	76.8	Z(1-4)	135.5		2/9/2006
153	3767497.9	1182359.5	37.56.15.61	-75.27.23.34	78.04	80.09	Z(1-4)	210.5		2/9/2006
154	3767485.1	1182359.8	37.56.15.64	-75.27.23.86	39.02	90.82	Z(1-4)	326.1		2/9/2006
155	3767475.2	1182359.9	37.56.15.65	-75.27.24.27	8.61	98.73	Z(1-4)	420.2		2/9/2006
156	3767483.6	1182360.5	37.56.15.66	-75.27.23.93	35.1	94.16	Z(1-4)	329.3		2/9/2006
157	3767492.3	1182360.6	37.56.15.65	-75.27.23.57	61.96	87.81	Z(1-4)	440.2		2/9/2006
158	3767477.7	1182360.8	37.56.15.68	-75.27.24.17	17.21	99.64	Z(1-4)	261.5		2/9/2006
159	3767485.7	1182361.1	37.56.15.68	-75.27.23.84	42.16	94.43	Z(1-4)	290.1		2/9/2006
160	3767476.2	1182361.4	37.56.15.70	-75.27.24.23	13.17	102.67	Z(1-4)	323.4		2/9/2006
161	3767481.1	1182361.6	37.56.15.70	-75.27.24.03	28.49	99.53	Z(1-4)	281.6		2/9/2006
162	3767490.5	1182361.8	37.56.15.69	-75.27.23.64	57.63	92.95	Z(1-4)	376.1		2/9/2006
163	3767497.6	1182361.8	37.56.15.69	-75.27.23.35	79.45	87.51	Z(1-4)	49.1		2/9/2006
164	3767497	1182362.3	37.56.15.70	-75.27.23.37	78.11	89.54	Z(1-4)	59.1		2/9/2006
165	3767498.9	1182362.6	37.56.15.71	-75.27.23.30	84.25	89.02	Z(1-4)	69.8		2/9/2006

Geophysical Dig Sheet and Target History

GRID 3C Unique Target ID	ORIGINAL SURVEY									
	Easting Coord. (m)	Northing Coord. (m)	Lat. Coord.	Long. Coord.	X - Local (Grid) Coord. (ft)	Y - Local (Grid) Coord. (ft)	Channel ID (i.e. C1, top senor, gradient)	Response Amplitude (mV)	Dig Priority	Date
166	3767491.3	1182362.7	37.56.15.72	-75.27.23.61	61	95.16	Z(1-4)	291.9		2/9/2006
167	3767488.4	1182363.6	37.56.15.76	-75.27.23.72	52.97	100.2	Z(1-4)	376.4		2/9/2006
168	3767493.3	1182364.4	37.56.15.78	-75.27.23.52	68.86	98.95	Z(1-4)	227.9		2/9/2006
169	3767501.5	1182364.5	37.56.15.77	-75.27.23.19	94.16	92.98	Z(1-4)	14.1		2/9/2006
170	3767499.1	1182364.8	37.56.15.78	-75.27.23.29	87.09	95.76	Z(1-4)	11.1		2/9/2006
171	3767500.1	1182365.2	37.56.15.80	-75.27.23.24	90.57	96.24	Z(1-4)	11.2		2/9/2006
172	3767501	1182365.6	37.56.15.81	-75.27.23.21	93.74	96.8	Z(1-4)	9.6		2/9/2006
173	3767497.9	1182365.9	37.56.15.82	-75.27.23.33	84.52	100.12	Z(1-4)	40.6		2/9/2006
174	3767499.9	1182366.7	37.56.15.84	-75.27.23.25	91.48	101.09	Z(1-4)	16.3		2/9/2006
175	3767501.2	1182366.7	37.56.15.84	-75.27.23.20	95.48	100.09	Z(1-4)	13.3		2/9/2006
176	3767509.52	1182335.1	37.56.14.81	-75.27.22.90	88.9	-5.08	Z(1-4)	329.8		2/9/2006

Note: *Fill in Acceptable Units (mV, nT/m, ppt, etc).

**Optional field – refer to SOW for applicability to specific project.

***For Anomaly type, U = UXO, F = frag, MD = munitions debris, S = scrap, A = small arms ammunition, NC = no contact, O = other.

Geophysical Dig Sheet and Target History

GRID 3C Unique Target ID	REACQUISITION SURVEY				
	Geophysical Instrument **	GPS Instrument**	Date	Comment	Response Amplitude (units*)**
1	Schondstedt	NA	2-16-06	used x/y coordinates to locate targets	NA
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					
14					
15					

Geophysical Dig Sheet and Target History

GRID 3C Unique Target ID	REACQUISITION SURVEY				
	Geophysical Instrument **	GPS Instrument**	Date	Comment	Response Amplitude (units*)**
16	Schondstedt	NA	2-16-06	used x/y coordinates to locate targets	NA
17					
18					
19					
20					
21					
22					
23					
24					
25					
26					
27					
28					
29					
30					

Geophysical Dig Sheet and Target History

GRID 3C Unique Target ID	REACQUISITION SURVEY Geophysical Instrument **	GPS Instrument**	Date	Comment	Response Amplitude (units*)**
31	Schondstedt	NA	2-16-06	used x/y coordinates to locate targets	NA
32					
33					
34					
35					
36					
37					
38					
39					
40					
41					
42					
43					
44					
45					

Geophysical Dig Sheet and Target History

GRID 3C Unique Target ID	REACQUISITION SURVEY				
	Geophysical Instrument **	GPS Instrument**	Date	Comment	Response Amplitude (units*)**
46	Schondstedt	NA	2-16-06	used x/y coordinates to locate targets	NA
47					
48					
49					
50					
51					
52					
53					
54					
55					
56					
57					
58					
59					
60					

Geophysical Dig Sheet and Target History

GRID 3C Unique Target ID	REACQUISITION SURVEY				
	Geophysical Instrument **	GPS Instrument**	Date	Comment	Response Amplitude (units*)**
61	Schondstedt	NA	2-16-06	used x/y coordinates to locate targets	NA
62					
63					
64					
65					
66					
67					
68					
69					
70					
71					
72					
73					
74					
75					

Geophysical Dig Sheet and Target History

GRID 3C Unique Target ID	REACQUISITION SURVEY Geophysical Instrument **	GPS Instrument**	Date	Comment	Response Amplitude (units*)**
76	Schondstedt	NA	2-16-06	used x/y coordinates to locate targets	NA
77					
78					
79					
80					
81					
82					
83					
84					
85					
86					
87					
88					
89					
90					

Geophysical Dig Sheet and Target History

GRID 3C Unique Target ID	REACQUISITION SURVEY Geophysical Instrument **	GPS Instrument**	Date	Comment	Response Amplitude (units*)**
91	Schonstedt	NA	2-16-06	used x/y coordinates to locate targets	NA
92					
93					
94					
95					
96					
97					
98					
99					
100					
101					
102					
103					
104					
105					

Geophysical Dig Sheet and Target History

GRID 3C Unique Target ID	REACQUISITION SURVEY				
	Geophysical Instrument **	GPS Instrument**	Date	Comment	Response Amplitude (units*)**
106	Schondstedt	NA	2-16-06	used x/y coordinates to locate targets	NA
107					
108					
109					
110					
111					
112					
113					
114					
115					
116					
117					
118					
119					
120					

Geophysical Dig Sheet and Target History

GRID 3C Unique Target ID	REACQUISITION SURVEY				
	Geophysical Instrument **	GPS Instrument**	Date	Comment	Response Amplitude (units*)**
121	Schondstedt	NA	2-16-06	used x/y coordinates to locate targets	NA
122					
123					
124					
125					
126					
127					
128					
129					
130					
131					
132					
133					
134					
135					

Geophysical Dig Sheet and Target History

GRID 3C Unique Target ID	REACQUISITION SURVEY				
	Geophysical Instrument **	GPS Instrument**	Date	Comment	Response Amplitude (units*)**
136	Schondstedt	NA	2-16-06	used x/y coordinates to locate targets	NA
137					
138					
139					
140					
141					
142					
143					
144					
145					
146					
147					
148					
149					
150					

Geophysical Dig Sheet and Target History

GRID 3C Unique Target ID	REACQUISITION SURVEY				
	Geophysical Instrument **	GPS Instrument**	Date	Comment	Response Amplitude (units*)**
151	Schondstedt	NA	2-16-06	used x/y coordinates to locate targets	NA
152					
153					
154					
155					
156					
157					
158					
159					
160					
161					
162					
163					
164					
165					

Geophysical Dig Sheet and Target History

GRID 3C Unique Target ID	REACQUISITION SURVEY				
	Geophysical Instrument **	GPS Instrument**	Date	Comment	Response Amplitude (units*)**
166	Schondstedt	NA	2-16-06	used x/y coordinates to locate targets	NA
167					
168					
169					
170					
171					
172					
173					
174					
175					
176					

Geophysical Dig Sheet and Target History

GRID 3C Unique Target ID	DIG RESULTS Anomaly Type ***	Approx. Weight (lbs-~~oz/kg-g~~)	Comments (e.g., response below 1 foot)	Offset Distance (ft)	Offset Direction (N, NE, etc.)	Orientation of Nose (Azimuth deg)	Inclination of Nose (deg)	Depth to Top of Item (in/~~cm~~)	Digital Photo Number	2006 Date	Team Leader
1	MD	.6	20 mm	0				8.0		17Feb06	W
2	MD	.4	20 mm	0				6.0		17Feb06	W
3	MD	.8	20 mm	0				8.0		17Feb06	W
4			LIP	0				>12.0"		17Feb06	W
5	MD	.8	20 mm X2	0				10.0		17Feb06	W
6	MD	.4	20 mm	0				6.0		17Feb06	W
7	MD	.2	20mm	1.0				2.0		17Feb06	W
8	MD	1.4	20 mm X4	0				10.0		17Feb06	W
9	MD	.8	20 mm	0				10.0		17Feb06	W
10	MD	.9	20mm X2	0				10.0		17Feb06	W
11	S	4.0	container lid	0				8.0		17Feb06	W
12	MD	.6	20 mm	0				4.0		17Feb06	W
13			LIP	0				>12.0"		17Feb06	W
14	MD	.2	20 mm	1.0				6.0		17Feb06	W
15	S	.4	scrap	0				4.0		17Feb06	W

Geophysical Dig Sheet and Target History

GRID 3C Unique Target ID	DIG RESULTS										
	Anomaly Type ***	Approx. Weight (lbs ~~oz/kg-g~~)	Comments (e.g., response below 1 foot)	Offset Distance (ft)	Offset Direction (N, NE, etc.)	Orientation of Nose (Azimuth deg)	Inclination of Nose (deg)	Depth to Top of Item (in/~~cm~~)	Digital Photo Number	2006 Date	Team Leader
16	S	.6	nail & scrap	0				8.0		17Feb06	W
17	S	1.4	nails & rebar	0				6.0		17Feb06	W
18	MD/S	1.5	20mm & rod	0				10.0		17Feb06	W
19	MD	.9	20mm x3	0				10.0		17Feb06	W
20	MD	.3	20mm	0.5				6.0		17Feb06	W
21			LIP	0				>12.0"		17Feb06	W
22	S	.2	scrap	0.5				6.0		17Feb06	W
23	MD	.9	20mm x2	0				10.0		17Feb06	W
24	MD	.6	20mm	0				8.0		17Feb06	W
25	S	1.1	nails x3/Rod	0				10.0		17Feb06	W
26	MD	.9	20mm x3	0				10.0		17Feb06	W
27	MD	.1	20mm	0.5				2.0		17Feb06	W
28	MD	.7	20mm x2	0				6.0		17Feb06	W
29	MD	.9	20mm x2	0				4.0		17Feb06	W
30	MD	.8	20mm x2	0				10.0		17Feb06	W

Geophysical Dig Sheet and Target History

GRID 3C Unique Target ID	DIG RESULTS										
	Anomaly Type ***	Approx. Weight (lbs ~~oz/kg-g~~)	Comments (e.g., response below 1 foot)	Offset Distance (ft)	Offset Direction (N, NE, etc.)	Orientation of Nose (Azimuth deg)	Inclination of Nose (deg)	Depth to Top of Item (in/~~cm~~)	Digital Photo Number	2006 Date	Team Leader
31	MD	.4	20 mm	0				6.0		17Feb06	[illegible]
32	MD	.8	20mm X 2	0				8.0		17Feb06	[illegible]
33	MD	.4	20 mm	0.5				6.0		17Feb06	[illegible]
34	MD	.8	20mm X 2	0				10.0		17Feb06	[illegible]
35	S	5.0	metal rod	0				12.0"+		17Feb06	[illegible]
36	MD	.9	20 mm X 3	0				12.0		17Feb06	[illegible]
37	MD	.8	20 mm X 2	0				6.0		17Feb06	[illegible]
38	MD	.7	20 mm X 2	0				10.0		17Feb06	[illegible]
39	MD	.4	20 mm	1.0				6.0		17Feb06	[illegible]
40	MD	.4	20 mm	0				4.0		17Feb06	[illegible]
41	MD	.4	20 mm	1.0				4.0		17Feb06	[illegible]
42	MD	.9	20 mm X 2	0				6.0		17Feb06	[illegible]
43	MD	.8	20 mm X 2	0				8.0		17Feb06	[illegible]
44	MD	1.3	20 mm X 3	0				4.0		17Feb06	[illegible]
45	MD	.8	20 mm X 2	0				8.0		17Feb06	[illegible]

Geophysical Dig Sheet and Target History

GRID 3C Unique Target ID	DIG RESULTS										
	Anomaly Type ***	Approx. Weight (lbs/~~oz/kg-g~~)	Comments (e.g., response below 1 foot)	Offset Distance (ft)	Offset Direction (N, NE, etc.)	Orientation of Nose (Azimuth deg)	Inclination of Nose (deg)	Depth to Top of Item (in/~~cm~~)	Digital Photo Number	2006 Date	Team Leader
46	MD	.4	20mm	0				6.0		17Feb06	
47	MD	.3	20 mm	0.5				4.0		17Feb06	
48	MD	.6	20mm X2	0				6.0		17Feb06	
49	S	1.8	rebar	0				10.0		17Feb06	
50	MD	1.2	20mm X4	0				8.0		17Feb06	
51	MD	0.6	20mm	0.5				8.0		17Feb06	
52	MD	1.0+	20mm LIP OB/OD PIT	0				>12.0"		17Feb06	
53	MD	.5	20 mm	0				6.0		17Feb06	
54	MD	.3	20 mm	1.0				6.0		17Feb06	
55	MD	1.0	20 mm X3	0				4.0		17Feb06	
56	MD	.4	20 mm	0				6.0		17Feb06	
57	MD	1.8	20mm X4	0				12.0		17Feb06	
58	MD	.8	20 mm	0				8.0		17Feb06	
59	S	3.0	pipe	0				6.0		17Feb06	
60	MD	1.1	20mm X3	0				10.0		17Feb06	

Geophysical Dig Sheet and Target History

GRID 3C Unique Target ID	DIG RESULTS										
	Anomaly Type ***	Approx. Weight (lbs-~~oz/kg-g~~)	Comments (e.g., response below 1 foot)	Offset Distance (ft)	Offset Direction (N, NE, etc.)	Orientation of Nose (Azimuth deg)	Inclination of Nose (deg)	Depth to Top of Item (in/~~cm~~)	Digital Photo Number	2006 Date	Team Leader
61	MD	.4	20 mm	0				10.0		17Feb06	W
62	MD	.6	20 mm	0				8.0		17Feb06	W
63	MD	.4	20 mm	0.5				8.0		17Feb06	W
64	MD	.9	20 mm x3	0				6.0		17Feb06	W
65	MD	.4	20 mm	0				6.0		17Feb06	W
66	MD/S	1.4	20mm & rod	0				6.0		17Feb06	W
67	MD	1.2	20 mm x3	0				6.0		17Feb06	W
68	MD	1.0	20 mm x2	0				10.0		17Feb06	W
69	MD	.9	20 mm x2	0				10.0		17Feb06	W
70	MD	.4	20 mm	1.0				6.0		17Feb06	W
71	MD	.5	20 mm	1.0				8.0		17Feb06	W
72	MD	.7	20 mm	0				6.0		17Feb06	W
73	MD	.9	20 mm x2	0				10.0		17Feb06	W
74	MD	.7	20 mm x2	0				8.0		17Feb06	W
75	MD	.9	20 mm x2	0				12.0		17Feb06	W

Geophysical Dig Sheet and Target History

GRID 3C Unique Target ID	DIG RESULTS										
	Anomaly Type ***	Approx. Weight (lbs-~~oz/kg-g~~)	Comments (e.g., response below 1 foot)	Offset Distance (ft)	Offset Direction (N, NE, etc.)	Orientation of Nose (Azimuth deg)	Inclination of Nose (deg)	Depth to Top of Item (in/~~cm~~)	Digital Photo Number	2006 Date	Team Leader
76	MD	.7	20mm x 2	0				6.0		17Feb06	W
77	MD	.9	20 mm X 3	0				8.0		17Feb06	W
78	MD	.8	20 mm	0				6.0		17Feb06	W
79			LIP	0				>12.0"		17Feb06	W
80	MD	2.2	20mm x9	0				6.0		17Feb06	W
81			LIP	0				>12.0"		17Feb06	W
82	MD	.6	20 mm	0.5				6.0		17Feb06	W
83	MD	.7	20 mm	0				8.0		17Feb06	W
84	MD	.4	20 mm	0				4.0		17Feb06	W
85	MD	.3	20 mm	0.5				4.0		17Feb06	W
86	MD	1.0	20 mm X2	0				6.0		17Feb06	W
87	MD	.5	20 mm	1.0				8.0		17Feb06	W
88	MD	.5	20 mm	0				10.0		17Feb06	W
89	MD	.7	20 mm	0				8.0		17Feb06	W
90	MD	1.1	20mm X4	0				10.0		17 Feb 06	W

✓

Geophysical Dig Sheet and Target History

GRID 3C Unique Target ID	DIG RESULTS Anomaly Type ***	Approx. Weight (lbs-~~oz/kg-g~~)	Comments (e.g., response below 1 foot)	Offset Distance (ft)	Offset Direction (N, NE, etc.)	Orientation of Nose (Azimuth deg)	Inclination of Nose (deg)	Depth to Top of Item (in/~~cm~~)	Digital Photo Number	2006 Date	Team Leader
91	MD/S	1.2	20mm x2 & rod	0				6.0		17Feb06	
92	MD	.7	20 mm x2	0				6.0		17Feb06	
93			LIP	0				>20"		17Feb06	
94	MD	.3	20mm	1.0				2.0		17Feb06	
95	MD	.6	20 mm	0				2.0		17Feb06	
96	MD	1.2	20 mm x4	0				6.0		17Feb06	
97	MD	1.3	20 mm x4	0				12.0		17Feb06	
98	MD	.8	20 mm x2	0				8.0		17Feb06	
99	MD	.8	20 mm	0				8.0		17Feb06	
100	S	2.2	bolt/nail/wire/rod	0				12.0		17Feb06	
101	MD	.3	20 mm	1.0				4.0		17Feb06	
102	MD	.9	20 mm x3	0				10.0		17Feb06	
103	MD	.5	20 mm	1.0				4.0		17Feb06	
104	MD	1.0	20 mm x3	0				10.0		17Feb06	
105	MD	.8	20 mm	0				8.0		17Feb06	

Geophysical Dig Sheet and Target History

GRID 3C Unique Target ID	DIG RESULTS Anomaly Type ***	Approx. Weight (lbs-oz/kg-g)	Comments (e.g., response below 1 foot)	Offset Distance (ft)	Offset Direction (N, NE, etc.)	Orientation of Nose (Azimuth deg)	Inclination of Nose (deg)	Depth to Top of Item (in/~~cm~~)	Digital Photo Number	2006 Date	Team Leader
106	MD	.3	20 mm	1.0				10.0		17Feb06	W
107	MD	.7	20 mm X2	0				8.0		17Feb06	W
108	MD	.5	20 mm	0.5				8.0		17Feb06	W
109	MD	1.2	20 mm X5	0				8.0		17Feb06	W
110			LIP	0				>12.0"		17Feb06	W
111	MD	.5	20 mm	0.5				12.0		17Feb06	W
112	MD	.4	20 mm	0				10.0		17Feb06	W
113	MD	.3	20 mm	1.0				8.0		17Feb06	W
114	MD	.8	20 mm X2	0				10.0		17Feb06	W
115	MD	.7	20 mm X2	0				8.0		17Feb06	W
116	MD	.4	20 mm	1.0				6.0		17Feb06	W
117	S	1.8	Scrap	0				10.0		17Feb06	W
118	MD	.7	20 mm X2	0				10.0		17Feb06	W
119	MD	.6	20 mm	0				6.0		17Feb06	W
120	S	.3	Scrap	0.5				4.0		17Feb06	W

Geophysical Dig Sheet and Target History

GRID 3C Unique Target ID	DIG RESULTS										
	Anomaly Type ***	Approx. Weight (lbs-~~oz/kg-g~~)	Comments (e.g., response below 1 foot)	Offset Distance (ft)	Offset Direction (N, NE, etc.)	Orientation of Nose (Azimuth deg)	Inclination of Nose (deg)	Depth to Top of Item (in/~~cm~~)	Digital Photo Number	2006 Date	Team Leader
121	MD	.6	20mm	0				6.0		17Feb06	W
122	MD	1.1	20 mm x4	0				10.0		17Feb06	W
123	MD	1.7	20 mm x5	0				10.0		17Feb06	W
124	MD	.4	20 mm	0				4.0		17Feb06	W
125	MD	.6	20mm	0				4.0		17Feb06	W
126	MD	.6	20 mm	0				2.0		17Feb06	W
127	MD	1.7	20 mm x5	0				4.0		17Feb06	W
128	MD	.2	20 mm	1.0				2.0		17Feb06	W
129	MD	.2	20 mm	1.0				2.0		17Feb06	W
130	MD	.7	20 mm x2	0				8.0		17Feb06	W
131	MD	.3	20 mm	0.5				6.0		17Feb06	W
132	MD	1.4	20 mm x4	0				10.0		17Feb06	W
133	MD	.8	20mm x3	0				8.0		17Feb06	W
134	MD	1.4	20 mm x4	0				10.0		17Feb06	W
135	MD	.2	20 mm	1.0				8.0		17Feb06	W

Geophysical Dig Sheet and Target History

GRID 3C	DIG RESULTS										
Unique Target ID	Anomaly Type ***	Approx. Weight (lbs-~~oz/kg-g~~)	Comments (e.g., response below 1 foot)	Offset Distance (ft)	Offset Direction (N, NE, etc.)	Orientation of Nose (Azimuth deg)	Inclination of Nose (deg)	Depth to Top of Item (in/~~cm~~)	Digital Photo Number	2006 Date	Team Leader
136	MD	1.6	20mm x6	0				12.0		17Feb06	W
137	MD	.6	20mm	0				6.0		17Feb06	W
138	MD	1.5	20mm x4	0				10.0		17Feb06	W
139	MD	.7	20mm x2	0				12.0		17Feb06	W
140	MD	1.2	20mm x3	0				10.0		17Feb06	W
141	MD	.5	20mm	1.0				8.0		17Feb06	W
142	MD	.5	20mm	0				10.0		17Feb06	W
143	MD	.5	20mm	0				6.0		17Feb06	W
144	MD	.6	20mm x2	0				6.0		17Feb06	W
145	MD	1.0	20mm/30mm	0				10.0		17Feb06	W
146	MD	1.0	20mm x4	0				10.0		17Feb06	W
147	MD	.7	20mm x2	0				6.0		17Feb06	W
148	MD	.4	20mm	1.0				4.0		17Feb06	W
149	MD	.6	20mm	0				4.0		17Feb06	W
150	S	2.0	rebar	0				8.0		17Feb06	W

Geophysical Dig Sheet and Target History

GRID 3C Unique Target ID	DIG RESULTS										
	Anomaly Type ***	Approx. Weight (lbs-~~oz/kg-g~~)	Comments (e.g., response below 1 foot)	Offset Distance (ft)	Offset Direction (N, NE, etc.)	Orientation of Nose (Azimuth deg)	Inclination of Nose (deg)	Depth to Top of Item (in/~~cm~~)	Digital Photo Number	2006 Date	Team Leader
151	MD	.7	20mm X2	0				6.0		17Feb06	W
152	MD	.9	20 mm x2	0				6.0		17Feb06	W
153	MD	1.0	20 mm x3	0				6.0		17Feb06	W
154	MD	.5	20mm	1.0				4.0		17Feb06	W
155	MD	.7	20 mm x4	0				8.0		17Feb06	W
156	MD	.9	20mm/30mm	0				8.0		17Feb06	W
157	MD	.4	20 mm	0.5				4.0		17Feb06	W
158	MD	.4	20 mm	0				6.0		17Feb06	W
159	MD	.4	20 mm	1.0				6.0		17Feb06	W
160	MD	.3	20 mm	1.0				6.0		17Feb06	W
161	S	.4	nailsx2/scrap	0				4.0		17Feb06	W
162	MD	.9	20mm x3	0				10.0		17Feb06	W
163	MD	1.0	20mm x2	0				6.0		17Feb06	W
164	MD	1.0	20mm x3	0				4.0		17Feb06	W
165	MD	.6	20mm	0				4.0		17Feb06	W

Geophysical Dig Sheet and Target History

GRID 3C Unique Target ID	DIG RESULTS										
	Anomaly Type ***	Approx. Weight (lbs-~~oz/kg-g~~)	Comments (e.g., response below 1 foot)	Offset Distance (ft)	Offset Direction (N, NE, etc.)	Orientation of Nose (Azimuth deg)	Inclination of Nose (deg)	Depth to Top of Item (in/~~cm~~)	Digital Photo Number	2006 Date	Team Leader
166	MD	.5	20 mm	0				6.0		17 Feb 06	W
167	MD	.4	20 mm	0				2.0		17 Feb 06	W
168	MD	.4	20 mm	1.0				4.0		17 Feb 06	W
169			LIP	0				>12.0"		17 Feb 06	W
170			LIP	0				>12.0"		17 Feb 06	W
171			LIP	0				>12.0"		17 Feb 06	W
172			LIP	0				>12.0"		17 Feb 06	W
173			LIP	0				>12.0"		17 Feb 06	W
174	MD	.7	20 mm x2	0				4.0		17 Feb 06	W
175	HR	.3	hot rock	1.0				4.0		17 Feb 06	W
176	MD	.7	20 mm x2	0				6.0		17 Feb 06	W

Geophysical Dig Sheet and Target History

GRID 3C Unique Target ID	POST-DIG UXO QC RESULTS			POST-DIG PROJECT QC		
	Excavation Hole Cleared?	UXO QC Spec. Initials	Date	Agreement Between Dig Results & Geophysical Data? (G=good, P=poor, U=unacceptable)	Project QC Initials	Date
1	Yes	[illegible]	2/17/06	G	VAS	2-17-06
2						
3						
4						
5						
6						
7						
8						
9						
10	Yes	[illegible]	2/17/06	G	VAS	2-17-06
11						
12						
13						
14						
15						

Geophysical Dig Sheet and Target History

GRID 3C Unique Target ID	POST-DIG UXO QC RESULTS			POST-DIG PROJECT QC		
	Excavation Hole Cleared?	UXO QC Spec. Initials	Date	Agreement Between Dig Results & Geophysical Data? (G=good, P=poor, U=unacceptable)	Project QC Initials	Date
16						
17						
18						
19						
20	Yes	EMD	2/17/06	G	VAS	2-17-06
21						
22						
23						
24						
25						
26						
27						
28						
29						
30	Yes	EMD	2/17/06	G	VAS	2-17-06

Geophysical Dig Sheet and Target History

GRID 3C	POST-DIG UXO QC RESULTS			POST-DIG PROJECT QC		
Unique Target ID	Excavation Hole Cleared?	UXO QC Spec. Initials	Date	Agreement Between Dig Results & Geophysical Data? (G=good, P=poor, U=unacceptable)	Project QC Initials	Date
31	Yes	EMD	2/17/06	G	VAS	2-17-06
32						
33						
34						
35						
36						
37						
38						
39						
40	Yes	EMD	2/17/06	G	VAS	2-17-06
41						
42						
43						
44						
45						

Geophysical Dig Sheet and Target History

GRID 3C Unique Target ID	POST-DIG UXO QC RESULTS			POST-DIG PROJECT QC		
	Excavation Hole Cleared?	UXO QC Spec. Initials	Date	Agreement Between Dig Results & Geophysical Data? (G=good, P=poor, U=unacceptable)	Project QC Initials	Date
46						
47						
48						
49						
50	Yes	EMD	2/17/06	G	VAS	2-17-06
51						
52						
53						
54						
55						
56						
57						
58						
59						
60	Yes	EMD	2/17/06	G	VAS	2-17-06

Geophysical Dig Sheet and Target History

GRID 3C Unique Target ID	POST-DIG UXO QC RESULTS			POST-DIG PROJECT QC		
	Excavation Hole Cleared?	UXO QC Spec. Initials	Date	Agreement Between Dig Results & Geophysical Data? (G=good, P=poor, U=unacceptable)	Project QC Initials	Date
61						
62						
63						
64						
65						
66						
67						
68						
69						
70	Yes	[illegible]	2/17/06	G	VAS	2-17-06
71						
72						
73						
74						
75						

Geophysical Dig Sheet and Target History

GRID 3C Unique Target ID	POST-DIG UXO QC RESULTS			POST-DIG PROJECT QC		
	Excavation Hole Cleared?	UXO QC Spec. Initials	Date	Agreement Between Dig Results & Geophysical Data? (G=good, P=poor, U=unacceptable)	Project QC Initials	Date
76						
77						
78						
79						
80	Yes	[illegible]	2/17/06	G	VAS	2-17-06
81						
82						
83						
84						
85						
86						
87						
88						
89						
90	Yes	[illegible]	2/17/06	G	VAS	2-17-06

Geophysical Dig Sheet and Target History

GRID 3C Unique Target ID	POST-DIG UXO QC RESULTS			POST-DIG PROJECT QC		
	Excavation Hole Cleared?	UXO QC Spec. Initials	Date	Agreement Between Dig Results & Geophysical Data? (G=good, P=poor, U=unacceptable)	Project QC Initials	Date
91						
92						
93						
94						
95						
96						
97						
98						
99						
100	Yes	EAD	2/17/06	G	VAS	2-17-06
101						
102						
103						
104						
105						

Geophysical Dig Sheet and Target History

GRID 3C Unique Target ID	POST-DIG UXO QC RESULTS			POST-DIG PROJECT QC		
	Excavation Hole Cleared?	UXO QC Spec. Initials	Date	Agreement Between Dig Results & Geophysical Data? (G=good, P=poor, U=unacceptable)	Project QC Initials	Date
106						
107						
108						
109						
110	NO Deeper than 12"	EAD	2/17/06	G	VAS	2-17-06
111						
112						
113						
114						
115						
116						
117						
118						
119						
120	Yes	EAD	2/17/06	G	VAS	2-17-06

Geophysical Dig Sheet and Target History

GRID 3C Unique Target ID	POST-DIG UXO QC RESULTS			POST-DIG PROJECT QC		
	Excavation Hole Cleared?	UXO QC Spec. Initials	Date	Agreement Between Dig Results & Geophysical Data? (G=good, P=poor, U=unacceptable)	Project QC Initials	Date
121						
122						
123						
124						
125						
126						
127						
128						
129						
130	Yes	EMD	2/17/06	G	VAS	2-17-06
131						
132						
133						
134						
135						

Geophysical Dig Sheet and Target History

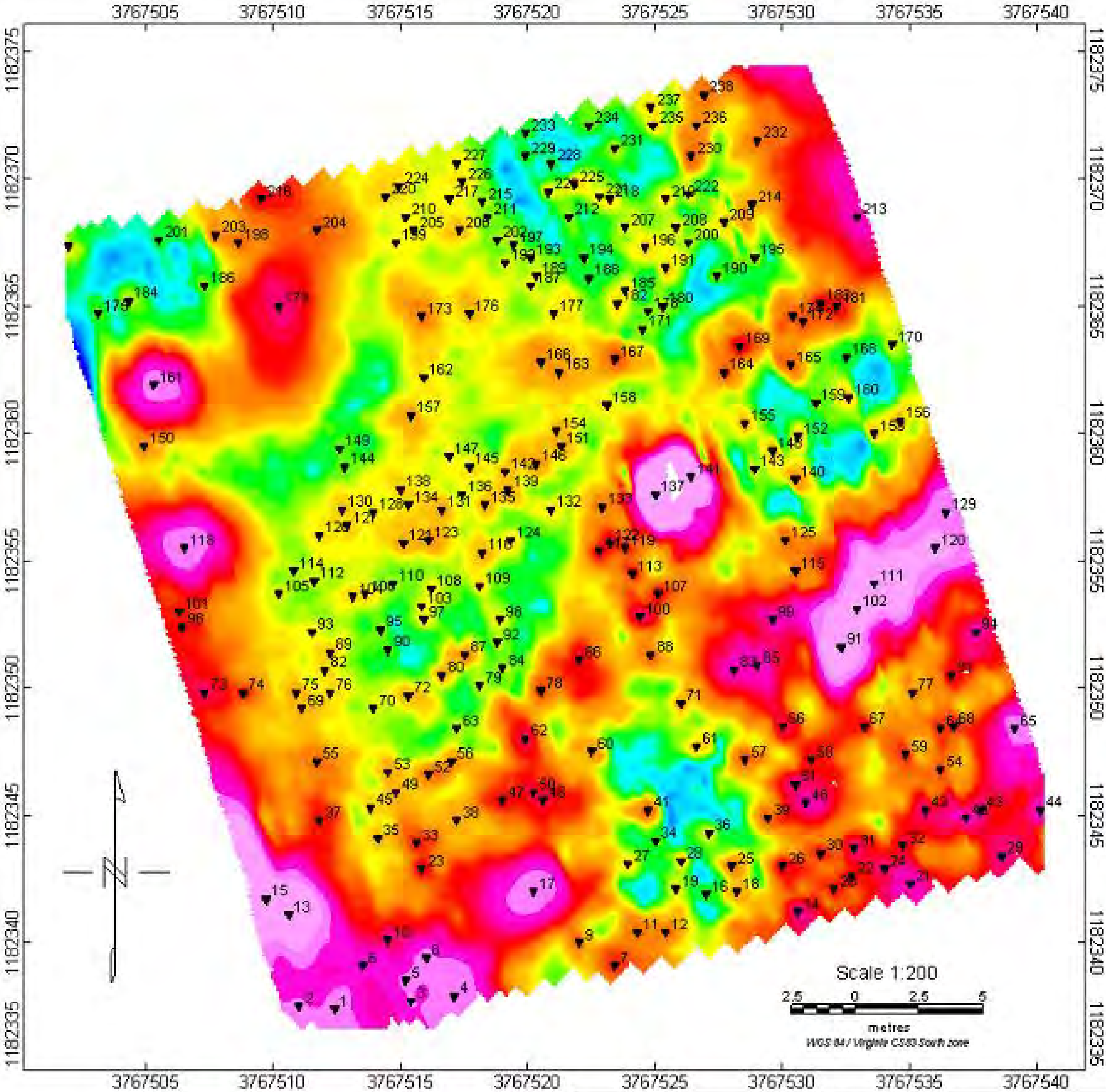
GRID 3C Unique Target ID	POST-DIG UXO QC RESULTS			POST-DIG PROJECT QC		
	Excavation Hole Cleared?	UXO QC Spec. Initials	Date	Agreement Between Dig Results & Geophysical Data? (G=good, P=poor, U=unacceptable)	Project QC Initials	Date
136						
137						
138						
139						
140	Yes	ESD	2/17/06	G	VAS	2-17-06
141						
142						
143						
144						
145						
146						
147						
148						
149						
150	Yes	ESD	2/17/06	G	VAS	2-17-06

Geophysical Dig Sheet and Target History

GRID 3C Unique Target ID	POST-DIG UXO QC RESULTS			POST-DIG PROJECT QC		
	Excavation Hole Cleared?	UXO QC Spec. Initials	Date	Agreement Between Dig Results & Geophysical Data? (G=good, P=poor, U=unacceptable)	Project QC Initials	Date
151						
152						
153						
154						
155						
156						
157						
158						
159						
160	Yes	[illegible]	2/17/06	G	UAS	2-17-06
161						
162						
163						
164						
165						

Geophysical Dig Sheet and Target History

GRID 3C Unique Target ID	POST-DIG UXO QC RESULTS			POST-DIG PROJECT QC		
	Excavation Hole Cleared?	UXO QC Spec. Initials	Date	Agreement Between Dig Results & Geophysical Data? (G=good, P=poor, U=unacceptable)	Project QC Initials	Date
166						
167						
168						
169						
170	NO	EMD	2/17/06	G	VAS	2-17-06
171						
172						
173						
174						
175						
176						



NASA

Wallops Flight Center
EM61 MK2 Data
Grid 3D

February 9, 2006

Tetra Tech EM Inc.

Geophysical Dig Sheet and Target History

GRID 3D Unique Target ID	ORIGINAL SURVEY									
	Easting Coord. (m)	Northing Coord. (m)	Lat. Coord.	Long. Coord.	X - Local (Grid) Coord. (ft)	Y - Local (Grid) Coord. (ft)	Channel ID (i.e. C1, top senor, gradient)	Response Amplitude (mV)	Dig Priority	Date
222	3767526.3	1182369.4	37.56.15.90	-75.27.22.17	77.49	88.74	Z(1-4)	20.7		2/9/2006
223	3767520.8	1182369.5	37.56.15.91	-75.27.22.39	60.66	93.35	Z(1-4)	22.7		2/9/2006
224	3767514.9	1182369.7	37.56.15.93	-75.27.22.63	42.69	98.61	Z(1-4)	29.5		2/9/2006
225	3767521.8	1182369.8	37.56.15.92	-75.27.22.35	64.04	93.49	Z(1-4)	29.6		2/9/2006
226	3767517.4	1182369.9	37.56.15.93	-75.27.22.53	50.59	97.26	Z(1-4)	24.6		2/9/2006
227	3767517.2	1182370.6	37.56.15.95	-75.27.22.54	50.68	99.59	Z(1-4)	22.8		2/9/2006
228	3767520.9	1182370.6	37.56.15.95	-75.27.22.39	62.08	96.68	Z(1-4)	8.5		2/9/2006
229	3767519.9	1182370.9	37.56.15.96	-75.27.22.43	59.3	98.39	Z(1-4)	9.2		2/9/2006
230	3767526.4	1182370.9	37.56.15.95	-75.27.22.16	79.31	93.29	Z(1-4)	63.6		2/9/2006
231	3767523.4	1182371.2	37.56.15.97	-75.27.22.28	70.38	96.57	Z(1-4)	17.9		2/9/2006
232	3767529	1182371.5	37.56.15.97	-75.27.22.05	87.92	93.11	Z(1-4)	57.3		2/9/2006
233	3767519.9	1182371.8	37.56.15.99	-75.27.22.42	60.21	101.18	Z(1-4)	8.1		2/9/2006
234	3767522.4	1182372.1	37.56.16.00	-75.27.22.32	68.21	100.14	Z(1-4)	14.4		2/9/2006
235	3767524.9	1182372.1	37.56.15.99	-75.27.22.22	75.9	98.18	Z(1-4)	32.2		2/9/2006
236	3767526.6	1182372.1	37.56.15.99	-75.27.22.15	81.14	96.84	Z(1-4)	48.6		2/9/2006

Geophysical Dig Sheet and Target History

GRID 3D Unique Target ID	ORIGINAL SURVEY									
	Easting Coord. (m)	Northing Coord. (m)	Lat. Coord.	Long. Coord.	X - Local (Grid) Coord. (ft)	Y - Local (Grid) Coord. (ft)	Channel ID (i.e. C1, top senor, gradient)	Response Amplitude (mV)	Dig Priority	Date
237	3767524.8	1182372.8	37.56.16.02	-75.27.22.22	76.3	✓100.42	Z(1-4)	29.8		2/9/2006
238	3767526.9	1182373.3	37.56.16.03	-75.27.22.14	83.27	✓100.31	Z(1-4)	54.2		2/9/2006
239	3767501.95	1182367.36	37.56.15.86	-75.27.23.17	0.44	✓101.58	Z(1-4)	16.6		2/9/2006

Note: *Fill in Acceptable Units (mV, nT/m, ppt, etc).

**Optional field – refer to SOW for applicability to specific project.

***For Anomaly type, U = UXO, F = frag, MD = munitions debris, S = scrap, A = small arms ammunition, NC = no contact, O = other.

Geophysical Dig Sheet and Target History

GRID 3D Unique Target ID	ORIGINAL SURVEY									
	Easting Coord. (m)	Northing Coord. (m)	Lat. Coord.	Long. Coord.	X - Local (Grid) Coord. (ft)	Y - Local (Grid) Coord. (ft)	Channel ID (i.e. C1, top senor, gradient)	Response Amplitude (mV)	Dig Priority	Date
1	3767512.4	1182337.4	37.56.14.88	-75.27.22.78	2.58	✓ -0.19	Z(1-4)	354.2		2/9/2006
2	3767511	1182337.5	37.56.14.89	-75.27.22.83	-1.62	✓ 1.16	Z(1-4)	283.7		2/9/2006
3	3767515.4	1182337.7	37.56.14.89	-75.27.22.65	12.1	✓ -1.49	Z(1-4)	263.4		2/9/2006
4	3767517.1	1182337.9	37.56.14.89	-75.27.22.58	17.52	✓ -2.13	Z(1-4)	394.4		2/9/2006
5	3767515.2	1182338.5	37.56.14.91	-75.27.22.66	12.28	✓ 1.16	Z(1-4)	275.6		2/9/2006
6	3767513.5	1182339.1	37.56.14.93	-75.27.22.73	7.66	✓ 4.31	Z(1-4)	224.9		2/9/2006
7	3767523.4	1182339.1	37.56.14.92	-75.27.22.32	38.07	✓ -3.06	Z(1-4)	73.7		2/9/2006
8	3767516	1182339.4	37.56.14.94	-75.27.22.63	15.64	✓ 3.38	Z(1-4)	289.1		2/9/2006
9	3767522	1182340	37.56.14.96	-75.27.22.38	34.67	✓ 0.79	Z(1-4)	71.4		2/9/2006
10	3767514.5	1182340.1	37.56.14.97	-75.27.22.69	11.74	✓ 6.69	Z(1-4)	141.5		2/9/2006
11	3767524.3	1182340.4	37.56.14.97	-75.27.22.29	42.14	✓ 0.33	Z(1-4)	55.8		2/9/2006
12	3767525.4	1182340.4	37.56.14.96	-75.27.22.24	45.51	✓ -0.49	Z(1-4)	54.6		2/9/2006
13	3767510.6	1182341.1	37.56.15.00	-75.27.22.85	0.75	✓ 12.74	Z(1-4)	1361		2/9/2006
14	3767530.6	1182341.2	37.56.14.99	-75.27.22.03	62.28	✓ -1.85	Z(1-4)	163.9		2/9/2006
15	3767509.7	1182341.7	37.56.15.02	-75.27.22.88	-1.41	✓ 15.3	Z(1-4)	1264		2/9/2006
16	3767527	1182341.9	37.56.15.01	-75.27.22.17	51.93	✓ 2.99	Z(1-4)	9.5		2/9/2006
17	3767520.2	1182342	37.56.15.02	-75.27.22.45	31.15	✓ 8.36	Z(1-4)	392.2		2/9/2006
18	3767528.2	1182342	37.56.15.01	-75.27.22.12	55.72	✓ 2.41	Z(1-4)	38.8		2/9/2006
19	3767525.8	1182342.1	37.56.15.02	-75.27.22.22	48.45	✓ 4.5	Z(1-4)	20.1		2/9/2006
20	3767532	1182342.1	37.56.15.01	-75.27.21.97	67.48	✓ -0.09	Z(1-4)	80.2		2/9/2006
21	3767535	1182342.3	37.56.15.02	-75.27.21.85	76.89	✓ -1.68	Z(1-4)	168.6		2/9/2006
22	3767532.7	1182342.6	37.56.15.03	-75.27.21.94	70.13	✓ 0.95	Z(1-4)	98.4		2/9/2006

Geophysical Dig Sheet and Target History

GRID 3D Unique Target ID	ORIGINAL SURVEY									
	Easting Coord. (m)	Northing Coord. (m)	Lat. Coord.	Long. Coord.	X - Local (Grid) Coord. (ft)	Y - Local (Grid) Coord. (ft)	Channel ID (i.e. C1, top senor, gradient)	Response Amplitude (mV)	Dig Priority	Date
23	3767515.8	1182342.9	37.56.15.06	-75.27.22.63	18.54	14.46	Z(1-4)	101.2		2/9/2006
24	3767534	1182342.9	37.56.15.04	-75.27.21.89	74.43	0.92	Z(1-4)	135.4		2/9/2006
25	3767528	1182343	37.56.15.05	-75.27.22.13	56.11	5.67	Z(1-4)	54.2		2/9/2006
26	3767530	1182343	37.56.15.04	-75.27.22.05	62.25	4.18	Z(1-4)	108.6		2/9/2006
27	3767523.9	1182343.1	37.56.15.05	-75.27.22.30	43.62	9.03	Z(1-4)	26.2		2/9/2006
28	3767526	1182343.2	37.56.15.05	-75.27.22.21	50.17	7.77	Z(1-4)	26.2		2/9/2006
29	3767538.6	1182343.4	37.56.15.05	-75.27.21.70	89.05	-0.93	Z(1-4)	142.9		2/9/2006
30	3767531.5	1182343.5	37.56.15.06	-75.27.21.99	67.36	4.62	Z(1-4)	78.8		2/9/2006
31	3767532.8	1182343.7	37.56.15.06	-75.27.21.93	71.55	4.28	Z(1-4)	122.9		2/9/2006
32	3767534.7	1182343.8	37.56.15.07	-75.27.21.86	77.48	3.19	Z(1-4)	114.4		2/9/2006
33	3767515.6	1182343.9	37.56.15.09	-75.27.22.64	18.92	17.74	Z(1-4)	76		2/9/2006
34	3767525	1182344	37.56.15.08	-75.27.22.25	47.9	11.01	Z(1-4)	12.7		2/9/2006
35	3767514.1	1182344.1	37.56.15.10	-75.27.22.70	14.51	19.49	Z(1-4)	32.9		2/9/2006
36	3767527.1	1182344.3	37.56.15.09	-75.27.22.17	54.65	10.37	Z(1-4)	22.2		2/9/2006
37	3767511.8	1182344.8	37.56.15.12	-75.27.22.79	8.15	23.42	Z(1-4)	82.8		2/9/2006
38	3767517.2	1182344.8	37.56.15.12	-75.27.22.57	24.74	19.34	Z(1-4)	38.5		2/9/2006
39	3767529.4	1182344.9	37.56.15.11	-75.27.22.07	62.32	10.52	Z(1-4)	64.2		2/9/2006
40	3767537.2	1182344.9	37.56.15.10	-75.27.21.75	86.26	4.74	Z(1-4)	164.8		2/9/2006
41	3767524.7	1182345.2	37.56.15.12	-75.27.22.26	48.19	14.96	Z(1-4)	64.8		2/9/2006

Geophysical Dig Sheet and Target History

GRID 3D Unique Target ID	ORIGINAL SURVEY									
	Easting Coord. (m)	Northing Coord. (m)	Lat. Coord.	Long. Coord.	X - Local (Grid) Coord. (ft)	Y - Local (Grid) Coord. (ft)	Channel ID (i.e. C1, top senor, gradient)	Response Amplitude (mV)	Dig Priority	Date
42	3767535.6	1182345.2	37.56.15.11	-75.27.21.82	81.65	✓ 6.85	Z(1-4)	131.8		2/9/2006
43	3767537.8	1182345.2	37.56.15.11	-75.27.21.73	88.41	✓ 5.23	Z(1-4)	142.9		2/9/2006
44	3767540.1	1182345.2	37.56.15.10	-75.27.21.63	95.46	✓ 3.53	Z(1-4)	168		2/9/2006
45	3767513.8	1182345.3	37.56.15.14	-75.27.22.71	14.79	✓ 23.47	Z(1-4)	28.6		2/9/2006
46	3767530.9	1182345.5	37.56.15.12	-75.27.22.01	67.53	✓ 11.27	Z(1-4)	153.5		2/9/2006
47	3767519	1182345.6	37.56.15.14	-75.27.22.50	31.08	✓ 20.48	Z(1-4)	90.1		2/9/2006
48	3767520.6	1182345.6	37.56.15.14	-75.27.22.43	35.99	✓ 19.28	Z(1-4)	106.2		2/9/2006
49	3767514.8	1182345.9	37.56.15.15	-75.27.22.67	18.47	✓ 24.58	Z(1-4)	34.8		2/9/2006
50	3767520.2	1182345.9	37.56.15.15	-75.27.22.45	35.06	✓ 20.51	Z(1-4)	108.1		2/9/2006
51	3767530.5	1182346.2	37.56.15.15	-75.27.22.02	67	✓ 13.74	Z(1-4)	133.1		2/9/2006
52	3767516.1	1182346.6	37.56.15.18	-75.27.22.61	23.17	✓ 25.79	Z(1-4)	58.6		2/9/2006
53	3767514.5	1182346.7	37.56.15.18	-75.27.22.68	18.35	✓ 27.31	Z(1-4)	36.4		2/9/2006
54	3767536.2	1182346.8	37.56.15.16	-75.27.21.79	85.11	✓ 11.36	Z(1-4)	65.5		2/9/2006
55	3767511.7	1182347.1	37.56.15.20	-75.27.22.79	10.14	✓ 30.68	Z(1-4)	56.3		2/9/2006
56	3767517	1182347.1	37.56.15.19	-75.27.22.58	26.44	✓ 26.67	Z(1-4)	45.4		2/9/2006

Geophysical Dig Sheet and Target History

GRID 3D Unique Target ID	ORIGINAL SURVEY									
	Easting Coord. (m)	Northing Coord. (m)	Lat. Coord.	Long. Coord.	X - Local (Grid) Coord. (ft)	Y - Local (Grid) Coord. (ft)	Channel ID (i.e. C1, top senor, gradient)	Response Amplitude (mV)	Dig Priority	Date
57	3767528.5	1182347.2	37.56.15.18	-75.27.22.10	61.87	18.33	Z(1-4)	65		2/9/2006
58	3767531.1	1182347.2	37.56.15.18	-75.27.22.00	69.85	16.39	Z(1-4)	90.5		2/9/2006
59	3767534.8	1182347.4	37.56.15.18	-75.27.21.85	81.42	14.25	Z(1-4)	73.5		2/9/2006
60	3767522.5	1182347.5	37.56.15.20	-75.27.22.35	43.74	23.76	Z(1-4)	43.4		2/9/2006
61	3767526.6	1182347.7	37.56.15.20	-75.27.22.18	56.54	21.31	Z(1-4)	28.2		2/9/2006
62	3767519.9	1182348	37.56.15.22	-75.27.22.46	36.25	27.28	Z(1-4)	118.8		2/9/2006
63	3767517.2	1182348.4	37.56.15.23	-75.27.22.57	28.35	30.57	Z(1-4)	16.4		2/9/2006
64	3767536.2	1182348.4	37.56.15.21	-75.27.21.79	86.72	16.3	Z(1-4)	70.8		2/9/2006
65	3767539.1	1182348.4	37.56.15.21	-75.27.21.67	95.62	14.15	Z(1-4)	323.8		2/9/2006
66	3767530	1182348.5	37.56.15.22	-75.27.22.04	67.78	21.24	Z(1-4)	110.7		2/9/2006
67	3767533.2	1182348.5	37.56.15.22	-75.27.21.91	77.61	18.85	Z(1-4)	91.1		2/9/2006
68	3767536.7	1182348.5	37.56.15.22	-75.27.21.77	88.36	16.24	Z(1-4)	70.4		2/9/2006
69	3767511.1	1182349.2	37.56.15.26	-75.27.22.81	10.4	37.7	Z(1-4)	35.1		2/9/2006
70	3767513.9	1182349.2	37.56.15.26	-75.27.22.70	19.01	35.57	Z(1-4)	17.6		2/9/2006
71	3767526	1182349.4	37.56.15.26	-75.27.22.20	56.4	27.03	Z(1-4)	34.1		2/9/2006

Geophysical Dig Sheet and Target History

GRID 3D Unique Target ID	ORIGINAL SURVEY									
	Easting Coord. (m)	Northing Coord. (m)	Lat. Coord.	Long. Coord.	X - Local (Grid) Coord. (ft)	Y - Local (Grid) Coord. (ft)	Channel ID (i.e. C1, top senor, gradient)	Response Amplitude (mV)	Dig Priority	Date
72	3767515.3	1182349.7	37.56.15.28	-75.27.22.64	23.82	36.06	Z(1-4)	31.2		2/9/2006
73	3767507.3	1182349.8	37.56.15.29	-75.27.22.97	-0.68	42.49	Z(1-4)	123.4		2/9/2006
74	3767508.8	1182349.8	37.56.15.29	-75.27.22.91	3.93	41.34	Z(1-4)	74.1		2/9/2006
75	3767510.9	1182349.8	37.56.15.28	-75.27.22.82	10.39	39.73	Z(1-4)	36.8		2/9/2006
76	3767512.2	1182349.8	37.56.15.28	-75.27.22.77	14.39	38.74	Z(1-4)	25.7		2/9/2006
77	3767535.1	1182349.8	37.56.15.26	-75.27.21.83	84.76	21.45	Z(1-4)	47.9		2/9/2006
78	3767520.5	1182349.9	37.56.15.28	-75.27.22.43	40	32.74	Z(1-4)	68.2		2/9/2006
79	3767518.1	1182350.1	37.56.15.29	-75.27.22.53	32.83	35.18	Z(1-4)	17.6		2/9/2006
80	3767516.6	1182350.5	37.56.15.30	-75.27.22.59	28.62	37.57	Z(1-4)	43.1		2/9/2006
81	3767536.6	1182350.5	37.56.15.28	-75.27.21.77	90.07	22.49	Z(1-4)	93.8		2/9/2006
82	3767512	1182350.7	37.56.15.31	-75.27.22.78	14.67	41.7	Z(1-4)	27.5		2/9/2006
83	3767528.1	1182350.7	37.56.15.30	-75.27.22.12	64.16	29.49	Z(1-4)	181.2		2/9/2006
84	3767519	1182350.8	37.56.15.31	-75.27.22.49	36.3	36.68	Z(1-4)	18.6		2/9/2006
85	3767529	1182350.9	37.56.15.30	-75.27.22.08	67.13	29.43	Z(1-4)	181.3		2/9/2006
86	3767522	1182351.1	37.56.15.32	-75.27.22.37	45.82	35.34	Z(1-4)	93.5		2/9/2006

Geophysical Dig Sheet and Target History

GRID 3D Unique Target ID	ORIGINAL SURVEY									
	Easting Coord. (m)	Northing Coord. (m)	Lat. Coord.	Long. Coord.	X - Local (Grid) Coord. (ft)	Y - Local (Grid) Coord. (ft)	Channel ID (i.e. C1, top senor, gradient)	Response Amplitude (mV)	Dig Priority	Date
87	3767517.5	1182351.3	37.56.15.33	-75.27.22.55	32.19	✓ 39.38	Z(1-4)	53.9		2/9/2006
88	3767524.8	1182351.3	37.56.15.32	-75.27.22.25	54.63	✓ 33.84	Z(1-4)	58.9		2/9/2006
89	3767512.2	1182351.4	37.56.15.34	-75.27.22.77	15.99	✓ 43.73	Z(1-4)	27.2		2/9/2006
90	3767514.5	1182351.5	37.56.15.34	-75.27.22.67	23.16	✓ 42.29	Z(1-4)	11.5		2/9/2006
91	3767532.3	1182351.6	37.56.15.32	-75.27.21.94	77.97	✓ 29.12	Z(1-4)	931.2		2/9/2006
92	3767518.8	1182351.8	37.56.15.34	-75.27.22.50	36.69	✓ 39.94	Z(1-4)	17.1		2/9/2006
93	3767511.5	1182352.2	37.56.15.36	-75.27.22.79	14.64	✓ 46.77	Z(1-4)	20		2/9/2006
94	3767537.6	1182352.2	37.56.15.33	-75.27.21.73	94.86	✓ 27	Z(1-4)	157.8		2/9/2006
95	3767514.2	1182352.3	37.56.15.36	-75.27.22.68	23.05	✓ 45.01	Z(1-4)	13.2		2/9/2006
96	3767506.4	1182352.4	37.56.15.37	-75.27.23.00	-0.85	✓ 51.31	Z(1-4)	91		2/9/2006
97	3767515.9	1182352.7	37.56.15.37	-75.27.22.61	28.67	✓ 44.96	Z(1-4)	22.4		2/9/2006
98	3767518.9	1182352.7	37.56.15.37	-75.27.22.49	37.9	✓ 42.67	Z(1-4)	20.9		2/9/2006
99	3767529.6	1182352.7	37.56.15.36	-75.27.22.05	70.79	✓ 34.55	Z(1-4)	159.1		2/9/2006
100	3767524.4	1182352.8	37.56.15.37	-75.27.22.27	54.91	✓ 38.8	Z(1-4)	123.9		2/9/2006
101	3767506.3	1182353	37.56.15.39	-75.27.23.01	-0.55	✓ 53.27	Z(1-4)	81		2/9/2006

Geophysical Dig Sheet and Target History

GRID 3D Unique Target ID	ORIGINAL SURVEY									
	Easting Coord. (m)	Northing Coord. (m)	Lat. Coord.	Long. Coord.	X - Local (Grid) Coord. (ft)	Y - Local (Grid) Coord. (ft)	Channel ID (i.e. C1, top senor, gradient)	Response Amplitude (mV)	Dig Priority	Date
102	3767532.9	1182353.1	37.56.15.37	-75.27.21.92	81.33	33.3	Z(1-4)	821		2/9/2006
103	3767515.8	1182353.2	37.56.15.39	-75.27.22.62	28.87	46.59	Z(1-4)	22.1		2/9/2006
104	3767513.1	1182353.6	37.56.15.41	-75.27.22.73	20.97	49.91	Z(1-4)	27.6		2/9/2006
105	3767510.2	1182353.7	37.56.15.41	-75.27.22.85	12.15	52.45	Z(1-4)	18.8		2/9/2006
106	3767513.6	1182353.7	37.56.15.41	-75.27.22.71	22.61	49.84	Z(1-4)	25.8		2/9/2006
107	3767525.1	1182353.7	37.56.15.40	-75.27.22.24	57.96	41.06	Z(1-4)	81.8		2/9/2006
108	3767516.2	1182353.9	37.56.15.41	-75.27.22.60	30.8	48.47	Z(1-4)	22.8		2/9/2006
109	3767518.1	1182354	37.56.15.41	-75.27.22.52	36.75	47.32	Z(1-4)	27.5		2/9/2006
110	3767514.7	1182354.1	37.56.15.42	-75.27.22.66	26.39	50.24	Z(1-4)	15.9		2/9/2006
111	3767533.6	1182354.1	37.56.15.40	-75.27.21.89	84.49	35.87	Z(1-4)	1099		2/9/2006
112	3767511.6	1182354.2	37.56.15.43	-75.27.22.79	16.95	52.93	Z(1-4)	18.4		2/9/2006
113	3767524.1	1182354.5	37.56.15.42	-75.27.22.28	55.7	44.3	Z(1-4)	85.1		2/9/2006
114	3767510.8	1182354.6	37.56.15.44	-75.27.22.82	14.89	54.8	Z(1-4)	16.9		2/9/2006
115	3767530.5	1182354.6	37.56.15.42	-75.27.22.01	75.47	39.75	Z(1-4)	56.7		2/9/2006
116	3767518.2	1182355.3	37.56.15.46	-75.27.22.52	38.36	51.29	Z(1-4)	33.9		2/9/2006

Geophysical Dig Sheet and Target History

GRID 3D Unique Target ID	ORIGINAL SURVEY									
	Easting Coord. (m)	Northing Coord. (m)	Lat. Coord.	Long. Coord.	X - Local (Grid) Coord. (ft)	Y - Local (Grid) Coord. (ft)	Channel ID (i.e. C1, top senor, gradient)	Response Amplitude (mV)	Dig Priority	Date
117	3767522.8	1182355.4	37.56.15.45	-75.27.22.33	52.61	48.08	Z(1-4)	87.9		2/9/2006
118	3767506.5	1182355.5	37.56.15.47	-75.27.22.99	2.57	60.93	Z(1-4)	403.7		2/9/2006
119	3767523.8	1182355.5	37.56.15.46	-75.27.22.29	55.78	47.63	Z(1-4)	75.9		2/9/2006
120	3767536	1182355.5	37.56.15.44	-75.27.21.79	93.27	38.38	Z(1-4)	553.6		2/9/2006
121	3767515.1	1182355.7	37.56.15.47	-75.27.22.64	29.23	54.92	Z(1-4)	38		2/9/2006
122	3767523.2	1182355.7	37.56.15.46	-75.27.22.31	54.14	48.71	Z(1-4)	89.9		2/9/2006
123	3767516.1	1182355.8	37.56.15.47	-75.27.22.60	32.4	54.46	Z(1-4)	44.4		2/9/2006
124	3767519.3	1182355.8	37.56.15.47	-75.27.22.47	42.25	52	Z(1-4)	26.5		2/9/2006
125	3767530.1	1182355.8	37.56.15.46	-75.27.22.03	75.45	43.77	Z(1-4)	58		2/9/2006
126	3767511.8	1182356	37.56.15.48	-75.27.22.78	19.38	58.4	Z(1-4)	22.7		2/9/2006
127	3767512.9	1182356.4	37.56.15.50	-75.27.22.73	23.16	58.79	Z(1-4)	26.5		2/9/2006
128	3767513.9	1182356.9	37.56.15.51	-75.27.22.69	26.74	59.58	Z(1-4)	22.2		2/9/2006
129	3767536.4	1182356.9	37.56.15.49	-75.27.21.77	95.92	42.4	Z(1-4)	423.6		2/9/2006
130	3767512.7	1182357	37.56.15.52	-75.27.22.74	23.15	60.82	Z(1-4)	29.1		2/9/2006
131	3767516.6	1182357	37.56.15.51	-75.27.22.58	35.15	57.81	Z(1-4)	39.7		2/9/2006

Geophysical Dig Sheet and Target History

GRID 3D Unique Target ID	ORIGINAL SURVEY									
	Easting Coord. (m)	Northing Coord. (m)	Lat. Coord.	Long. Coord.	X - Local (Grid) Coord. (ft)	Y - Local (Grid) Coord. (ft)	Channel ID (i.e. C1, top senor, gradient)	Response Amplitude (mV)	Dig Priority	Date
132	3767520.9	1182357	37.56.15.51	-75.27.22.40	48.37	54.51	Z(1-4)	24.3		2/9/2006
133	3767522.9	1182357.1	37.56.15.51	-75.27.22.32	54.62	53.28	Z(1-4)	49.9		2/9/2006
134	3767515.3	1182357.2	37.56.15.52	-75.27.22.63	31.35	59.43	Z(1-4)	27.1		2/9/2006
135	3767518.3	1182357.2	37.56.15.52	-75.27.22.51	40.58	57.12	Z(1-4)	31.2		2/9/2006
136	3767517.4	1182357.6	37.56.15.53	-75.27.22.55	38.21	59.06	Z(1-4)	19.3		2/9/2006
137	3767525	1182357.6	37.56.15.52	-75.27.22.23	61.58	53.23	Z(1-4)	4569		2/9/2006
138	3767515	1182357.8	37.56.15.54	-75.27.22.64	31.03	61.53	Z(1-4)	27.1		2/9/2006
139	3767519.2	1182357.8	37.56.15.54	-75.27.22.47	43.95	58.3	Z(1-4)	33.7		2/9/2006
140	3767530.5	1182358.2	37.56.15.54	-75.27.22.01	79.1	50.89	Z(1-4)	49.8		2/9/2006
141	3767526.4	1182358.3	37.56.15.54	-75.27.22.18	66.59	54.33	Z(1-4)	2383		2/9/2006
142	3767519.1	1182358.5	37.56.15.56	-75.27.22.47	44.35	60.55	Z(1-4)	30.2		2/9/2006
143	3767528.9	1182358.6	37.56.15.55	-75.27.22.07	74.58	53.35	Z(1-4)	18.5		2/9/2006
144	3767512.8	1182358.7	37.56.15.57	-75.27.22.73	25.16	66.04	Z(1-4)	12.6		2/9/2006
145	3767517.7	1182358.7	37.56.15.57	-75.27.22.53	40.24	62.25	Z(1-4)	26.4		2/9/2006
146	3767520.3	1182358.8	37.56.15.57	-75.27.22.43	48.34	60.56	Z(1-4)	44.3		2/9/2006

Geophysical Dig Sheet and Target History

GRID 3D Unique Target ID	ORIGINAL SURVEY									
	Easting Coord. (m)	Northing Coord. (m)	Lat. Coord.	Long. Coord.	X - Local (Grid) Coord. (ft)	Y - Local (Grid) Coord. (ft)	Channel ID (i.e. C1, top senor, gradient)	Response Amplitude (mV)	Dig Priority	Date
147	3767516.9	1182359.1	37.56.15.58	-75.27.22.56	38.18	64.11	Z(1-4)	21.4		2/9/2006
148	3767529.6	1182359.3	37.56.15.57	-75.27.22.04	77.44	54.98	Z(1-4)	36.5		2/9/2006
149	3767512.6	1182359.4	37.56.15.59	-75.27.22.74	25.25	68.38	Z(1-4)	10.9		2/9/2006
150	3767504.9	1182359.5	37.56.15.61	-75.27.23.05	1.65	74.69	Z(1-4)	47		2/9/2006
151	3767521.3	1182359.5	37.56.15.59	-75.27.22.38	52.12	61.96	Z(1-4)	37.2		2/9/2006
152	3767530.6	1182359.9	37.56.15.59	-75.27.22.00	81.12	56.07	Z(1-4)	27.3		2/9/2006
153	3767533.6	1182360	37.56.15.59	-75.27.21.88	90.44	54.09	Z(1-4)	27.8		2/9/2006
154	3767521.1	1182360.1	37.56.15.61	-75.27.22.39	52.11	63.98	Z(1-4)	36.9		2/9/2006
155	3767528.5	1182360.4	37.56.15.61	-75.27.22.09	75.17	59.22	Z(1-4)	35.9		2/9/2006
156	3767534.6	1182360.5	37.56.15.61	-75.27.21.84	94.02	54.87	Z(1-4)	33.8		2/9/2006
157	3767515.4	1182360.7	37.56.15.63	-75.27.22.62	35.18	70.25	Z(1-4)	37.7		2/9/2006
158	3767523.1	1182361.1	37.56.15.64	-75.27.22.31	59.27	65.54	Z(1-4)	22.8		2/9/2006
159	3767531.3	1182361.2	37.56.15.63	-75.27.21.97	84.58	59.55	Z(1-4)	14		2/9/2006
160	3767532.6	1182361.4	37.56.15.64	-75.27.21.92	88.78	59.17	Z(1-4)	28.8		2/9/2006
161	3767505.3	1182361.9	37.56.15.68	-75.27.23.04	5.29	81.87	Z(1-4)	341.3		2/9/2006

Geophysical Dig Sheet and Target History

GRID 3D Unique Target ID	ORIGINAL SURVEY									
	Easting Coord. (m)	Northing Coord. (m)	Lat. Coord.	Long. Coord.	X - Local (Grid) Coord. (ft)	Y - Local (Grid) Coord. (ft)	Channel ID (i.e. C1, top senor, gradient)	Response Amplitude (mV)	Dig Priority	Date
162	3767515.9	1182362.2	37.56.15.68	-75.27.22.60	38.22	74.53	Z(1-4)	26.6		2/9/2006
163	3767521.2	1182362.4	37.56.15.68	-75.27.22.38	54.73	71.03	Z(1-4)	44.1		2/9/2006
164	3767527.7	1182362.4	37.56.15.68	-75.27.22.12	74.73	66.02	Z(1-4)	67.1		2/9/2006
165	3767530.3	1182362.7	37.56.15.68	-75.27.22.01	83.02	64.95	Z(1-4)	62.9		2/9/2006
166	3767520.5	1182362.8	37.56.15.70	-75.27.22.41	52.98	72.82	Z(1-4)	40.7		2/9/2006
167	3767523.4	1182362.9	37.56.15.70	-75.27.22.29	62	70.88	Z(1-4)	70.5		2/9/2006
168	3767532.5	1182363	37.56.15.69	-75.27.21.92	90.09	64.19	Z(1-4)	10.3		2/9/2006
169	3767528.3	1182363.4	37.56.15.71	-75.27.22.09	77.58	68.65	Z(1-4)	101.7		2/9/2006
170	3767534.3	1182363.5	37.56.15.70	-75.27.21.85	96.13	64.35	Z(1-4)	18.2		2/9/2006
171	3767524.5	1182364.1	37.56.15.73	-75.27.22.25	66.6	73.75	Z(1-4)	15.4		2/9/2006
172	3767530.8	1182364.4	37.56.15.74	-75.27.21.99	86.28	69.81	Z(1-4)	62		2/9/2006
173	3767515.8	1182364.6	37.56.15.76	-75.27.22.60	40.33	82.06	Z(1-4)	50.5		2/9/2006
174	3767530.4	1182364.6	37.56.15.74	-75.27.22.00	85.25	70.74	Z(1-4)	62.7		2/9/2006
175	3767503.1	1182364.7	37.56.15.78	-75.27.23.12	1.32	92.36	Z(1-4)	11.9		2/9/2006
176	3767517.7	1182364.7	37.56.15.76	-75.27.22.52	46.28	80.89	Z(1-4)	36.2		2/9/2006

Geophysical Dig Sheet and Target History

GRID 3D Unique Target ID	ORIGINAL SURVEY									
	Easting Coord. (m)	Northing Coord. (m)	Lat. Coord.	Long. Coord.	X - Local (Grid) Coord. (ft)	Y - Local (Grid) Coord. (ft)	Channel ID (i.e. C1, top senor, gradient)	Response Amplitude (mV)	Dig Priority	Date
177	3767521	1182364.7	37.56.15.76	-75.27.22.39	56.43	✓78.32	Z(1-4)	26.3		2/9/2006
178	3767524.7	1182364.8	37.56.15.76	-75.27.22.24	67.92	✓75.76	Z(1-4)	14.8		2/9/2006
179	3767510.2	1182365	37.56.15.78	-75.27.22.83	23.49	✓87.69	Z(1-4)	125		2/9/2006
180	3767525.3	1182365	37.56.15.76	-75.27.22.21	69.97	✓75.91	Z(1-4)	17.5		2/9/2006
181	3767532.1	1182365	37.56.15.76	-75.27.21.93	90.88	✓70.66	Z(1-4)	83.7		2/9/2006
182	3767523.5	1182365.1	37.56.15.77	-75.27.22.29	64.53	✓77.62	Z(1-4)	24.5		2/9/2006
183	3767531.5	1182365.1	37.56.15.76	-75.27.21.96	89.14	✓71.43	Z(1-4)	83.7		2/9/2006
184	3767504.3	1182365.2	37.56.15.79	-75.27.23.07	5.52	✓92.97	Z(1-4)	16.9		2/9/2006
185	3767523.8	1182365.6	37.56.15.78	-75.27.22.27	65.96	✓78.93	Z(1-4)	22.8		2/9/2006
186	3767507.3	1182365.8	37.56.15.81	-75.27.22.95	15.36	✓92.47	Z(1-4)	12.8		2/9/2006
187	3767520.1	1182365.8	37.56.15.79	-75.27.22.42	54.77	✓82.43	Z(1-4)	20.1		2/9/2006
188	3767522.4	1182366.1	37.56.15.80	-75.27.22.33	62.15	✓81.57	Z(1-4)	9.5		2/9/2006
189	3767520.3	1182366.2	37.56.15.81	-75.27.22.42	55.79	✓83.52	Z(1-4)	19.5		2/9/2006
190	3767527.4	1182366.2	37.56.15.80	-75.27.22.12	77.64	✓78	Z(1-4)	13.5		2/9/2006
191	3767525.4	1182366.5	37.56.15.81	-75.27.22.21	71.79	✓80.48	Z(1-4)	29.7		2/9/2006

Geophysical Dig Sheet and Target History

GRID 3D Unique Target ID	ORIGINAL SURVEY									
	Easting Coord. (m)	Northing Coord. (m)	Lat. Coord.	Long. Coord.	X - Local (Grid) Coord. (ft)	Y - Local (Grid) Coord. (ft)	Channel ID (i.e. C1, top senor, gradient)	Response Amplitude (mV)	Dig Priority	Date
192	3767519.1	1182366.7	37.56.15.82	-75.27.22.46	52.6	✓ 86	Z(1-4)	18.6		2/9/2006
193	3767520.1	1182366.9	37.56.15.83	-75.27.22.42	55.88	✓ 85.84	Z(1-4)	16.5		2/9/2006
194	3767522.2	1182366.9	37.56.15.83	-75.27.22.34	62.35	✓ 84.2	Z(1-4)	12		2/9/2006
195	3767528.9	1182366.9	37.56.15.82	-75.27.22.06	82.96	✓ 79	Z(1-4)	16.9		2/9/2006
196	3767524.6	1182367.3	37.56.15.84	-75.27.22.24	70.13	✓ 83.57	Z(1-4)	26.1		2/9/2006
197	3767519.4	1182367.4	37.56.15.85	-75.27.22.45	54.23	✓ 87.94	Z(1-4)	16.2		2/9/2006
198	3767508.6	1182367.5	37.56.15.86	-75.27.22.89	21.08	✓ 96.74	Z(1-4)	62		2/9/2006
199	3767514.8	1182367.5	37.56.15.85	-75.27.22.64	40.17	✓ 91.86	Z(1-4)	21.3		2/9/2006
200	3767526.3	1182367.5	37.56.15.84	-75.27.22.17	75.57	✓ 82.87	Z(1-4)	16		2/9/2006
201	3767505.5	1182367.6	37.56.15.87	-75.27.23.02	11.63	✓ 99.51	Z(1-4)	9.3		2/9/2006
202	3767518.8	1182367.6	37.56.15.85	-75.27.22.48	52.59	✓ 89.03	Z(1-4)	15.5		2/9/2006
203	3767507.7	1182367.8	37.56.15.87	-75.27.22.93	18.6	✓ 98.39	Z(1-4)	51.7		2/9/2006
204	3767511.7	1182368	37.56.15.87	-75.27.22.77	31.13	✓ 95.85	Z(1-4)	59.2		2/9/2006
205	3767515.5	1182368	37.56.15.87	-75.27.22.61	42.83	✓ 92.86	Z(1-4)	21.5		2/9/2006
206	3767517.3	1182368	37.56.15.87	-75.27.22.54	48.37	✓ 91.45	Z(1-4)	30.1		2/9/2006

Geophysical Dig Sheet and Target History

GRID 3D Unique Target ID	ORIGINAL SURVEY									
	Easting Coord. (m)	Northing Coord. (m)	Lat. Coord.	Long. Coord.	X - Local (Grid) Coord. (ft)	Y - Local (Grid) Coord. (ft)	Channel ID (i.e. C1, top senor, gradient)	Response Amplitude (mV)	Dig Priority	Date
207	3767523.8	1182368.1	37.56.15.86	-75.27.22.27	68.48	86.67	Z(1-4)	17.6		2/9/2006
208	3767525.8	1182368.1	37.56.15.86	-75.27.22.19	74.63	85.11	Z(1-4)	21.2		2/9/2006
209	3767527.7	1182368.3	37.56.15.87	-75.27.22.11	80.68	84.25	Z(1-4)	27.7		2/9/2006
210	3767515.2	1182368.5	37.56.15.89	-75.27.22.62	42.41	94.65	Z(1-4)	21.8		2/9/2006
211	3767518.4	1182368.5	37.56.15.88	-75.27.22.49	52.26	92.13	Z(1-4)	15.7		2/9/2006
212	3767521.6	1182368.5	37.56.15.88	-75.27.22.36	62.11	89.63	Z(1-4)	15.6		2/9/2006
213	3767532.9	1182368.5	37.56.15.87	-75.27.21.90	96.88	80.83	Z(1-4)	160.3		2/9/2006
214	3767528.8	1182369	37.56.15.89	-75.27.22.06	84.77	85.56	Z(1-4)	40.9		2/9/2006
215	3767518.2	1182369.1	37.56.15.90	-75.27.22.50	52.25	94.15	Z(1-4)	15.8		2/9/2006
216	3767509.5	1182369.2	37.56.15.91	-75.27.22.85	25.56	101.32	Z(1-4)	87.3		2/9/2006
217	3767516.9	1182369.2	37.56.15.91	-75.27.22.55	48.35	95.48	Z(1-4)	24.8		2/9/2006
218	3767523.2	1182369.2	37.56.15.90	-75.27.22.29	67.74	90.54	Z(1-4)	22.4		2/9/2006
219	3767525.4	1182369.2	37.56.15.90	-75.27.22.20	74.51	88.82	Z(1-4)	25.8		2/9/2006
220	3767514.4	1182369.3	37.56.15.91	-75.27.22.65	40.75	97.76	Z(1-4)	28.4		2/9/2006
221	3767522.8	1182369.3	37.56.15.90	-75.27.22.31	66.61	91.16	Z(1-4)	21.8		2/9/2006

Geophysical Dig Sheet and Target History

GRID 3D Unique Target ID	REACQUISITION SURVEY				
	Geophysical Instrument **	GPS Instrument**	Date	Comment	Response Amplitude (units*)**
1	Schondstedt	NA	2-16-06	used x/y coordinates to locate targets	NA
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					
14					
15					
16					
17					
18					
19					
20					
21					
22					

Geophysical Dig Sheet and Target History

GRID 3D Unique Target ID	REACQUISITION SURVEY Geophysical Instrument **	GPS Instrument**	Date	Comment	Response Amplitude (units*)**
23	Schondstedt	NA	2-16-06	used x/y coordinates to locate Targets	NA
24					
25					
26					
27					
28					
29					
30					
31					
32					
33					
34					
35					
36					
37					
38					
39					
40					
41					

Geophysical Dig Sheet and Target History

GRID 3D Unique Target ID	REACQUISITION SURVEY				
	Geophysical Instrument **	GPS Instrument**	Date	Comment	Response Amplitude (units*)**
42	Schondstedt	NA	2-16-06	used x/y coordinates to locate targets	NA
43					
44					
45					
46					
47					
48					
49					
50					
51					
52					
53					
54					
55					
56					

Geophysical Dig Sheet and Target History

GRID 3D Unique Target ID	REACQUISITION SURVEY				
	Geophysical Instrument **	GPS Instrument**	Date	Comment	Response Amplitude (units*)**
57	Schonstedt	NA	2-16-06	used x/y coordinates to locate targets	NA
58					
59					
60					
61					
62					
63					
64					
65					
66					
67					
68					
69					
70					
71					

Geophysical Dig Sheet and Target History

GRID 3D Unique Target ID	REACQUISITION SURVEY				
	Geophysical Instrument **	GPS Instrument**	Date	Comment	Response Amplitude (units*)**
72	Schondstedt	NA	2-16-06	used x/y coordinates to locate targets	NA
73					
74					
75					
76					
77					
78					
79					
80					
81					
82					
83					
84					
85					
86					

Geophysical Dig Sheet and Target History

GRID 3D Unique Target ID	REACQUISITION SURVEY				
	Geophysical Instrument **	GPS Instrument**	Date	Comment	Response Amplitude (units*)**
87	Schondstedt	NA	2-16-06	used x/y coordinates to locate targets	NA
88					
89					
90					
91					
92					
93					
94					
95					
96					
97					
98					
99					
100					
101					

Geophysical Dig Sheet and Target History

GRID 3D Unique Target ID	REACQUISITION SURVEY				
	Geophysical Instrument **	GPS Instrument**	Date	Comment	Response Amplitude (units*)**
102	Schonstedt	NA	2-16-06	used x/y coordinates to locate targets	NA
103					
104					
105					
106					
107					
108					
109					
110					
111					
112					
113					
114					
115					
116					

Geophysical Dig Sheet and Target History

GRID 3D Unique Target ID	REACQUISITION SURVEY				
	Geophysical Instrument **	GPS Instrument**	Date	Comment	Response Amplitude (units*)**
117	Schondstedt	NA	2-16-06	used x/y coordinates to locate targets	NA
118					
119					
120					
121					
122					
123					
124					
125					
126					
127					
128					
129					
130					
131					

Geophysical Dig Sheet and Target History

GRID 3D Unique Target ID	REACQUISITION SURVEY Geophysical Instrument **	GPS Instrument**	Date	Comment	Response Amplitude (units*)**
132	Schondstedt	NA	2-16-06	used x r y coordinates to locate targets	NA
133					
134					
135					
136					
137					
138					
139					
140					
141					
142					
143					
144					
145					
146					

Geophysical Dig Sheet and Target History

GRID 3D Unique Target ID	REACQUISITION SURVEY				
	Geophysical Instrument **	GPS Instrument**	Date	Comment	Response Amplitude (units*)**
147	Schondstedt	NA	2-16-06	used x/y coordinates to locate targets	NA
148					
149					
150					
151					
152					
153					
154					
155					
156					
157					
158					
159					
160					
161					

Geophysical Dig Sheet and Target History

GRID 3D Unique Target ID	REACQUISITION SURVEY Geophysical Instrument **	GPS Instrument**	Date	Comment	Response Amplitude (units*)**
162	Schondstedt	NA	2-16-06	used x/y coordinates to locate targets	NA
163					
164					
165					
166					
167					
168					
169					
170					
171					
172					
173					
174					
175					
176					

Geophysical Dig Sheet and Target History

GRID 3D Unique Target ID	REACQUISITION SURVEY				
	Geophysical Instrument **	GPS Instrument**	Date	Comment	Response Amplitude (units*)**
177	Schondstedt	NA	2-16-06	used x/y coordinates to locate targets	NA
178					
179					
180					
181					
182					
183					
184					
185					
186					
187					
188					
189					
190					
191					

Geophysical Dig Sheet and Target History

	REACQUISITION SURVEY				
GRID 3D Unique Target ID	Geophysical Instrument **	GPS Instrument**	Date	Comment	Response Amplitude (units*)**
192	Schondstedt	NA	2-16-06	used x/y coordinates to locate targets	NA
193					
194					
195					
196					
197					
198					
199					
200					
201					
202					
203					
204					
205					
206					

Geophysical Dig Sheet and Target History

GRID 3D Unique Target ID	REACQUISITION SURVEY Geophysical Instrument **	GPS Instrument**	Date	Comment	Response Amplitude (units*)**
207	Schondstedt	NA	2-16-06	used x/y coordinates to locate targets	NA
208					
209					
210					
211					
212					
213					
214					
215					
216					
217					
218					
219					
220					
221					

Geophysical Dig Sheet and Target History

GRID 3D Unique Target ID	REACQUISITION SURVEY				
	Geophysical Instrument **	GPS Instrument**	Date	Comment	Response Amplitude (units*)**
222	Schonstedt	NA	2-16-06	used x/y coordinates to locate targets	NA
223					
224					
225					
226					
227					
228					
229					
230					
231					
232					
233					
234					
235					
236					

Geophysical Dig Sheet and Target History

GRID 3D Unique Target ID	REACQUISITION SURVEY				
	Geophysical Instrument **	GPS Instrument**	Date	Comment	Response Amplitude (units*)**
237	Schonstedt	NA	2-16-06	used x/y coordinates to locate targets	NA
238	↓	↓	↓	↓	↓
239	↓	↓	↓	↓	↓

Geophysical Dig Sheet and Target History

GRID 3D Unique Target ID	DIG RESULTS										
	Anomaly Type ***	Approx. Weight (lbs-oz/kg-g)	Comments (e.g., response below 1 foot)	Offset Distance (ft)	Offset Direction (N, NE, etc.)	Orientation of Nose (Azimuth deg)	Inclination of Nose (deg)	Depth to Top of Item (in/cm)	Digital Photo Number	Date	Team Leader
1	S	.1	NAIL	0.5				6.0		2/18/06	RW
2	S	.5	SCRAP	0				4.0			RW
3	MD	.7	20 MM (2)	0				6.0			RW
4	MD	.9	20MM X 3	0				8.0		19 Feb 06	
5	MD	.4	20 MM	1.0				4.0			RW
6	MD	.6	20 MM (2)	0				5.0			RW
7	MD	.6	20 MM (2)	0				4.0			RW
8	MD	.8	20 MM (3)	0				5.0			RW
9	MD	.4	20 MM (2)	1.0				5.0			RW
10	MD	.3	20 MM	0.5				6.0			RW
11	MD	.3	20 MM	0.5				4.0			RW
12	MD	.6	20 MM (2)	0				4.0			RW
13	MD	.3	20 MM	0				4.0			RW
14	MD	.6	30 MM	0				5.0			RW
15	MD	.3	20 MM	1.0				4.0			RW
16	MD	.4	20 MM	0				6.0			RW
17	MD	.3	20 MM	0				4.0			RW
18	MD	.3	20 MM	0				5.0			RW
19	MD	.4	20 MM (2)	0				4.0			RW
20	MD	.3	20 MM	0				5.0			RW
21	MD	.2	20 MM	1.0				4.0			RW
22	MD	.3	20MM	0				4.0			RW

Geophysical Dig Sheet and Target History

GRID 3D Unique Target ID	DIG RESULTS										
	Anomaly Type ***	Approx. Weight (lbs-oz/kg-g)	Comments (e.g., response below 1 foot)	Offset Distance (ft)	Offset Direction (N, NE, etc.)	Orientation of Nose (Azimuth deg)	Inclination of Nose (deg)	Depth to Top of Item (in/cm)	Digital Photo Number	Date	Team Leader
23	MD	.3	20 mm (2)	1.0				4.0		2/18/06	RW
24	MD	.5	30 mm	0				5.0			RW
25	MD	.3	20 mm	0.5				4.0			RW
26	MD	1.0	20 mm (5)	1.0				3.0			RW
27	MD	.2	20 mm	0				4.0			RW
28	MD	.3	20 mm	0				8.0			RW
29	S	.1	Scrap	1.0				4.0			RW
30	MD	.3	20 mm	0				4.0			RW
31	MD	.3	20 mm	0				4.0			RW
32	MD	.4	30 mm	0				5.0			RW
33	MD	.4	20 mm	0				5.0			RW
34	MD	.3	20 mm	1.0				4.0			RW
35	MD	.3	20 mm	0				4.0			RW
36	MD	.3	20 mm	0.5				4.0			RW
37	MD	.3	20 mm	0				5.0			RW
38	MD	.4	30 mm	0				4.0			RW
39	MD	.3	20 mm	0				5.0			RW
40	MD	.3	20 mm	1.0				6.0			RW
41	MD	.3	20 mm	0				5.0			RW

Geophysical Dig Sheet and Target History

GRID 3D Unique Target ID	DIG RESULTS Anomaly Type ***	Approx. Weight (lbs-oz/kg-g)	Comments (e.g., response below 1 foot)	Offset Distance (ft)	Offset Direction (N, NE, etc.)	Orientation of Nose (Azimuth deg)	Inclination of Nose (deg)	Depth to Top of Item (in/cm)	Digital Photo Number	Date	Team Leader
42	MD	.4	20 mm	0.5				4.0		2/18/06	RW
43	MD	.6	20mm (2)	0				5.0			RW
44	MD	1.0	20 mm (4)	0				4.0			RW
45	S	.2	scrap	1.0				5.0			RW
46	MD	.3	20mm	0				6.0			RW
47	MD	.6	20 mm (2)*	0				5.0			RW
48			LIP	0				>12"			RW
49	S	.2	scrap	1.0				5.0			RW
50			LIP	0				>12"			RW
51	MD	.9	20 mm (3)	0				5.0			RW
52	S	.2	scrap	0.5				4.0			RW
53	MD	.3	20mm	0				5.0			RW
54	MD	.2	20mm	0				5.0			RW
55	MD	.3	20mm	0				4.0			RW
56	MD	.3	20 mm	0				4.0			RW

Geophysical Dig Sheet and Target History

GRID 3D Unique Target ID	DIG RESULTS Anomaly Type ***	Approx. Weight (lbs-oz/kg-g)	Comments (e.g., response below 1 foot)	Offset Distance (ft)	Offset Direction (N, NE, etc.)	Orientation of Nose (Azimuth deg)	Inclination of Nose (deg)	Depth to Top of Item (in/cm)	Digital Photo Number	Date	Team Leader
57	MD	.2	20mm	1.0				4.0		2/18/06	RW
58	MD	.4	30mm	0				6.0			RW
59			LIP	0				>12"			
60	MD	4	20MM	0				5.0			RW
61	MD	.3	20MM	0.5				4.0			RW
62	MD	.8	30mm (2)	0				5.0			RW
63	MD	.3	20MM	0				4.0			RW
64	MD	.3	20 MM	1.0				5.0			RW
65	S	.5	SCRAP	0				5.0			RW
66	MD	.9	20mm (3)	0				4.0			RW
67	MD	.9	20MM (3)	0				5.0			RW
68	S	.2	SCRAP	1.0				5.0			RW
69	MD	.3	20mm	0				4.0			RW
70	MD	.2	20MM	1.0				5.0			RW
71	MD	.2	20 MM	0				5.0			RW

Geophysical Dig Sheet and Target History

GRID 3D Unique Target ID	DIG RESULTS Anomaly Type ***	Approx. Weight (lbs-oz/kg-g)	Comments (e.g., response below 1 foot)	Offset Distance (ft)	Offset Direction (N, NE, etc.)	Orientation of Nose (Azimuth deg)	Inclination of Nose (deg)	Depth to Top of Item (in/cm)	Digital Photo Number	Date	Team Leader
72	MD	.2	GRENADE SPOON	1.0				6.0		2/18/06	RW
73	MD	.3	20MM	0				4.0			RW
74	MD	.3	20MM	0				5.0			RW
75			LIP	0				>12"			
76	MD	.3	20MM	0.5				4.0			RW
77	MD	.4	30 MM	0				5.0			RW
78	MD	.3	20 MM	0				5.0			RW
79	S	.4	SCRAP	0				4.0			RW
80	MD	.3	20 MM	0				4.0			RW
81	S	.2	SCRAP	1.0				3.0			RW
82			LIP	0				>12"			
83	MD	.3	20MM	0				6.0			RW
84	MD	.3	20 MM	1.0				5.0			RW
85	MD	.3	20 MM	0				5.0			RW
86	MD	.3	20 mm	0				5.0			RW

Geophysical Dig Sheet and Target History

GRID 3D Unique Target ID	DIG RESULTS										
	Anomaly Type ***	Approx. Weight (lbs-oz/kg-g)	Comments (e.g., response below 1 foot)	Offset Distance (ft)	Offset Direction (N, NE, etc.)	Orientation of Nose (Azimuth deg)	Inclination of Nose (deg)	Depth to Top of Item (in/cm)	Digital Photo Number	Date	Team Leader
87	MD	.3	20 MM	1.0				4.0		3/18/06	RW
88	MD	.4	20 MM	0				5.0			RW
89	S	.1	NAIL	1.5				4.0			RW
90	S	.2	SCRAP/NAIL	1.0				4.0			RW
91	MD	.9	20 MM	0				5.0			RW
92	S	.3	20 MM	0				5.0			RW
93	S	.2	SCRAP	0.5				3.0			RW
94	MD	.3	20 MM	0				4.0			RW
95	HR		HOT ROCK	1.5				4.0			RW
96	MD	.3	20 MM	0				4.0			RW
97	MD	.3	20 MM	0				5.0			RW
98	MD	.3	20 MM	0.5				5.0			RW
99	MD	.3	20 MM	0				5.0			RW
100	MD	.4	20 MM	0				4.0			RW
101	MD	.3	20 MM	0				4.0			RW

Geophysical Dig Sheet and Target History

GRID 3D Unique Target ID	DIG RESULTS Anomaly Type ***	Approx. Weight (lbs-oz/kg-g)	Comments (e.g., response below 1 foot)	Offset Distance (ft)	Offset Direction (N, NE, etc.)	Orientation of Nose (Azimuth deg)	Inclination of Nose (deg)	Depth to Top of Item (in/cm)	Digital Photo Number	Date	Team Leader
102	MD	1.0	30 mm (5)	0				6.0		2/18/04	RW
103	MD	.3	20 MM	0				5.0			RW
104	MD	.4	20 MM	0				4.0			RW
105	S	.2	Scrap	1.0				4.0			RW
106			LID	0				7 12"			RW
107	MD	1.0	20 mm (4)	0				4.0			RW
108	MD	.2	20 MM	0.5				5.0			RW
109	MD	.3	20 mm	0				5.0			RW
110	HR	.1	Hot Rock	1.5				6.0			RW
111	S	.4	Scrap	0				5.0			RW
112	S	.2	Scrap (wire)	0.5				4.0			RW
113	MD	.4	20 MM	0				5.0			RW
114	MD	.3	20 MM	0				4.0			RW
115	MD	.9	20 mm (3)	0				5.0			RW
116	MD	.3	20 mm	0				5.0			RW

Geophysical Dig Sheet and Target History

GRID 3D Unique Target ID	DIG RESULTS										
	Anomaly Type ***	Approx. Weight (lbs-oz/kg-g)	Comments (e.g., response below 1 foot)	Offset Distance (ft)	Offset Direction (N, NE, etc.)	Orientation of Nose (Azimuth deg)	Inclination of Nose (deg)	Depth to Top of Item (in/cm)	Digital Photo Number	Date	Team Leader
117	MD	.3	20 MM	0				6.0		2/18/06	RW
118	S	.1	SCRAP	1.0				4.0			RW
119	MD	.3	20 MM	0				6.0			RW
120	MD	.8	30 MM (3)	0				5.0			RW
121	S	.2	SCRAP	1.0				5.0			RW
122	MD	.6	20 MM (2)	0				4.0			RW
123	MD	.3	20 MM	0				4.0			RW
124	MD	.3	20 MM	0				5.0			RW
125	MD	.6	20 MM (2)	0				6.0			RW
126	S	.3	SCRAP	0				4.0			RW
127	S	.2	SCRAP	0.5				5.0			RW
128	MD	.3	20 MM	0				4.0			RW
129	S	.3	M1-MAGAZINE	0				5.0			RW
130			LID	0				> 12"			RW
131	MD	.4	30 MM	0				4.0			RW

Geophysical Dig Sheet and Target History

GRID 3D Unique Target ID	DIG RESULTS										
	Anomaly Type ***	Approx. Weight (lbs-oz/kg-g)	Comments (e.g., response below 1 foot)	Offset Distance (ft)	Offset Direction (N, NE, etc.)	Orientation of Nose (Azimuth deg)	Inclination of Nose (deg)	Depth to Top of Item (in/cm)	Digital Photo Number	Date	Team Leader
132	S	.2	SCRAP	1.0				4.0		2/18/06	RW
133	MD	.4	20mm	0				7.0			[illegible]
134			LIP	0				>12"			RW
135	MD	.2	20 MM	0				5.0			RW
136	S	.1	Scrap	1.5				5.0			RW
137			Electric Box	LIP				Sur			RW
138	S	.1	SCRAP	0.5				4.0			RW
139	S	.2	SCRAP	1.0				4.0			RW
140	MD	.3	20 MM	0				5.0			RW
141			Electric Box	LIP				Sur			RW
142	MD	.3	20 mm	0				4.0			RW
143	MD	.3	20 mm	0				4.0			RW
144			LIP	0				>12"			RW
145	S	.4	SCRAP	0				4.0			RW
146	MD	.3	20 mm	0				4.0			RW

Geophysical Dig Sheet and Target History

GRID 3D Unique Target ID	DIG RESULTS										
	Anomaly Type ***	Approx. Weight (lbs-oz/kg-g)	Comments (e.g., response below 1 foot)	Offset Distance (ft)	Offset Direction (N, NE, etc.)	Orientation of Nose (Azimuth deg)	Inclination of Nose (deg)	Depth to Top of Item (in/cm)	Digital Photo Number	Date	Team Leader
147	S	.3	SCRAP	0.5				5.0		18Feb06	RW
148	MD	.4	20 MM	0				5.0			RW
149	S	.3	MORTAR FINS	0				4.0			RW
150	S	.2	SCRAP	1.0				4.0			RW
151	S	.3	scrap	0				5.0			[illegible]
152	MD	.3	20 MM	0				4.0			RW
153	MD	.3	20 MM	0				4.0			RW
154	MD	.3	20 mm	0				6.0		19Feb06	[illegible]
155	S	.2	nail	0				7.0		18Feb06	[illegible]
156	MD	.3	20 MM	0				4.0			RW
157	S	.1	SCRAP / NAIL	1.0				4.0			RW
158	MD	.4	20 mm	0				8.0			[illegible]
159	MD	.3	20 MM	0				4.0			RW
160	MD	.4	20 MM	0				4.0			RW
161	S	.2	SCRAP	0.5				3.0			RW

Geophysical Dig Sheet and Target History

GRID 3D Unique Target ID	DIG RESULTS										
	Anomaly Type ***	Approx. Weight (lbs-~~oz/kg-g~~)	Comments (e.g., response below 1 foot)	Offset Distance (ft)	Offset Direction (N, NE, etc.)	Orientation of Nose (Azimuth deg)	Inclination of Nose (deg)	Depth to Top of Item (in/~~cm~~)	Digital Photo Number	2006 Date	Team Leader
162	MD	.3	20 mm	0				4.0		18Feb06	RW
163	S	.2	Scrap	1.0				6.0		19Feb06	EMD
164	S	.3	scrap	0				4.0		19Feb06	EMD
165	S	.2	nail	0				4.0		19Feb06	EMD
166	S	.3	scrap	0				6.0		19Feb06	EMD
167	MD	.4	20mm	0				6.0		19Feb06	EMD
168	MD	.4	20 mm	0				8.0		19Feb06	EMD
169	S	.3	scrap	0				4.0		2/18/06	EMD
170	S	.1	washer	1.0				1.0		2/18/06	EMD
171	S	.2	wire	0				2.0		2/18/06	EMD
172	MD	.4	20mm	0				8.0		2/18/06	EMD
173	S	.1	Scrap	1.0				4.0		2/18/06	RW
174	S	.3	scrap	0				6.0		2/18/06	EMD
175			Lip	0				>12"		2/18/06	RW
176	S	.1	Scrap	1.0				4.0		2/18/06	RW

Geophysical Dig Sheet and Target History

GRID 3D Unique Target ID	DIG RESULTS Anomaly Type ***	Approx. Weight (lbs-oz/kg-g)	Comments (e.g., response below 1 foot)	Offset Distance (ft)	Offset Direction (N, NE, etc.)	Orientation of Nose (Azimuth deg)	Inclination of Nose (deg)	Depth to Top of Item (in/cm)	Digital Photo Number	Date	Team Leader
177	MD	3.0	30 mm (c)	0				5.0		2/18/06	RW
178			LIP	0				> 12"			[illegible]
179	MD	.4	20mm	0				5.0			RW
180	S	.1	Scrap	0				5.0			[illegible]
181	S	.5	scrap	0				4.0			[illegible]
182			LIP	0				> 12"			[illegible]
183	S	.2	scrap	1.0				> 12"			[illegible]
184	MD	.3	20mm	0				4.0			RW
185			LIP	0				> 12"			[illegible]
186	S	.2	Scrap	0				5.0			RW
187	MD	.3	20mm	0				3"			[illegible]
188			LIP	0				> 12"			[illegible]
189			LIP	0				> 12"			[illegible]
190	S	.2	scrap	0				5			[illegible]
191	S	.3	scrap	0				4			[illegible]

Geophysical Dig Sheet and Target History

GRID 3D Unique Target ID	DIG RESULTS Anomaly Type ***	Approx. Weight (lbs-oz/kg-g)	Comments (e.g., response below 1 foot)	Offset Distance (ft)	Offset Direction (N, NE, etc.)	Orientation of Nose (Azimuth deg)	Inclination of Nose (deg)	Depth to Top of Item (in/cm)	Digital Photo Number	Date	Team Leader
192	MD	.9	20 mm (?)	0				4.0		2/18/06	RW
193	S	.2	Scrap	0				5			EWD
194			LIP	0				>12			EWD
195	S	.1	Scrap	1.0				6			EWD
196	MD	.4	20 mm	0				4			EWD
197	S	.2	Scrap	0				4			EWD
198			LIP	0				>12"			RW
199			LIP	0				>12"			RW
200	MD	.7	30 mm	0				6.0		19Feb06	EWD
201			LIP	0				7		2/18/06	EWD
202	MD	.3	20 mm	0				5.0			RW
203	MD	.3	20 mm	0				4.0			RW
204			LIP	0				>12"			RW
205	S	.1	SCRAP	1.0				5.0			RW
206			LIP	0				9			EWD

Geophysical Dig Sheet and Target History

GRID 3D Unique Target ID	DIG RESULTS										
	Anomaly Type ***	Approx. Weight (lbs-oz/kg-g)	Comments (e.g., response below 1 foot)	Offset Distance (ft)	Offset Direction (N, NE, etc.)	Orientation of Nose (Azimuth deg)	Inclination of Nose (deg)	Depth to Top of Item (in/cm)	Digital Photo Number	Date	Team Leader
207	MD	.4	20mm	0				5		19/Feb06	[illegible]
208	S	.2	Scrap	0				6		2/18/06	[illegible]
209	S	.3	scrap	0				8			[illegible]
210	S	.4	M1- MAGAZINE	0				5.0			RW
211			LIP	0				>12"			RW
212	MD	.4	20mm	0				8.0		19/Feb06	[illegible]
213	MD	.4	20mm	0				8.0		19/Feb06	[illegible]
214	MD	.7	30mm	0				6.0		19Feb06	[illegible]
215	S	.1	Scrap	1.0				5.0		18Feb06	RW
216	S	.1	Scrap	1.0				5.0			RW
217			LIP	0				>12"			RW
218	S	.2	Scrap	0				4.0			RW
219	MD	.6	20mm	0				6.0		19Feb06	[illegible]
220			LIP	0				>12"		2/18/06	RW
221	~~S~~	~~+~~	~~[illegible]~~ LIP	0				>12"		2/18/06	RW

Geophysical Dig Sheet and Target History

GRID 3D Unique Target ID	DIG RESULTS										
	Anomaly Type ***	Approx. Weight (lbs-oz/kg-g)	Comments (e.g., response below 1 foot)	Offset Distance (ft)	Offset Direction (N, NE, etc.)	Orientation of Nose (Azimuth deg)	Inclination of Nose (deg)	Depth to Top of Item (in/cm)	Digital Photo Number	Date	Team Leader
222	MD	.5	20 mm	0				6"		2/18/06	
223			LIP	0				>12"		2/18/06	RW
224	S	.1	NAIL	1.0				4.0		2/18/06	RW
225	S	.1	SCRAP	1.0				5.0		2/18/06	RW
226	MD	.3	20 MM	0				5.0		2/18/06	RW
227			LIP	0				>12"		2/18/06	RW
228	MD	.4	20 MM	0				4.0		2/18/06	RW
229			LIP	0				>12"		2/18/06	[illegible]
230			LIP	0				>12		2/18/06	RW
231	MD	.3	20 MM	0				4.0		2/18/06	RW
232	MD	.3	20 MM	0				5.0		2/18/06	RW
233			LIP	0				>12"		2/18/06	RW
234	S	.2	SCRAP	0				4.0		2/18/06	RW
235			LIP	0				4.0		2/18/06	RW
236	S	.2	SCRAP	0				5.0		2/18/06	RW

Geophysical Dig Sheet and Target History

GRID 3D Unique Target ID	DIG RESULTS Anomaly Type ***	Approx. Weight (lbs-oz/kg-g)	Comments (e.g., response below 1 foot)	Offset Distance (ft)	Offset Direction (N, NE, etc.)	Orientation of Nose (Azimuth deg)	Inclination of Nose (deg)	Depth to Top of Item (in/cm)	Digital Photo Number	Date	Team Leader
237			LIP	0				4.0		18Feb06	RW
238	MD	.5	20MM (2)	0				6.0		18Feb06	RW
239	HR		Hot Rock	0				4.0		18Feb06	RW

Geophysical Dig Sheet and Target History

GRID 3D Unique Target ID	POST-DIG UXO QC RESULTS			POST-DIG PROJECT QC		
	Excavation Hole Cleared?	UXO QC Spec. Initials	Date	Agreement Between Dig Results & Geophysical Data? (G=good, P=poor, U=unacceptable)	Project QC Initials	Date
1	Yes	EMD	2/18/06	G	VAS	2-18-06
2						
3						
4						
5						
6						
7						
8						
9						
10	Yes	EMD	2/18/06	G	VAS	2-18-06
11						
12						
13						
14						
15						
16						
17						
18						
19						
20	EMD Yes	EMD	2/19/06	G	VAS	2-18-06
21						
22						

Geophysical Dig Sheet and Target History

GRID 3D Unique Target ID	POST-DIG UXO QC RESULTS Excavation Hole Cleared?	UXO QC Spec. Initials	Date	POST-DIG PROJECT QC Agreement Between Dig Results & Geophysical Data? (G=good, P=poor, U=unacceptable)	Project QC Initials	Date
23						
24						
25						
26						
27						
28						
29						
30	Yes	EMD	2/18/06	G	VAS	2-18-06
31						
32						
33						
34						
35						
36						
37						
38						
39						
40	Yes	EMD	2/18/06	G	VAS	2-18-06
41						

Geophysical Dig Sheet and Target History

GRID 3D Unique Target ID	POST-DIG UXO QC RESULTS			POST-DIG PROJECT QC		
	Excavation Hole Cleared?	UXO QC Spec. Initials	Date	Agreement Between Dig Results & Geophysical Data? (G=good, P=poor, U=unacceptable)	Project QC Initials	Date
42						
43						
44						
45						
46						
47						
48						
49						
50	No Deeper than 12"	EWD	2/18/06	G	VAS	2-18-06
51						
52						
53						
54						
55						
56						

Geophysical Dig Sheet and Target History

GRID 3D Unique Target ID	POST-DIG UXO QC RESULTS			POST-DIG PROJECT QC		
	Excavation Hole Cleared?	UXO QC Spec. Initials	Date	Agreement Between Dig Results & Geophysical Data? (G=good, P=poor, U=unacceptable)	Project QC Initials	Date
57						
58						
59						
60	Yes	EWD	2/18/06	G	VAS	2-18-06
61						
62						
63						
64						
65						
66						
67						
68						
69						
70	Yes	EWD	2/18/06	G	VAS	2-18-06
71						

Geophysical Dig Sheet and Target History

GRID 3D Unique Target ID	POST-DIG UXO QC RESULTS			POST-DIG PROJECT QC		
	Excavation Hole Cleared?	UXO QC Spec. Initials	Date	Agreement Between Dig Results & Geophysical Data? (G=good, P=poor, U=unacceptable)	Project QC Initials	Date
72						
73						
74						
75						
76						
77						
78						
79						
80	Yes	[illegible]	2/18/06	G	VAS	2-18-06
81						
82						
83						
84						
85						
86						

Geophysical Dig Sheet and Target History

GRID 3D Unique Target ID	POST-DIG UXO QC RESULTS			POST-DIG PROJECT QC		
	Excavation Hole Cleared?	UXO QC Spec. Initials	Date	Agreement Between Dig Results & Geophysical Data? (G=good, P=poor, U=unacceptable)	Project QC Initials	Date
87						
88						
89						
90	Yes	[illegible]	2/18/06	G	VAS	2-18-06
91						
92						
93						
94						
95						
96						
97						
98						
99						
100	Yes	[illegible]	2/18/06	G	VAS	2-18-06
101						

Geophysical Dig Sheet and Target History

GRID 3D Unique Target ID	POST-DIG UXO QC RESULTS			POST-DIG PROJECT QC		
	Excavation Hole Cleared?	UXO QC Spec. Initials	Date	Agreement Between Dig Results & Geophysical Data? (G=good, P=poor, U=unacceptable)	Project QC Initials	Date
102						
103						
104						
105						
106						
107						
108						
109						
110	Yes	[illegible]	2/18/06	G	VAS	2-18-06
111						
112						
113						
114						
115						
116						

Geophysical Dig Sheet and Target History

GRID 3D Unique Target ID	POST-DIG UXO QC RESULTS			POST-DIG PROJECT QC		
	Excavation Hole Cleared?	UXO QC Spec. Initials	Date	Agreement Between Dig Results & Geophysical Data? (G=good, P=poor, U=unacceptable)	Project QC Initials	Date
117						
118						
119						
120	Yes	EgD	2/18/06	G	VAS	2-18-06
121						
122						
123						
124						
125						
126						
127						
128						
129						
130	NO Deeper Than 12"	EgD	2/14/06	G	VAS	2-18-06
131						

Geophysical Dig Sheet and Target History

GRID 3D Unique Target ID	POST-DIG UXO QC RESULTS			POST-DIG PROJECT QC		
	Excavation Hole Cleared?	UXO QC Spec. Initials	Date	Agreement Between Dig Results & Geophysical Data? (G=good, P=poor, U=unacceptable)	Project QC Initials	Date
132						
133						
134						
135						
136						
137						
138						
139						
140	~~EGD~~ Yes	EGD	2/18/06	G	VAS	2-18-06
141						
142						
143						
144						
145						
146						

Geophysical Dig Sheet and Target History

GRID 3D Unique Target ID	POST-DIG UXO QC RESULTS			POST-DIG PROJECT QC		
	Excavation Hole Cleared?	UXO QC Spec. Initials	Date	Agreement Between Dig Results & Geophysical Data? (G=good, P=poor, U=unacceptable)	Project QC Initials	Date
147						
148						
149						
150	Yes	EMD	18Feb06	G	VAS	2-18-06
151						
152						
153						
154						
155						
156						
157						
158						
159						
160	Yes	EMD	18Feb06	G	VAS	2-18-06
161						

Geophysical Dig Sheet and Target History

GRID 3D Unique Target ID	POST-DIG UXO QC RESULTS			POST-DIG PROJECT QC		
	Excavation Hole Cleared?	UXO QC Spec. Initials	Date	Agreement Between Dig Results & Geophysical Data? (G=good, P=poor, U=unacceptable)	Project QC Initials	Date
162						
163						
164						
165						
166						
167						
168						
169						
170	Yes	[illegible]	2/18/06	G	VAS	2-18-06
171						
172						
173						
174						
175						
176						

Geophysical Dig Sheet and Target History

	POST-DIG UXO QC RESULTS			POST-DIG PROJECT QC		
GRID 3D Unique Target ID	Excavation Hole Cleared?	UXO QC Spec. Initials	Date	Agreement Between Dig Results & Geophysical Data? (G=good, P=poor, U=unacceptable)	Project QC Initials	Date
177						
178						
179						
180	Yes	EMD	2/18/06	G	VAS	2-18-06
181						
182						
183						
184						
185						
186						
187						
188						
189						
190	Yes	EMD	2/18/06	G	VAS	2-18-06
191						

Geophysical Dig Sheet and Target History

GRID 3D Unique Target ID	POST-DIG UXO QC RESULTS			POST-DIG PROJECT QC		
	Excavation Hole Cleared?	UXO QC Spec. Initials	Date	Agreement Between Dig Results & Geophysical Data? (G=good, P=poor, U=unacceptable)	Project QC Initials	Date
192						
193						
194						
195						
196						
197						
198						
199						
200	Yes	END	2/19/06	G	VAS	2-18-06
201						
202						
203						
204						
205						
206						

Geophysical Dig Sheet and Target History

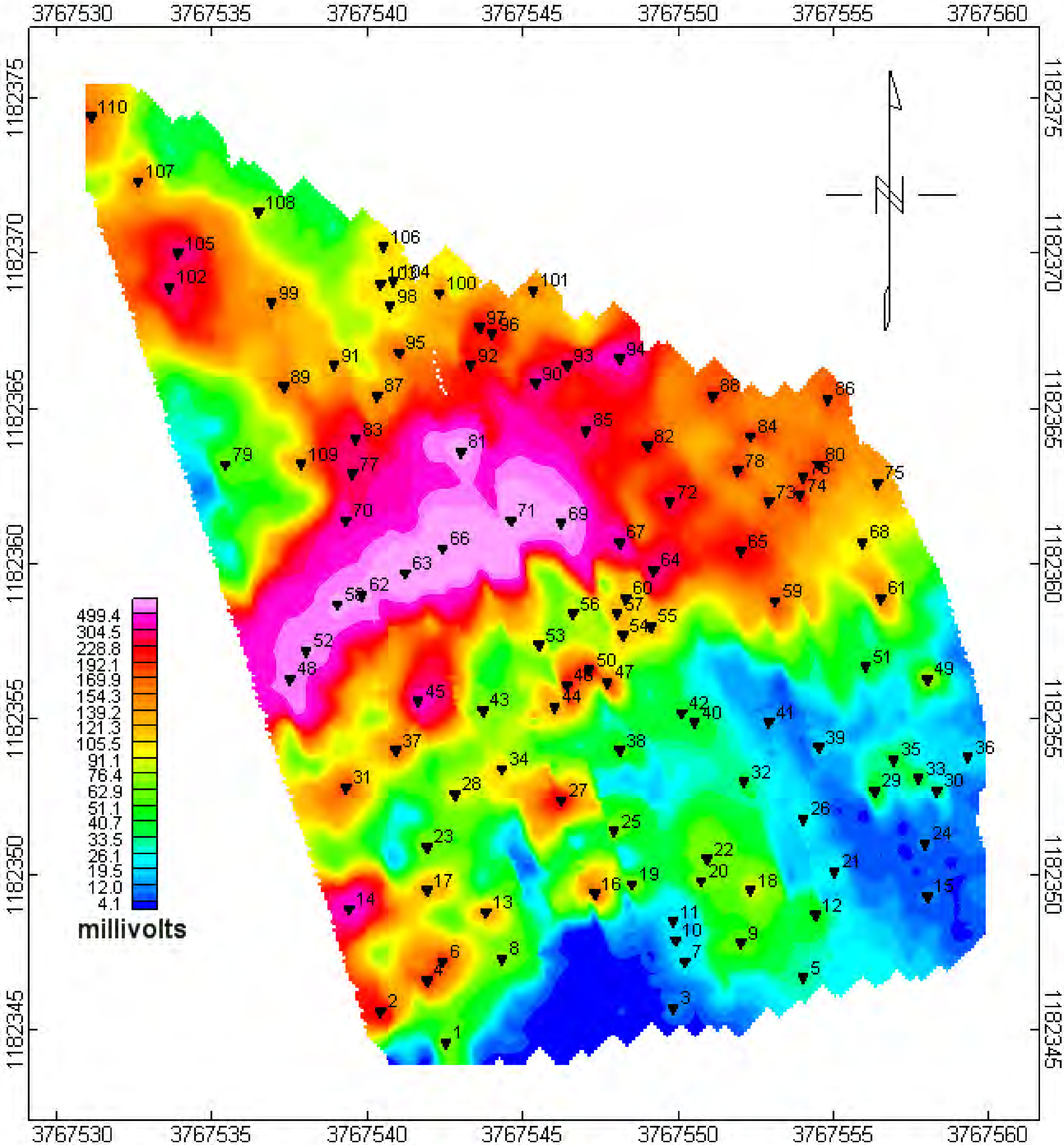
GRID 3D Unique Target ID	POST-DIG UXO QC RESULTS Excavation Hole Cleared?	UXO QC Spec. Initials	Date	POST-DIG PROJECT QC Agreement Between Dig Results & Geophysical Data? (G=good, P=poor, U=unacceptable)	Project QC Initials	Date
207						
208						
209						
210	Yes	[illegible]	2/18/06	G	VAS	2-18-06
211						
212						
213						
214						
215						
216						
217						
218						
219						
220	NO Deeper Than 12"	[illegible]	2/18/06	G	VAS	2-18-06
221						

Geophysical Dig Sheet and Target History

GRID 3D Unique Target ID	POST-DIG UXO QC RESULTS			POST-DIG PROJECT QC		
	Excavation Hole Cleared?	UXO QC Spec. Initials	Date	Agreement Between Dig Results & Geophysical Data? (G=good, P=poor, U=unacceptable)	Project QC Initials	Date
222						
223						
224						
225						
226						
227						
228						
229						
230	ND - Deeper Than 12"	[illegible]	2/18/06	G	VAS	2-18-06
231						
232						
233						
234						
235						
236						

Geophysical Dig Sheet and Target History

GRID 3D Unique Target ID	POST-DIG UXO QC RESULTS			POST-DIG PROJECT QC		
	Excavation Hole Cleared?	UXO QC Spec. Initials	Date	Agreement Between Dig Results & Geophysical Data? (G=good, P=poor, U=unacceptable)	Project QC Initials	Date
237						
238						
239	Yes	[illegible]	2/18/06	G	VAS	2-18-06



Scale 1:200

2.5 0 2.5

metres

WGS 84 / Virginia CS83 South zone

NASA

Wallops Flight Center
EM61 MK2 Data
Grid 3E

February 9, 2006

Tetra Tech EM Inc.

Geophysical Dig Sheet and Target History

GRID 3E Unique Target ID	ORIGINAL SURVEY									
	Easting Coord. (m)	Northing Coord. (m)	Lat. Coord.	Long. Coord.	X - Local (Grid) Coord. (ft)	Y - Local (Grid) Coord. (ft)	Channel ID (i.e. C1, top senor, gradient)	Response Amplitude (mV)	Dig Priority	Date
1	3767542.5	1182344.6	37.56.15.08	-75.27.21.54	4.67	-0.02	Z(1-4)	65		2/9/2006
2	3767540.4	1182345.6	37.56.15.12	-75.27.21.62	-1.34	4.53	Z(1-4)	237.8		2/9/2006
3	3767549.8	1182345.7	37.56.15.11	-75.27.21.24	30.65	-1.6	Z(1-4)	11.9		2/9/2006
4	3767541.9	1182346.6	37.56.15.15	-75.27.21.56	4.86	6.61	Z(1-4)	188.4		2/9/2006
5	3767554	1182346.7	37.56.15.14	-75.27.21.06	46.01	-1.36	Z(1-4)	34.4		2/9/2006
6	3767542.4	1182347.2	37.56.15.17	-75.27.21.54	7.23	8.13	Z(1-4)	186.9		2/9/2006
7	3767550.2	1182347.2	37.56.15.16	-75.27.21.22	33.68	2.79	Z(1-4)	22.8		2/9/2006
8	3767544.3	1182347.3	37.56.15.17	-75.27.21.46	13.78	7.14	Z(1-4)	76.2		2/9/2006
9	3767552	1182347.8	37.56.15.18	-75.27.21.14	40.45	3.42	Z(1-4)	55		2/9/2006
10	3767549.9	1182347.9	37.56.15.18	-75.27.21.23	33.44	5.17	Z(1-4)	23.5		2/9/2006
11	3767549.8	1182348.5	37.56.15.20	-75.27.21.23	33.77	7.1	Z(1-4)	23.6		2/9/2006
12	3767554.4	1182348.7	37.56.15.20	-75.27.21.04	49.59	4.58	Z(1-4)	49.3		2/9/2006
13	3767543.8	1182348.8	37.56.15.22	-75.27.21.48	13.76	12.14	Z(1-4)	137.3		2/9/2006
14	3767539.4	1182348.9	37.56.15.23	-75.27.21.66	-1.05	15.47	Z(1-4)	411.8		2/9/2006
15	3767558	1182349.3	37.56.15.22	-75.27.20.89	62.47	3.98	Z(1-4)	9.6		2/9/2006

Geophysical Dig Sheet and Target History

GRID 3E Unique Target ID	ORIGINAL SURVEY									
	Easting Coord. (m)	Northing Coord. (m)	Lat. Coord.	Long. Coord.	X - Local (Grid) Coord. (ft)	Y - Local (Grid) Coord. (ft)	Channel ID (i.e. C1, top senor, gradient)	Response Amplitude (mV)	Dig Priority	Date
16	3767547.3	1182349.4	37.56.15.23	-75.27.21.33	26.3	11.61	Z(1-4)	175.7		2/9/2006
17	3767541.9	1182349.5	37.56.15.24	-75.27.21.55	8.1	15.62	Z(1-4)	128.9		2/9/2006
18	3767552.3	1182349.5	37.56.15.23	-75.27.21.13	43.37	8.5	Z(1-4)	88.3		2/9/2006
19	3767548.5	1182349.7	37.56.15.24	-75.27.21.28	30.7	11.72	Z(1-4)	72.6		2/9/2006
20	3767550.7	1182349.8	37.56.15.24	-75.27.21.19	38.27	10.53	Z(1-4)	74.8		2/9/2006
21	3767555	1182350.1	37.56.15.25	-75.27.21.02	53.19	8.52	Z(1-4)	23.7		2/9/2006
22	3767550.9	1182350.5	37.56.15.27	-75.27.21.18	39.73	12.57	Z(1-4)	68.1		2/9/2006
23	3767541.9	1182350.9	37.56.15.29	-75.27.21.55	9.66	19.97	Z(1-4)	70		2/9/2006
24	3767557.9	1182351	37.56.15.27	-75.27.20.90	64.03	9.33	Z(1-4)	8.7		2/9/2006
25	3767547.9	1182351.4	37.56.15.30	-75.27.21.31	30.56	17.42	Z(1-4)	71.4		2/9/2006
26	3767554	1182351.8	37.56.15.30	-75.27.21.06	51.7	14.48	Z(1-4)	28.1		2/9/2006
27	3767546.2	1182352.4	37.56.15.33	-75.27.21.37	25.91	21.69	Z(1-4)	231.2		2/9/2006
28	3767542.8	1182352.6	37.56.15.34	-75.27.21.51	14.61	24.64	Z(1-4)	89.6		2/9/2006
29	3767556.3	1182352.7	37.56.15.33	-75.27.20.96	60.5	15.7	Z(1-4)	42.1		2/9/2006
30	3767558.3	1182352.7	37.56.15.33	-75.27.20.88	67.28	14.34	Z(1-4)	35.9		2/9/2006

Geophysical Dig Sheet and Target History

GRID 3E Unique Target ID	ORIGINAL SURVEY									
	Easting Coord. (m)	Northing Coord. (m)	Lat. Coord.	Long. Coord.	X - Local (Grid) Coord. (ft)	Y - Local (Grid) Coord. (ft)	Channel ID (i.e. C1, top senor, gradient)	Response Amplitude (mV)	Dig Priority	Date
31	3767539.3	1182352.8	37.56.15.35	-75.27.21.66	2.96	27.65	Z(1-4)	183.1		2/9/2006
32	3767552.1	1182353	37.56.15.35	-75.27.21.13	46.59	19.51	Z(1-4)	34.8		2/9/2006
33	3767557.7	1182353.1	37.56.15.34	-75.27.20.90	65.69	15.99	Z(1-4)	38.9		2/9/2006
34	3767544.3	1182353.4	37.56.15.37	-75.27.21.45	20.59	26.1	Z(1-4)	115.6		2/9/2006
35	3767556.9	1182353.7	37.56.15.36	-75.27.20.93	63.65	18.4	Z(1-4)	35.8		2/9/2006
36	3767559.3	1182353.8	37.56.15.36	-75.27.20.84	71.9	17.07	Z(1-4)	21		2/9/2006
37	3767540.9	1182354	37.56.15.39	-75.27.21.59	9.72	30.29	Z(1-4)	169.6		2/9/2006
38	3767548.1	1182354	37.56.15.38	-75.27.21.29	34.14	25.36	Z(1-4)	57.6		2/9/2006
39	3767554.5	1182354.1	37.56.15.38	-75.27.21.03	55.96	21.29	Z(1-4)	17.9		2/9/2006
40	3767550.5	1182354.9	37.56.15.41	-75.27.21.19	43.28	26.51	Z(1-4)	41.7		2/9/2006
41	3767552.9	1182354.9	37.56.15.41	-75.27.21.10	51.42	24.87	Z(1-4)	15.5		2/9/2006
42	3767550.1	1182355.2	37.56.15.42	-75.27.21.21	42.26	27.72	Z(1-4)	41.3		2/9/2006
43	3767543.7	1182355.3	37.56.15.43	-75.27.21.47	20.67	32.41	Z(1-4)	80.1		2/9/2006
44	3767546	1182355.4	37.56.15.43	-75.27.21.38	28.58	31.15	Z(1-4)	137		2/9/2006
45	3767541.6	1182355.6	37.56.15.44	-75.27.21.56	13.88	34.78	Z(1-4)	339.6		2/9/2006

Geophysical Dig Sheet and Target History

GRID 3E Unique Target ID	ORIGINAL SURVEY									
	Easting Coord. (m)	Northing Coord. (m)	Lat. Coord.	Long. Coord.	X - Local (Grid) Coord. (ft)	Y - Local (Grid) Coord. (ft)	Channel ID (i.e. C1, top senor, gradient)	Response Amplitude (mV)	Dig Priority	Date
46	3767546.4	1182356.1	37.56.15.45	-75.27.21.36	30.72	✓ 33.05	Z(1-4)	205.6		2/9/2006
47	3767547.7	1182356.2	37.56.15.45	-75.27.21.31	35.24	✓ 32.47	Z(1-4)	191.1		2/9/2006
48	3767537.5	1182356.3	37.56.15.47	-75.27.21.72	0.76	✓ 39.76	Z(1-4)	693		2/9/2006
49	3767558	1182356.3	37.56.15.45	-75.27.20.89	70.28	✓ 25.73	Z(1-4)	80.3		2/9/2006
50	3767547.1	1182356.6	37.56.15.47	-75.27.21.33	33.65	✓ 34.12	Z(1-4)	211.5		2/9/2006
51	3767556	1182356.7	37.56.15.46	-75.27.20.97	63.94	✓ 28.34	Z(1-4)	43		2/9/2006
52	3767538	1182357.2	37.56.15.50	-75.27.21.70	3.46	✓ 42.22	Z(1-4)	715.8		2/9/2006
53	3767545.5	1182357.4	37.56.15.49	-75.27.21.40	29.12	✓ 37.7	Z(1-4)	101.2		2/9/2006
54	3767548.2	1182357.7	37.56.15.50	-75.27.21.28	38.61	✓ 36.79	Z(1-4)	116.4		2/9/2006
55	3767549.1	1182358	37.56.15.51	-75.27.21.25	41.99	✓ 37.1	Z(1-4)	121.3		2/9/2006
56	3767546.6	1182358.4	37.56.15.53	-75.27.21.35	33.96	✓ 40.06	Z(1-4)	87.5		2/9/2006
57	3767548	1182358.4	37.56.15.52	-75.27.21.29	38.71	✓ 39.1	Z(1-4)	121.5		2/9/2006
58	3767539	1182358.7	37.56.15.54	-75.27.21.66	8.52	✓ 46.19	Z(1-4)	741.8		2/9/2006
59	3767553.1	1182358.8	37.56.15.53	-75.27.21.08	56.45	✓ 36.85	Z(1-4)	173.6		2/9/2006
60	3767548.3	1182358.9	37.56.15.54	-75.27.21.28	40.28	✓ 40.45	Z(1-4)	119.5		2/9/2006

Geophysical Dig Sheet and Target History

GRID 3E Unique Target ID	ORIGINAL SURVEY									
	Easting Coord. (m)	Northing Coord. (m)	Lat. Coord.	Long. Coord.	X - Local (Grid) Coord. (ft)	Y - Local (Grid) Coord. (ft)	Channel ID (i.e. C1, top senor, gradient)	Response Amplitude (mV)	Dig Priority	Date
61	3767556.5	1182358.9	37.56.15.53	-75.27.20.94	68.09	34.83	Z(1-4)	149.4		2/9/2006
62	3767539.8	1182359	37.56.15.55	-75.27.21.63	11.57	46.58	Z(1-4)	736.3		2/9/2006
63	3767541.2	1182359.7	37.56.15.57	-75.27.21.57	17.1	47.79	Z(1-4)	1454		2/9/2006
64	3767549.2	1182359.8	37.56.15.57	-75.27.21.24	44.34	42.63	Z(1-4)	282.1		2/9/2006
65	3767552	1182360.4	37.56.15.59	-75.27.21.13	54.51	42.57	Z(1-4)	221.6		2/9/2006
66	3767542.4	1182360.5	37.56.15.60	-75.27.21.52	22.06	49.46	Z(1-4)	1680		2/9/2006
67	3767548.1	1182360.7	37.56.15.60	-75.27.21.28	41.61	46.18	Z(1-4)	380.3		2/9/2006
68	3767555.9	1182360.7	37.56.15.59	-75.27.20.97	68.07	40.84	Z(1-4)	109.7		2/9/2006
69	3767546.2	1182361.3	37.56.15.62	-75.27.21.36	35.84	49.34	Z(1-4)	782.8		2/9/2006
70	3767539.3	1182361.4	37.56.15.63	-75.27.21.64	12.55	54.38	Z(1-4)	404.3		2/9/2006
71	3767544.6	1182361.4	37.56.15.63	-75.27.21.43	30.53	50.75	Z(1-4)	1320		2/9/2006
72	3767549.7	1182362	37.56.15.64	-75.27.21.22	48.49	49.12	Z(1-4)	254.1		2/9/2006
73	3767552.9	1182362	37.56.15.64	-75.27.21.09	59.34	46.93	Z(1-4)	183		2/9/2006
74	3767553.9	1182362.2	37.56.15.64	-75.27.21.05	62.96	46.87	Z(1-4)	201		2/9/2006
75	3767556.4	1182362.6	37.56.15.65	-75.27.20.94	71.88	46.4	Z(1-4)	142.1		2/9/2006

Geophysical Dig Sheet and Target History

GRID 3E Unique Target ID	ORIGINAL SURVEY									
	Easting Coord. (m)	Northing Coord. (m)	Lat. Coord.	Long. Coord.	X - Local (Grid) Coord. (ft)	Y - Local (Grid) Coord. (ft)	Channel ID (i.e. C1, top senor, gradient)	Response Amplitude (mV)	Dig Priority	Date
76	3767554	1182362.8	37.56.15.66	-75.27.21.04	63.96	48.66	Z(1-4)	188.8		2/9/2006
77	3767539.5	1182362.9	37.56.15.68	-75.27.21.63	14.9	58.9	Z(1-4)	289.8		2/9/2006
78	3767551.9	1182363	37.56.15.67	-75.27.21.13	57.07	50.72	Z(1-4)	183.4		2/9/2006
79	3767535.4	1182363.2	37.56.15.69	-75.27.21.80	1.33	62.64	Z(1-4)	57.6		2/9/2006
80	3767554.5	1182363.2	37.56.15.67	-75.27.21.02	66.11	49.56	Z(1-4)	182.5		2/9/2006
81	3767543	1182363.6	37.56.15.70	-75.27.21.49	27.55	58.68	Z(1-4)	859.4		2/9/2006
82	3767549	1182363.8	37.56.15.70	-75.27.21.24	48.12	55.19	Z(1-4)	224.2		2/9/2006
83	3767539.6	1182364	37.56.15.71	-75.27.21.63	16.47	62.25	Z(1-4)	278.2		2/9/2006
84	3767552.3	1182364.1	37.56.15.70	-75.27.21.11	59.65	53.87	Z(1-4)	185.5		2/9/2006
85	3767547	1182364.3	37.56.15.72	-75.27.21.33	41.9	58.12	Z(1-4)	301.2		2/9/2006
86	3767554.8	1182365.3	37.56.15.74	-75.27.21.00	69.47	55.88	Z(1-4)	175		2/9/2006
87	3767540.3	1182365.4	37.56.15.76	-75.27.21.60	20.4	66.12	Z(1-4)	155.1		2/9/2006
88	3767551.1	1182365.4	37.56.15.75	-75.27.21.16	57.03	58.73	Z(1-4)	186.2		2/9/2006
89	3767537.3	1182365.7	37.56.15.77	-75.27.21.72	10.57	69.11	Z(1-4)	162.9		2/9/2006
90	3767545.4	1182365.8	37.56.15.77	-75.27.21.39	38.15	63.87	Z(1-4)	333		2/9/2006

Geophysical Dig Sheet and Target History

GRID 3E Unique Target ID	ORIGINAL SURVEY									
	Easting Coord. (m)	Northing Coord. (m)	Lat. Coord.	Long. Coord.	X - Local (Grid) Coord. (ft)	Y - Local (Grid) Coord. (ft)	Channel ID (i.e. C1, top senor, gradient)	Response Amplitude (mV)	Dig Priority	Date
91	3767538.9	1182366.4	37.56.15.79	-75.27.21.65	16.77	70.19	Z(1-4)	137.5		2/9/2006
92	3767543.3	1182366.4	37.56.15.79	-75.27.21.47	31.69	67.18	Z(1-4)	219.6		2/9/2006
93	3767546.4	1182366.4	37.56.15.79	-75.27.21.35	42.21	65.05	Z(1-4)	259.7		2/9/2006
94	3767548.1	1182366.6	37.56.15.79	-75.27.21.28	48.19	64.51	Z(1-4)	362.5		2/9/2006
95	3767541	1182366.8	37.56.15.80	-75.27.21.57	24.34	69.99	Z(1-4)	173.2		2/9/2006
96	3767544	1182367.4	37.56.15.82	-75.27.21.44	35.18	69.8	Z(1-4)	221		2/9/2006
97	3767543.6	1182367.6	37.56.15.83	-75.27.21.46	34.05	70.7	Z(1-4)	218.9		2/9/2006
98	3767540.7	1182368.3	37.56.15.85	-75.27.21.58	25	74.86	Z(1-4)	105.4		2/9/2006
99	3767536.9	1182368.4	37.56.15.86	-75.27.21.73	12.22	77.77	Z(1-4)	151.3		2/9/2006
100	3767542.3	1182368.7	37.56.15.86	-75.27.21.51	30.87	75.01	Z(1-4)	142.4		2/9/2006
101	3767545.3	1182368.8	37.56.15.86	-75.27.21.39	41.15	73.26	Z(1-4)	145.5		2/9/2006
102	3767533.6	1182368.9	37.56.15.88	-75.27.21.87	1.59	81.58	Z(1-4)	295.3		2/9/2006
103	3767540.4	1182369	37.56.15.88	-75.27.21.59	24.76	77.24	Z(1-4)	108		2/9/2006
104	3767540.8	1182369.1	37.56.15.88	-75.27.21.57	26.23	77.28	Z(1-4)	106.1		2/9/2006
105	3767533.9	1182370	37.56.15.92	-75.27.21.85	3.83	84.8	Z(1-4)	279.2		2/9/2006

Geophysical Dig Sheet and Target History

GRID 3E Unique Target ID	ORIGINAL SURVEY									
	Easting Coord. (m)	Northing Coord. (m)	Lat. Coord.	Long. Coord.	X - Local (Grid) Coord. (ft)	Y - Local (Grid) Coord. (ft)	Channel ID (i.e. C1, top senor, gradient)	Response Amplitude (mV)	Dig Priority	Date
106	3767540.5	1182370.2	37.56.15.91	-75.27.21.58	26.44	80.9	Z(1-4)	107.8		2/9/2006
107	3767532.6	1182372.3	37.56.15.99	-75.27.21.90	1.99	92.83	Z(1-4)	154.9		2/9/2006
108	3767536.49	1182371.31	37.56.15.96	-75.27.21.75	14.08	87.09	Z(1-4)	87.1		2/9/2006
109	3767537.84	1182363.22	37.56.15.69	-75.27.21.70	9.62	61.03	Z(1-4)	139.2		2/9/2006
110	3767531.1	1182374.39	37.56.16.06	-75.27.21.96	-0.78	100.36	Z(1-4)	*		2/9/2006

Note: *Fill in Acceptable Units (mV, nT/m, ppt, etc).

**Optional field – refer to SOW for applicability to specific project.

***For Anomaly type, U = UXO, F = frag, MD = munitions debris, S = scrap, A = small arms ammunition, NC = no contact, O = other.

Geophysical Dig Sheet and Target History

GRID 3E Unique Target ID	REACQUISITION SURVEY				
	Geophysical Instrument **	GPS Instrument**	Date	Comment	Response Amplitude (units*)**
1	Schondstedt	NA	2-18-06	used x/y coordinates to locate targets	NA
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					
14					
15					

Geophysical Dig Sheet and Target History

GRID 3E Unique Target ID	REACQUISITION SURVEY				
	Geophysical Instrument **	GPS Instrument**	Date	Comment	Response Amplitude (units*)**
16	Schondstedt	NA	2-18-06	used x/y coordinates to locate targets	NA
17					
18					
19					
20					
21					
22					
23					
24					
25					
26					
27					
28					
29					
30					

Geophysical Dig Sheet and Target History

GRID 3E Unique Target ID	REACQUISITION SURVEY				
	Geophysical Instrument **	GPS Instrument**	Date	Comment	Response Amplitude (units*)**
31	Schondstedt	NA	2-18-06	used x/y coordinates to locate targets	NA
32					
33					
34					
35					
36					
37					
38					
39					
40					
41					
42					
43					
44					
45					

Geophysical Dig Sheet and Target History

GRID 3E Unique Target ID	REACQUISITION SURVEY				
	Geophysical Instrument **	GPS Instrument**	Date	Comment	Response Amplitude (units*)**
46	Schondstedt	NA	2-18-06	used x/y coordinates to locate targets	NA
47					
48					
49					
50					
51					
52					
53					
54					
55					
56					
57					
58					
59					
60					

Geophysical Dig Sheet and Target History

GRID 3E Unique Target ID	REACQUISITION SURVEY				
	Geophysical Instrument **	GPS Instrument**	Date	Comment	Response Amplitude (units*)**
61	Schondstedt	NA	2-18-06	used x/y coordinates to locate targets	NA
62					
63					
64					
65					
66					
67					
68					
69					
70					
71					
72					
73					
74					
75					

Geophysical Dig Sheet and Target History

GRID 3E Unique Target ID	REACQUISITION SURVEY				
	Geophysical Instrument **	GPS Instrument**	Date	Comment	Response Amplitude (units*)**
76	Schondstedt	NA	2-18-06	used x/y coordinates to locate targets	NA
77					
78					
79					
80					
81					
82					
83					
84					
85					
86					
87					
88					
89					
90					

Geophysical Dig Sheet and Target History

GRID 3E Unique Target ID	REACQUISITION SURVEY				
	Geophysical Instrument **	GPS Instrument**	Date	Comment	Response Amplitude (units*)**
91	Schondstedt	NA	2-18-06	used x/y coordinate to locate targets	NA
92					
93					
94					
95					
96					
97					
98					
99					
100					
101					
102					
103					
104					
105					

Geophysical Dig Sheet and Target History

GRID 3E Unique Target ID	REACQUISITION SURVEY				
	Geophysical Instrument **	GPS Instrument**	Date	Comment	Response Amplitude (units*)**
106	Schondstedt	NA	2-18-06	used x/y coordinates to locate targets	NA
107					
108					
109					
110					

Geophysical Dig Sheet and Target History

GRID 3E Unique Target ID	DIG RESULTS										
	Anomaly Type ***	Approx. Weight (lbs-~~oz/kg-g~~)	Comments (e.g., response below 1 foot)	Offset Distance (ft)	Offset Direction (N, NE, etc.)	Orientation of Nose (Azimuth deg)	Inclination of Nose (deg)	Depth to Top of Item (in/~~cm~~)	Digital Photo Number	2006 Date	Team Leader
1	MD	.4	30 mm	0				4		2/19/06	RW
2	MD	.8	20mm x 3	0				8			RW
3	S	.2	nail	1.0				5			RW
4	MD	.7	20mm x 2	0				6			RW
5	MD	.4	20 mm	0				4			RW
6	MD	.8	20mm x 2	0				7			RW
7	S	.1	nail	1.0				8			RW
8	MD	.7	20 mm	0				3			RW
9	S	.1	scrap	0				6			RW
10	S	.2	scrap	1.0				6			RW
11	MD	.6	20 mm	0				4			RW
12			LIP	0				>12			RW
13	MD	1.1	20mm x 3	0				7			RW
14	MD	.8	20mm x 2	0				6			RW
15			LIP	0				>12			RW

Geophysical Dig Sheet and Target History

GRID 3E Unique Target ID	DIG RESULTS Anomaly Type ***	Approx. Weight (lbs-oz/kg-g)	Comments (e.g., response below 1 foot)	Offset Distance (ft)	Offset Direction (N, NE, etc.)	Orientation of Nose (Azimuth deg)	Inclination of Nose (deg)	Depth to Top of Item (in/~~cm~~)	Digital Photo Number	Date	Team Leader
16	S	.4	scrap	0				4		2/19/06	RW
17	MD	.9	30 mm	0				3			RW
18	MD	.4	20 mm	0				5			RW
19	MD	.5	20 mm	0				6			RW
20	S	.6	scrap	0				7			RW
21			LIP	0				>12"			RW
22	MD	.8	20 mm	0				4			RW
23	S	.1	nail	1.0				7			RW
24	S	.2	scrap	0				6			RW
25	MD	.7	20 mm	0				6			RW
26	S	.2	scrap	1.0				10			RW
27	MD	.6	20 mm	0				6			RW
28	S	.2	scrap	1.0				12			RW
29	MD	.4	20 mm	0				7			RW
30			LIP	0				>12"			RW

Geophysical Dig Sheet and Target History

GRID 3E Unique Target ID	DIG RESULTS										
	Anomaly Type ***	Approx. Weight (lbs-oz/kg-g)	Comments (e.g., response below 1 foot)	Offset Distance (ft)	Offset Direction (N, NE, etc.)	Orientation of Nose (Azimuth deg)	Inclination of Nose (deg)	Depth to Top of Item (in/~~cm~~)	Digital Photo Number	Date	Team Leader
31	MD	1.0	20mm X3	1.0				8		2/19/06	RW
32	MD	.4	20mm	0				10			RW
33	S	.1	scrap	0				9			RW
34	MD	.7	20mm X2	0				8			RW
35	S	.2	scrap	1.0				6			RW
36			LIP	0				>12''			RW
37	MD	.5	20mm	0				3			RW
38	S	.5	scrap	0				3			RW
39	S	.3	scrap	0				4			RW
40			LIP	0				>12''			RW
41	MD	.4	20mm	0				6			RW
42	MD	.4	20mm	0				7			RW
43	MD	.4	20mm	0				8			RW
44	S	.2	bolt	0.5				9			RW
45	S	.3	scrap	0				10			RW

Geophysical Dig Sheet and Target History

GRID 3E Unique Target ID	DIG RESULTS										
	Anomaly Type ***	Approx. Weight (lbs-oz/kg-g)	Comments (e.g., response below 1 foot)	Offset Distance (ft)	Offset Direction (N, NE, etc.)	Orientation of Nose (Azimuth deg)	Inclination of Nose (deg)	Depth to Top of Item (in/~~cm~~)	Digital Photo Number	Date	Team Leader
46	MD	1.1	20 mm X3	0				7		2/19/06	RW
47	S	.1	Scrap	1.5				8			RW
48	MD	1.8	20 mm X4	0				12			RW
49	MD	.6	20 mm	0				6			RW
50	MD	.7	20 mm X2	0				5			RW
51	MD	.7	20 mm	0				4			RW
52	MD	.9	20 mm X2	0				2			RW
53	MD	.7	20 mm	0				7			RW
54	MD	.3	20 mm	0				8			RW
55	S	.1	Scrap	1.5				2			RW
56	MD	.8	20 mm	0				1			RW
57	MD	.4	20 mm	0				3			RW
58	MD	.5	20 mm	0				4			RW
59	MD	.4	20 mm	0				7			RW
60	MD	.4	20 mm	0				6			RW

Geophysical Dig Sheet and Target History

GRID 3E Unique Target ID	DIG RESULTS										
	Anomaly Type ***	Approx. Weight (lbs-oz/kg-g)	Comments (e.g., response below 1 foot)	Offset Distance (ft)	Offset Direction (N, NE, etc.)	Orientation of Nose (Azimuth deg)	Inclination of Nose (deg)	Depth to Top of Item (in/~~cm~~)	Digital Photo Number	Date	Team Leader
61	MD	.3	20 mm	0				1		2/19/06	rw
62	MD	.9	30 mm	0				7			rw
63	S	.5	Scrap	0				8			rw
64	MD	.3	20 mm	0				2			rw
65	S	.2	Scrap	1.0				5			rw
66	MD	1.8	20 mm x 7	0				4			rw
67	MD	1.5	20 mm x 2	0				7			rw
68	MD	.3	20 mm	1.0				9			rw
69	MD	1.2	20 mm x4	0				12			rw
70	S	.1	Scrap	1.0				4			rw
71	MD	.7	20 mm	0				3			rw
72	S	.1	Scrap	0				2			rw
73	MD	.8	20 mm x 2	0				6			rw
74	MD	.4	20 mm	0				8			rw
75	MD	.4	20 mm	0				9			rw

Geophysical Dig Sheet and Target History

GRID 3E Unique Target ID	DIG RESULTS										
	Anomaly Type ***	Approx. Weight (lbs-oz/kg-g)	Comments (e.g., response below 1 foot)	Offset Distance (ft)	Offset Direction (N, NE, etc.)	Orientation of Nose (Azimuth deg)	Inclination of Nose (deg)	Depth to Top of Item (in/~~cm~~)	Digital Photo Number	Date	Team Leader
76	S	.2	nail	1.0				1		2/9/06	RW
77	MD	.5	30 mm	0				6			RW
78	MD	.8	20 mm x 2	0				5			RW
79	MD	.5	20 mm	0				4			RW
80	MD	.3	20 mm	0				3			RW
81	MD	.8	20 mm x2	0				2			RW
82	MD	.4	20 mm	0				1			RW
83	MD	.5	20 mm	0				9			RW
84	MD	.8	20 mm	0				7			RW
85	S	.2	nail	1.0				8			RW
86	MD	.5	20 mm	0				7			RW
87	S	.1	scrap	1.0				6			RW
88	MD	.7	20 mm	0				5			RW
89	MD	.7	20 mm	0				3			RW
90	S	.3	scrap	0				2			RW

Geophysical Dig Sheet and Target History

GRID 3E Unique Target ID	DIG RESULTS Anomaly Type ***	Approx. Weight (lbs-oz/kg-g)	Comments (e.g., response below 1 foot)	Offset Distance (ft)	Offset Direction (N, NE, etc.)	Orientation of Nose (Azimuth deg)	Inclination of Nose (deg)	Depth to Top of Item (in/~~cm~~)	Digital Photo Number	Date	Team Leader
91	MD	.8	20mm	0				6		2/19/04	RW
92	MD	.5	20 mm	0				10			RW
93	MD.	.7	20 mm	0				5			RW
94	MD	.5	20 mm	0				4			RW
95	S	1.2	scrap	0				3			RW
96	MD	.4	20 mm	0				1			RW
97	S	.4	Scrap	0				2			RW
98	S	1.0	scrap	0				3			RW
99	MD	.4	20 mm	1.0				2			RW
100	MD	.4	20 mm	0				3			RW
101	MD	.6	20 mm	0				4			RW
102	S	.2	Scrap	0				5			RW
103	MD	.7	20 mm x 2	0				9			RW
104	MD	.4	20 mm	0				1			RW
105	MD	.4	20 mm	0				1			RW

Geophysical Dig Sheet and Target History

GRID 3E Unique Target ID	DIG RESULTS										
	Anomaly Type ***	Approx. Weight (lbs-oz/kg-g)	Comments (e.g., response below 1 foot)	Offset Distance (ft)	Offset Direction (N, NE, etc.)	Orientation of Nose (Azimuth deg)	Inclination of Nose (deg)	Depth to Top of Item (in/~~cm~~)	Digital Photo Number	Date	Team Leader
106	S	.4	Scrap	0				4		2/19/08	RW
107	S	.4	Spring	0				5			RW
108	S	.3	Scrap	1.0				2			RW
109	MD	.5	20mm	0				1			RW
110	MD	.7	20mm	0				3			RW

Geophysical Dig Sheet and Target History

GRID 3E Unique Target ID	POST-DIG UXO QC RESULTS			POST-DIG PROJECT QC		
	Excavation Hole Cleared?	UXO QC Spec. Initials	Date	Agreement Between Dig Results & Geophysical Data? (G=good, P=poor, U=unacceptable)	Project QC Initials	Date
1	Yes	EMD	2/19/06	G	VAS	2-19-06
2						
3						
4						
5						
6						
7						
8						
9						
10	Yes	EMD	2/19/06	G	VAS	2-19-06
11						
12						
13						
14						
15						

Geophysical Dig Sheet and Target History

GRID 3E Unique Target ID	POST-DIG UXO QC RESULTS			POST-DIG PROJECT QC		
	Excavation Hole Cleared?	UXO QC Spec. Initials	Date	Agreement Between Dig Results & Geophysical Data? (G=good, P=poor, U=unacceptable)	Project QC Initials	Date
16						
17						
18						
19						
20	Yes	EMD	2/19/06	G	VAS	2-19-06
21						
22						
23						
24						
25						
26						
27						
28						
29						
30	N/O Deeper than 12"	EMD	2/19/06	G	VAS	2-19-06

Geophysical Dig Sheet and Target History

GRID 3E Unique Target ID	POST-DIG UXO QC RESULTS			POST-DIG PROJECT QC		
	Excavation Hole Cleared?	UXO QC Spec. Initials	Date	Agreement Between Dig Results & Geophysical Data? (G=good, P=poor, U=unacceptable)	Project QC Initials	Date
31						
32						
33						
34						
35						
36						
37						
38						
39						
40						
41	Yes	EMD	2/19/06	G	VAS	2-19-06
42						
43						
44						
45						

Geophysical Dig Sheet and Target History

GRID 3E Unique Target ID	POST-DIG UXO QC RESULTS			POST-DIG PROJECT QC		
	Excavation Hole Cleared?	UXO QC Spec. Initials	Date	Agreement Between Dig Results & Geophysical Data? (G=good, P=poor, U=unacceptable)	Project QC Initials	Date
46						
47						
48						
49						
50	Yes	EMD	2/19/06	G	VAS	2-19-06
51						
52						
53						
54						
55						
56						
57						
58						
59						
60	Yes	EMD	2/19/06	G	VAS	2-19-06

Geophysical Dig Sheet and Target History

GRID 3E Unique Target ID	POST-DIG UXO QC RESULTS Excavation Hole Cleared?	UXO QC Spec. Initials	Date	POST-DIG PROJECT QC Agreement Between Dig Results & Geophysical Data? (G=good, P=poor, U=unacceptable)	Project QC Initials	Date
61						
62						
63						
64						
65						
66						
67						
68						
69						
70	Yes	[illegible]	2/19/06	G	VAS	2-19-06
71						
72						
73						
74						
75						

Geophysical Dig Sheet and Target History

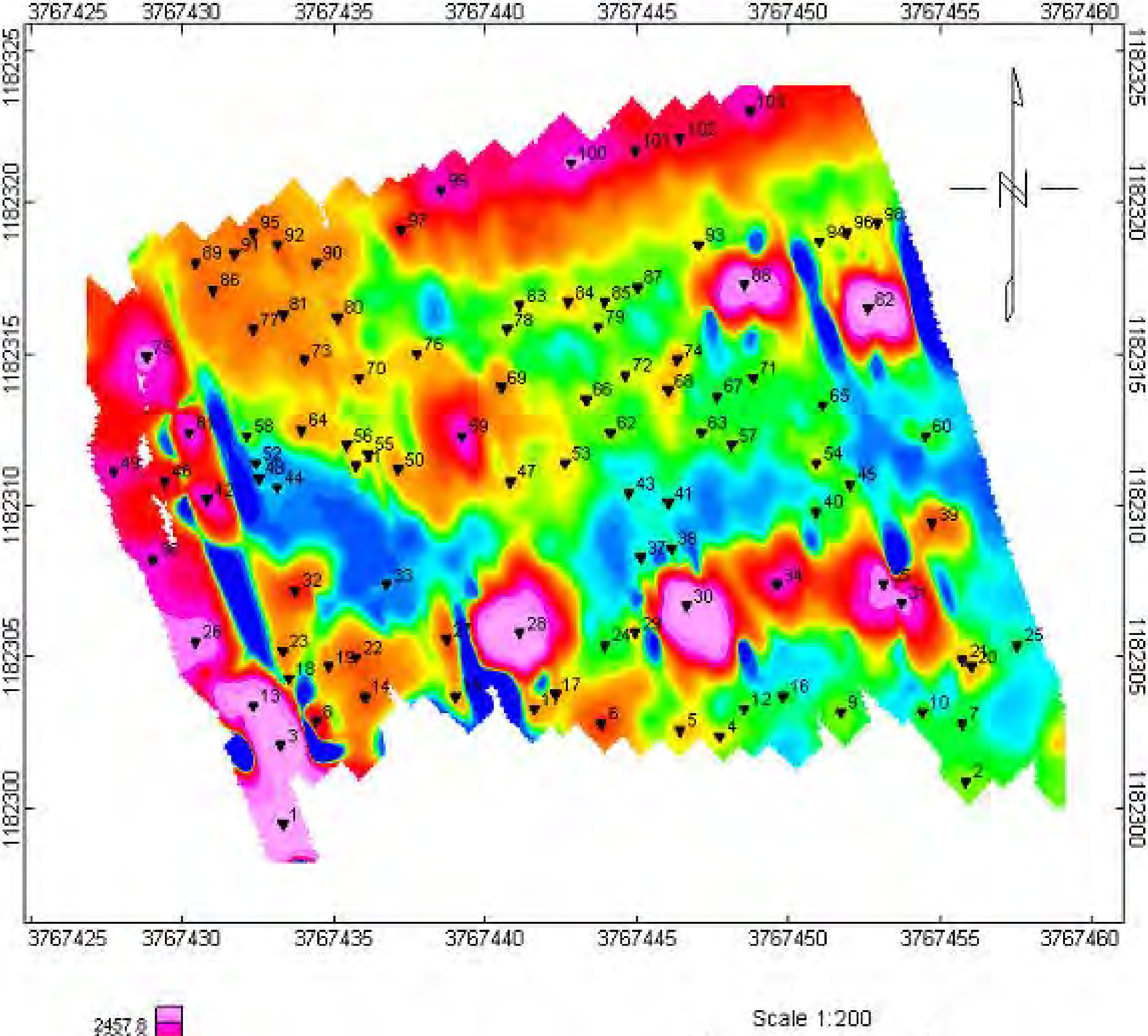
GRID 3E Unique Target ID	POST-DIG UXO QC RESULTS			POST-DIG PROJECT QC		
	Excavation Hole Cleared?	UXO QC Spec. Initials	Date	Agreement Between Dig Results & Geophysical Data? (G=good, P=poor, U=unacceptable)	Project QC Initials	Date
76						
77						
78						
79						
80	Yes	[illegible]		G	VAS	2-19-06
81						
82						
83						
84						
85						
86						
87						
88						
89						
90	Yes			G	VAS	2-19-06

Geophysical Dig Sheet and Target History

GRID 3E Unique Target ID	POST-DIG UXO QC RESULTS			POST-DIG PROJECT QC		
	Excavation Hole Cleared?	UXO QC Spec. Initials	Date	Agreement Between Dig Results & Geophysical Data? (G=good, P=poor, U=unacceptable)	Project QC Initials	Date
91						
92						
93						
94						
95						
96						
97						
98						
99						
100	Yes	EMD	2/19/06	G	VAS	2-19-06
101						
102						
103						
104						
105						

Geophysical Dig Sheet and Target History

GRID 3E	POST-DIG UXO QC RESULTS			POST-DIG PROJECT QC		
Unique Target ID	Excavation Hole Cleared?	UXO QC Spec. Initials	Date	Agreement Between Dig Results & Geophysical Data? (G=good, P=poor, U=unacceptable)	Project QC Initials	Date
106						
107						
108						
109						
110	Yes	[illegible]	2/19/06	G	VAS	2-19-06



NASA
Wallops Flight Center **EM61 MK2 Data** **Grid 4A**
February 9, 2006
Tetra Tech EM Inc.

Geophysical Dig Sheet and Target History

GRID 4A Unique Target ID	ORIGINAL SURVEY									
	Easting Coord. (m)	Northing Coord. (m)	Lat. Coord.	Long. Coord.	X - Local (Grid) Coord. (ft)	Y - Local (Grid) Coord. (ft)	Channel ID (i.e. C1, top senor, gradient)	Response Amplitude (mV)	Dig Priority	Date
1	3767433.3	1182299.5	37.56.13.74	-75.27.26.06	16.78	26.99	Z(1-4)	29026		2/9/2006
2	3767455.8	1182300.9	37.56.13.76	-75.27.25.14	97.78	19.18	Z(1-4)	94.6		2/9/2006
3	3767433.2	1182302.1	37.56.13.82	-75.27.26.07	17.91	36.32	Z(1-4)	33995		2/9/2006
4	3767447.7	1182302.4	37.56.13.81	-75.27.25.47	69.76	29.13	Z(1-4)	120.1		2/9/2006
5	3767446.4	1182302.6	37.56.13.82	-75.27.25.52	65.24	30.59	Z(1-4)	166.3		2/9/2006
6	3767443.8	1182302.8	37.56.13.83	-75.27.25.63	56.09	32.78	Z(1-4)	456.5		2/9/2006
7	3767455.7	1182302.8	37.56.13.82	-75.27.25.14	98.5	26	Z(1-4)	76		2/9/2006
8	3767434.4	1182302.9	37.56.13.84	-75.27.26.02	22.64	38.49	Z(1-4)	1128		2/9/2006
9	3767451.7	1182303.2	37.56.13.84	-75.27.25.31	84.47	29.71	Z(1-4)	93.9		2/9/2006
10	3767454.4	1182303.2	37.56.13.83	-75.27.25.20	94.1	28.17	Z(1-4)	88.7		2/9/2006
11	3767441.6	1182303.3	37.56.13.85	-75.27.25.72	48.53	35.81	Z(1-4)	204.8		2/9/2006
12	3767448.5	1182303.3	37.56.13.84	-75.27.25.44	73.12	31.89	Z(1-4)	81.1		2/9/2006
13	3767432.3	1182303.4	37.56.13.86	-75.27.26.10	15.44	41.46	Z(1-4)	14138		2/9/2006
14	3767436	1182303.7	37.56.13.87	-75.27.25.95	28.8	40.43	Z(1-4)	323.4		2/9/2006
15	3767439	1182303.7	37.56.13.87	-75.27.25.83	39.49	38.72	Z(1-4)	167.1		2/9/2006

Geophysical Dig Sheet and Target History

GRID 4A Unique Target ID	ORIGINAL SURVEY									
	Easting Coord. (m)	Northing Coord. (m)	Lat. Coord.	Long. Coord.	X - Local (Grid) Coord. (ft)	Y - Local (Grid) Coord. (ft)	Channel ID (i.e. C1, top senor, gradient)	Response Amplitude (mV)	Dig Priority	Date
16	3767449.8	1182303.7	37.56.13.85	-75.27.25.38	77.99	32.57	Z(1-4)	69.2		2/9/2006
17	3767442.3	1182303.8	37.56.13.87	-75.27.25.69	51.31	37.2	Z(1-4)	191.8		2/9/2006
18	3767433.5	1182304.3	37.56.13.89	-75.27.26.05	20.23	43.99	Z(1-4)	204.3		2/9/2006
19	3767434.8	1182304.7	37.56.13.90	-75.27.26.00	25.09	44.68	Z(1-4)	275.9		2/9/2006
20	3767456	1182304.7	37.56.13.88	-75.27.25.13	100.65	32.61	Z(1-4)	157.9		2/9/2006
21	3767455.7	1182304.9	37.56.13.89	-75.27.25.14	99.7	33.49	Z(1-4)	160.6		2/9/2006
22	3767435.7	1182305	37.56.13.91	-75.27.25.96	28.47	45.23	Z(1-4)	338.1		2/9/2006
23	3767433.3	1182305.2	37.56.13.92	-75.27.26.06	20.03	47.31	Z(1-4)	248.1		2/9/2006
24	3767443.9	1182305.4	37.56.13.92	-75.27.25.62	57.92	41.99	Z(1-4)	76.7		2/9/2006
25	3767457.5	1182305.4	37.56.13.90	-75.27.25.07	106.4	34.25	Z(1-4)	63.8		2/9/2006
26	3767430.4	1182305.5	37.56.13.93	-75.27.26.18	9.86	50.03	Z(1-4)	6707		2/9/2006
27	3767438.7	1182305.6	37.56.13.93	-75.27.25.84	39.5	45.66	Z(1-4)	309.3		2/9/2006
28	3767441.1	1182305.8	37.56.13.93	-75.27.25.74	48.17	45.01	Z(1-4)	30036		2/9/2006
29	3767444.9	1182305.8	37.56.13.93	-75.27.25.58	61.72	42.85	Z(1-4)	150.8		2/9/2006
30	3767446.6	1182306.7	37.56.13.95	-75.27.25.51	68.29	45.09	Z(1-4)	20472		2/9/2006

Geophysical Dig Sheet and Target History

GRID 4A Unique Target ID	ORIGINAL SURVEY									
	Easting Coord. (m)	Northing Coord. (m)	Lat. Coord.	Long. Coord.	X - Local (Grid) Coord. (ft)	Y - Local (Grid) Coord. (ft)	Channel ID (i.e. C1, top senor, gradient)	Response Amplitude (mV)	Dig Priority	Date
31	3767453.7	1182306.8	37.56.13.95	-75.27.25.22	93.65	✓ 41.4	Z(1-4)	3099		2/9/2006
32	3767433.7	1182307.2	37.56.13.98	-75.27.26.04	22.59	✓ 54.21	Z(1-4)	557.1		2/9/2006
33	3767436.7	1182307.4	37.56.13.99	-75.27.25.92	33.4	✓ 53.22	Z(1-4)	33.7		2/9/2006
34	3767449.6	1182307.4	37.56.13.97	-75.27.25.39	79.38	✓ 45.87	Z(1-4)	1852		2/9/2006
35	3767453.1	1182307.4	37.56.13.97	-75.27.25.24	91.86	✓ 43.88	Z(1-4)	5407		2/9/2006
36	3767429	1182308.2	37.56.14.02	-75.27.26.23	6.41	✓ 60.45	Z(1-4)	1988		2/9/2006
37	3767445.1	1182308.3	37.56.14.01	-75.27.25.57	63.85	✓ 51.64	Z(1-4)	51.9		2/9/2006
38	3767446.1	1182308.6	37.56.14.02	-75.27.25.53	67.59	✓ 52.14	Z(1-4)	64.1		2/9/2006
39	3767454.7	1182309.4	37.56.14.03	-75.27.25.18	98.7	✓ 50.1	Z(1-4)	380.1		2/9/2006
40	3767450.9	1182309.8	37.56.14.05	-75.27.25.33	85.38	✓ 53.69	Z(1-4)	66.7		2/9/2006
41	3767446	1182310.1	37.56.14.07	-75.27.25.53	68.08	✓ 57.55	Z(1-4)	54.8		2/9/2006
42	3767430.8	1182310.2	37.56.14.08	-75.27.26.15	13.96	✓ 66.56	Z(1-4)	1768		2/9/2006
43	3767444.7	1182310.4	37.56.14.08	-75.27.25.58	63.62	✓ 59.36	Z(1-4)	55.2		2/9/2006
44	3767433.1	1182310.6	37.56.14.10	-75.27.26.06	22.39	✓ 66.67	Z(1-4)	35.1		2/9/2006
45	3767452	1182310.7	37.56.14.08	-75.27.25.28	89.81	✓ 56.27	Z(1-4)	87.9		2/9/2006

Geophysical Dig Sheet and Target History

GRID 4A Unique Target ID	ORIGINAL SURVEY									
	Easting Coord. (m)	Northing Coord. (m)	Lat. Coord.	Long. Coord.	X - Local (Grid) Coord. (ft)	Y - Local (Grid) Coord. (ft)	Channel ID (i.e. C1, top senor, gradient)	Response Amplitude (mV)	Dig Priority	Date
46	3767429.4	1182310.8	37.56.14.11	-75.27.26.21	9.31	69.49	Z(1-4)	1045		2/9/2006
47	3767440.8	1182310.8	37.56.14.09	-75.27.25.74	49.95	63	Z(1-4)	139.9		2/9/2006
48	3767432.5	1182310.9	37.56.14.11	-75.27.26.08	20.42	68.08	Z(1-4)	25.8		2/9/2006
49	3767427.7	1182311.1	37.56.14.12	-75.27.26.28	3.43	71.53	Z(1-4)	1628		2/9/2006
50	3767437.1	1182311.2	37.56.14.11	-75.27.25.89	36.99	66.53	Z(1-4)	198.5		2/9/2006
51	3767435.7	1182311.3	37.56.14.12	-75.27.25.95	32.05	67.69	Z(1-4)	158.7		2/9/2006
52	3767432.4	1182311.4	37.56.14.12	-75.27.26.09	20.35	69.92	Z(1-4)	49.2		2/9/2006
53	3767442.6	1182311.4	37.56.14.11	-75.27.25.67	56.71	64.12	Z(1-4)	128.6		2/9/2006
54	3767450.9	1182311.4	37.56.14.10	-75.27.25.33	86.29	59.39	Z(1-4)	113.2		2/9/2006
55	3767436.1	1182311.7	37.56.14.13	-75.27.25.93	33.71	68.89	Z(1-4)	132.1		2/9/2006
56	3767435.4	1182312	37.56.14.14	-75.27.25.96	31.38	70.35	Z(1-4)	161.1		2/9/2006
57	3767448.1	1182312	37.56.14.12	-75.27.25.44	76.65	63.12	Z(1-4)	95.2		2/9/2006
58	3767432.1	1182312.3	37.56.14.15	-75.27.26.10	19.79	73.3	Z(1-4)	102.2		2/9/2006
59	3767439.2	1182312.3	37.56.14.14	-75.27.25.81	45.1	69.26	Z(1-4)	2070		2/9/2006
60	3767454.5	1182312.3	37.56.14.13	-75.27.25.18	99.63	60.55	Z(1-4)	87.8		2/9/2006

Geophysical Dig Sheet and Target History

GRID 4A Unique Target ID	ORIGINAL SURVEY									
	Easting Coord. (m)	Northing Coord. (m)	Lat. Coord.	Long. Coord.	X - Local (Grid) Coord. (ft)	Y - Local (Grid) Coord. (ft)	Channel ID (i.e. C1, top senor, gradient)	Response Amplitude (mV)	Dig Priority	Date
61	3767430.2	1182312.4	37.56.14.16	-75.27.26.17	13.08	74.74	Z(1-4)	2743		2/9/2006
62	3767444.1	1182312.4	37.56.14.14	-75.27.25.61	62.62	66.83	Z(1-4)	100.8		2/9/2006
63	3767447.1	1182312.4	37.56.14.14	-75.27.25.48	73.32	65.12	Z(1-4)	93		2/9/2006
64	3767433.9	1182312.5	37.56.14.16	-75.27.26.02	26.32	72.99	Z(1-4)	206.1		2/9/2006
65	3767451.1	1182313.3	37.56.14.16	-75.27.25.32	88.09	66.05	Z(1-4)	78.3		2/9/2006
66	3767443.3	1182313.5	37.56.14.18	-75.27.25.64	60.4	71.2	Z(1-4)	118.8		2/9/2006
67	3767447.6	1182313.6	37.56.14.18	-75.27.25.46	75.78	69.11	Z(1-4)	71.4		2/9/2006
68	3767446	1182313.8	37.56.14.19	-75.27.25.53	70.19	70.74	Z(1-4)	161.8		2/9/2006
69	3767440.5	1182313.9	37.56.14.19	-75.27.25.75	50.64	74.22	Z(1-4)	241		2/9/2006
70	3767435.8	1182314.2	37.56.14.21	-75.27.25.94	34.06	77.97	Z(1-4)	185.4		2/9/2006
71	3767448.8	1182314.2	37.56.14.20	-75.27.25.41	80.4	70.57	Z(1-4)	80.9		2/9/2006
72	3767444.6	1182314.3	37.56.14.20	-75.27.25.58	65.49	73.31	Z(1-4)	112.9		2/9/2006
73	3767434	1182314.8	37.56.14.23	-75.27.26.02	27.99	81.13	Z(1-4)	244.8		2/9/2006
74	3767446.3	1182314.8	37.56.14.22	-75.27.25.51	71.83	74.13	Z(1-4)	179		2/9/2006
75	3767428.8	1182314.9	37.56.14.24	-75.27.26.23	9.51	84.45	Z(1-4)	2954		2/9/2006

Geophysical Dig Sheet and Target History

GRID 4A Unique Target ID	ORIGINAL SURVEY									
	Easting Coord. (m)	Northing Coord. (m)	Lat. Coord.	Long. Coord.	X - Local (Grid) Coord. (ft)	Y - Local (Grid) Coord. (ft)	Channel ID (i.e. C1, top senor, gradient)	Response Amplitude (mV)	Dig Priority	Date
76	3767437.7	1182315	37.56.14.23	-75.27.25.86	41.29	79.74	Z(1-4)	159.1		2/9/2006
77	3767432.3	1182315.8	37.56.14.26	-75.27.26.08	22.5	85.66	Z(1-4)	254.7		2/9/2006
78	3767440.7	1182315.8	37.56.14.26	-75.27.25.74	52.44	80.88	Z(1-4)	107.9		2/9/2006
79	3767443.7	1182315.9	37.56.14.26	-75.27.25.62	63.19	79.53	Z(1-4)	103.9		2/9/2006
80	3767435.1	1182316.2	37.56.14.27	-75.27.25.97	32.71	85.5	Z(1-4)	214.2		2/9/2006
81	3767433.3	1182316.3	37.56.14.28	-75.27.26.04	26.35	86.88	Z(1-4)	246.1		2/9/2006
82	3767452.6	1182316.5	37.56.14.27	-75.27.25.25	95.25	76.6	Z(1-4)	14927		2/9/2006
83	3767441.1	1182316.6	37.56.14.28	-75.27.25.72	54.32	83.51	Z(1-4)	123.7		2/9/2006
84	3767442.7	1182316.7	37.56.14.28	-75.27.25.66	60.08	82.95	Z(1-4)	141.8		2/9/2006
85	3767443.9	1182316.7	37.56.14.28	-75.27.25.61	64.36	82.27	Z(1-4)	109.8		2/9/2006
86	3767431	1182317.1	37.56.14.31	-75.27.26.14	18.6	91.04	Z(1-4)	294.6		2/9/2006
87	3767445	1182317.2	37.56.14.30	-75.27.25.56	68.56	83.42	Z(1-4)	93		2/9/2006
88	3767448.5	1182317.3	37.56.14.30	-75.27.25.42	81.09	81.79	Z(1-4)	8704		2/9/2006
89	3767430.4	1182318	37.56.14.34	-75.27.26.16	16.98	94.59	Z(1-4)	257.1		2/9/2006
90	3767434.4	1182318	37.56.14.33	-75.27.26.00	31.23	92.31	Z(1-4)	245.7		2/9/2006

Geophysical Dig Sheet and Target History

GRID 4A Unique Target ID	ORIGINAL SURVEY									
	Easting Coord. (m)	Northing Coord. (m)	Lat. Coord.	Long. Coord.	X - Local (Grid) Coord. (ft)	Y - Local (Grid) Coord. (ft)	Channel ID (i.e. C1, top senor, gradient)	Response Amplitude (mV)	Dig Priority	Date
91	3767431.7	1182318.3	37.56.14.35	-75.27.26.11	21.78	94.92	Z(1-4)	255.5		2/9/2006
92	3767433.1	1182318.6	37.56.14.35	-75.27.26.05	26.94	95.19	Z(1-4)	314.4		2/9/2006
93	3767447	1182318.6	37.56.14.34	-75.27.25.48	76.49	87.28	Z(1-4)	122.2		2/9/2006
94	3767451	1182318.7	37.56.14.34	-75.27.25.31	90.8	85.35	Z(1-4)	113.2		2/9/2006
95	3767432.3	1182319	37.56.14.37	-75.27.26.08	24.32	97.07	Z(1-4)	275.4		2/9/2006
96	3767451.9	1182319	37.56.14.35	-75.27.25.28	94.18	85.91	Z(1-4)	128.4		2/9/2006
97	3767437.2	1182319.1	37.56.14.37	-75.27.25.88	41.84	94.64	Z(1-4)	678		2/9/2006
98	3767452.9	1182319.3	37.56.14.36	-75.27.25.24	97.92	86.41	Z(1-4)	139.5		2/9/2006
99	3767438.5	1182320.4	37.56.14.41	-75.27.25.82	47.22	98.53	Z(1-4)	1644		2/9/2006
100	3767442.8	1182321.3	37.56.14.43	-75.27.25.65	63.05	99.29	Z(1-4)	2700		2/9/2006
101	3767444.9	1182321.7	37.56.14.44	-75.27.25.56	70.77	99.52	Z(1-4)	1195		2/9/2006
102	3767446.4	1182322.1	37.56.14.45	-75.27.25.50	76.34	100.09	Z(1-4)	1095		2/9/2006
103	3767448.7	1182323	37.56.14.48	-75.27.25.40	85.05	101.99	Z(1-4)	1510		2/9/2006

Geophysical Dig Sheet and Target History

GRID 4A Unique Target ID	ORIGINAL SURVEY									
	Easting Coord. (m)	Northing Coord. (m)	Lat. Coord.	Long. Coord.	X - Local (Grid) Coord. (ft)	Y - Local (Grid) Coord. (ft)	Channel ID (i.e. C1, top senor, gradient)	Response Amplitude (mV)	Dig Priority	Date

Note: *Fill in Acceptable Units (mV, nT/m, ppt, etc).

**Optional field – refer to SOW for applicability to specific project.

***For Anomaly type, U = UXO, F = frag, MD = munitions debris, S = scrap, A = small arms ammunition, NC = no contact, O = other.

Geophysical Dig Sheet and Target History

GRID 4A Unique Target ID	REACQUISITION SURVEY				
	Geophysical Instrument **	GPS Instrument**	Date	Comment	Response Amplitude (units*)**
1	Schondstedt	Trimble	2-19-06	used x/y axis coordinates to locate targets	NA
2				Trimble used to confirm locations.	
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					
14					
15					

Geophysical Dig Sheet and Target History

GRID 4A Unique Target ID	REACQUISITION SURVEY				
	Geophysical Instrument **	GPS Instrument**	Date	Comment	Response Amplitude (units*)**
16	Schondstedt	Trimble	2-19-06	used x/y coordinates and Trimble to	NA
17				locate targets	
18					
19					
20					
21					
22					
23					
24					
25					
26					
27					
28					
29					
30					

Geophysical Dig Sheet and Target History

GRID 4A Unique Target ID	REACQUISITION SURVEY Geophysical Instrument **	GPS Instrument**	Date	Comment	Response Amplitude (units*)**
31	Schondstedt	Trimble	2-19-06	used x/y coordinates and Trimble	NA
32				to locate Targets	
33					
34					
35					
36					
37					
38					
39					
40					
41					
42					
43					
44					
45					

Geophysical Dig Sheet and Target History

GRID 4A Unique Target ID	REACQUISITION SURVEY				
	Geophysical Instrument **	GPS Instrument**	Date	Comment	Response Amplitude (units*)**
46	Schonstedt	Trimble	2-19-06	used x/y coordinates and Trimble	NA
47				to locate targets	
48					
49					
50					
51					
52					
53					
54					
55					
56					
57					
58					
59					
60					

Geophysical Dig Sheet and Target History

GRID 4A Unique Target ID	REACQUISITION SURVEY				
	Geophysical Instrument **	GPS Instrument**	Date	Comment	Response Amplitude (units*)**
61	Schondstedt	Trimble	2-19-06	used x/y coordinates and Trimble	NA
62				to locate targets	
63					
64					
65					
66					
67					
68					
69					
70					
71					
72					
73					
74					
75					

Geophysical Dig Sheet and Target History

GRID 4A Unique Target ID	REACQUISITION SURVEY				
	Geophysical Instrument **	GPS Instrument**	Date	Comment	Response Amplitude (units*)**
76	Schondstedt	Trimble	2-19-06	used x/y coordinates and Trimble	NA
77				to locate targets	
78					
79					
80					
81					
82					
83					
84					
85					
86					
87					
88					
89					
90					

Geophysical Dig Sheet and Target History

GRID 4A Unique Target ID	REACQUISITION SURVEY				
	Geophysical Instrument **	GPS Instrument**	Date	Comment	Response Amplitude (units*)**
91	Schondstedt	Trimble	2-19-06	used x/y coordinates and Trimble	NA
92				to locate Targets	
93					
94					
95					
96					
97					
98					
99					
100					
101					
102					
103					

Geophysical Dig Sheet and Target History

GRID 4A Unique Target ID	REACQUISITION SURVEY				
	Geophysical Instrument **	GPS Instrument**	Date	Comment	Response Amplitude (units*)**

Geophysical Dig Sheet and Target History

GRID 4A Unique Target ID	DIG RESULTS										
	Anomaly Type ***	Approx. Weight (lbs-oz/kg-g)	Comments (e.g., response below 1 foot)	Offset Distance (ft)	Offset Direction (N, NE, etc.)	Orientation of Nose (Azimuth deg)	Inclination of Nose (deg)	Depth to Top of Item (in/cm)	Digital Photo Number	Date	Team Leader
1	S	300	LIP 2" THICK PLATE	0				4		2/21/06	[illegible]
2	MD	.6	20MM X2	0				7		2/21/06	[illegible]
3	S	300	LIP 2" THICK PLATE	0				4		2/21/06	[illegible]
4			≠12" LIP	0				≠12"		2/21/06	[illegible]
5			≠12" LIP	0				≠12"		2/21/06	[illegible]
6			≠12" LIP	0				≠12"		2/21/06	[illegible]
7	MD	.4	20MM	0				3		2/21/06	[illegible]
8	MD	.8	20MM X2	0				11		2/21/06	[illegible]
9			≠12" LIP	0				≠12"		2/21/06	[illegible]
10			≠12" LIP	0				≠12"		2/21/06	[illegible]
11			≠12" LIP	0				≠12"		2/21/06	[illegible]
12			≠12" LIP	0				≠12"		2/21/06	[illegible]
13	MD	.4	20MM	0				5		2/21/06	[illegible]
14	S	.2	WIRE CABLE	1.0				3		2/21/06	[illegible]
15			<12" LIP	0				≠12"		2/21/06	[illegible]

Geophysical Dig Sheet and Target History

GRID 4A Unique Target ID	DIG RESULTS Anomaly Type ***	Approx. Weight (lbs/oz/kg-g)	Comments (e.g., response below 1 foot)	Offset Distance (ft)	Offset Direction (N, NE, etc.)	Orientation of Nose (Azimuth deg)	Inclination of Nose (deg)	Depth to Top of Item (in/cm)	Digital Photo Number	Date	Team Leader
16			≥12" LIP	0				≥12"		2/21/06	mdd
17			≥12" LIP	0				≥12"		2/21/06	mdd
18	MD	.5	20MM	0				4		2/21/06	mdd
19	MD	.4	20MM	0				2		2/21/06	mdd
20	MD	.3	20MM	0				8		2/21/06	mdd
21	MD	.2	20MM	1.0				2		2/21/06	mdd
22	MD	.4	20MM	0				1		2/21/06	mdd
23	MD	.4	20MM	0				8		2/21/06	mdd
24			≥12" LIP	0				≥12"		2/21/06	mdd
25	MD	.3	20MM	0.5				10		2/21/06	mdd
26	S	300	LIP PLATE 2" THICK METAL	0				4		2/21/06	mdd
27			≥12" LIP	0				≥12"		2/21/06	mdd
28			≥12" LIP	0				≥12"		2/21/06	mdd
29			≥12" LIP	0				≥12"		2/21/06	mdd
30			≥12 LIP	0				≥12"		2/21/06	mdd

Geophysical Dig Sheet and Target History

GRID 4A Unique Target ID	Anomaly Type ***	Approx. Weight (lbs-oz/kg-g)	Comments (e.g., response below 1 foot)	Offset Distance (ft)	Offset Direction (N, NE, etc.)	Orientation of Nose (Azimuth deg)	Inclination of Nose (deg)	Depth to Top of Item (in/cm)	Digital Photo Number	Date	Team Leader
	DIG RESULTS										
31	MD	.3	20MM	0				1		2/21/05	[illegible]
32	MD	.6	20MM x 2	0				8		2/21/05	[illegible]
33			≥12" LIP	0				<12"		2/21/05	[illegible]
34	S	.9	REBAR	0				3		2/21/05	[illegible]
35			≥ 12" LIP	0				≥12"		2/21/05	[illegible]
36	S	.1	WIRE	0.5				2		2/21/05	[illegible]
37	MD	.2	20MM	0				5		2/21/05	[illegible]
38	S	1	REBAR	0				8		2/21/05	[illegible]
39			≥12" LIP					≥12"		2/21/05	[illegible]
40	MD	.4	20MM	0				3		2/21/05	[illegible]
41	MD	.2	20MM	1.0				5		2/21/05	[illegible]
42			FENCE LIP							2/21/05	[illegible]
43	MD	.2	20mm	1.0				7		2/21/05	[illegible]
44	MD	.4	20MM	0				4		2/21/05	[illegible]
45	S	.1	NAIL	0				3		2/21/05	[illegible]

Geophysical Dig Sheet and Target History

GRID 4A Unique Target ID	DIG RESULTS										
	Anomaly Type ***	Approx. Weight (lbs-oz/kg-g)	Comments (e.g., response below 1 foot)	Offset Distance (ft)	Offset Direction (N, NE, etc.)	Orientation of Nose (Azimuth deg)	Inclination of Nose (deg)	Depth to Top of Item (in/cm)	Digital Photo Number	Date	Team Leader
46	MD	.4	20MM	0				2		2/21/05	[illegible]
47			<12" LIP	0				≯12"		2/21/05	[illegible]
48	MD	.3	20MM	1.0				5		2/21/05	[illegible]
49			FENCE LIP	0						2/21/05	[illegible]
50	S	.7	NAILS	0				8		2/21/05	[illegible]
51	S	4	SCRAP	0				4		2/21/05	[illegible]
52	MD	.4	20MM	0				1		2/21/05	[illegible]
53	MD	.3	20MM	0				4		2/21/05	[illegible]
54	S	.5	WIRE	0				2		2/21/05	[illegible]
55	MD	.3	20MM	1.0				3		2/21/05	[illegible]
56	MD	.8	20MMx3	0				12		2/21/05	[illegible]
57	MD	.2	20MM	1.0				3		2/21/05	[illegible]
58	MD	.4	20MM	0				2		2/21/05	[illegible]
59			<12" LIP	0				≯12"		2/21/05	[illegible]
60	S	.8	REBAR	0				7		2/21/05	[illegible]

Geophysical Dig Sheet and Target History

GRID 4A Unique Target ID	DIG RESULTS										
	Anomaly Type ***	Approx. Weight (lbs-oz/kg-g)	Comments (e.g., response below 1 foot)	Offset Distance (ft)	Offset Direction (N, NE, etc.)	Orientation of Nose (Azimuth deg)	Inclination of Nose (deg)	Depth to Top of Item (in/cm)	Digital Photo Number	Date	Team Leader
61	X		FENCE LIP	0						2/21/06	[illegible]
62	MD	.4	20MM	0				3		2/21/05	[illegible]
63	MD	.4	20MM	0				7		2/21/06	[illegible]
64	MD	.4	20MM	0				8		2/21/05	[illegible]
65	MD	1.2	20MMX3	0				7		2/21/05	[illegible]
66	MD	.4	20MM	0				8		2/21/05	[illegible]
67	MD	.8	20MMX2	0				5		2/21/05	[illegible]
68	MD	.3	20MM	1.0				1		2/21/05	[illegible]
69			~~7~~ 12" LIP	0				~~8~~ 12"		2/21/05	[illegible]
70	MD	.4	20MM	0				12		2/21/05	[illegible]
71	S	.4	NAIL	0				8		2/21/05	[illegible]
72	MD	.3	20MM	1.0				1		2/21/05	[illegible]
73	MD	.9	20MM X 3	0				11		2/21/05	[illegible]
74	MD	.4	20MM	0				3		2/21/05	[illegible]
75			FENCE LIP	0						2/21/05	[illegible]

Geophysical Dig Sheet and Target History

GRID 4A Unique Target ID	DIG RESULTS										
	Anomaly Type ***	Approx. Weight (lbs-oz/kg-g)	Comments (e.g., response below 1 foot)	Offset Distance (ft)	Offset Direction (N, NE, etc.)	Orientation of Nose (Azimuth deg)	Inclination of Nose (deg)	Depth to Top of Item (in/cm)	Digital Photo Number	Date	Team Leader
76	MD	.2	20MM	1.0				4		2/21/06	[illegible]
77	MD	.8	20MM x 2	0				8		2/21/06	[illegible]
78	MD	4.	20MM	0				3		2/21/06	[illegible]
79	MD	1.1	30MM x 2	0				2		2/21/06	[illegible]
80	MD	.8	20MM x 2	0				4		2/21/06	[illegible]
81	MD	.6	20MM x 2	0				2		2/21/06	[illegible]
82	S	100	2" THICK LIP METAL PLATE	0				12		2/21/06	[illegible]
83	MD	.9	20MM x 3	0				4		2/21/06	[illegible]
84	MD	.6	30MM	0				7		2/21/06	[illegible]
85	MD	.3	20MM	0				1		2/21/06	[illegible]
86	MD	1.2	20MM x 4	0				8		2/21/06	[illegible]
87	MD	.4	20MM	0				3		2/21/06	[illegible]
88	S	75	2" THICK LIP PLATE	0				12		2/21/06	[illegible]
89	MD	1.4	20MM x 5	0				4		2/21/06	[illegible]
90	MD	2.0	20MM x 7	0				5		2/21/06	[illegible]

Geophysical Dig Sheet and Target History

	DIG RESULTS										
GRID 4A Unique Target ID	Anomaly Type ***	Approx. Weight (lbs-oz/kg-g)	Comments (e.g., response below 1 foot)	Offset Distance (ft)	Offset Direction (N, NE, etc.)	Orientation of Nose (Azimuth deg)	Inclination of Nose (deg)	Depth to Top of Item (in/cm)	Digital Photo Number	Date	Team Leader
91	MD	1.2	20MM X 3	0				4		2/21/06	[illegible]
92	MD	1.2	20MM X 3	0				7		2/21/06	[illegible]
93	MD	.2	20MM	0.5				1		2/21/06	[illegible]
94	S	.8	REBAR	0				8		2/21/06	[illegible]
95	MD	.8	20MM X 2	0				7		2/21/06	[illegible]
96	MD	.4	20MM	0				5		2/21/06	[illegible]
97	MD	.3	20MM	0.5				1		2/21/06	[illegible]
98	S	.5	BUCKET HANDLE	0				2		2/21/06	[illegible]
99	MD	.4	20MM	0				7		2/21/06	[illegible]
100	S		≥12" LIP	0				≥12"		2/21/06	[illegible]
101	MD	.6	20MM X 2	0				3		2/21/06	[illegible]
102			≥12" LIP	0				≥12"		2/21/06	[illegible]
103			≥12" LIP	0				≥12"		2/21/06	[illegible]

Geophysical Dig Sheet and Target History

GRID 4A Unique Target ID	DIG RESULTS										
	Anomaly Type ***	Approx. Weight (lbs-oz/kg-g)	Comments (e.g., response below 1 foot)	Offset Distance (ft)	Offset Direction (N, NE, etc.)	Orientation of Nose (Azimuth deg)	Inclination of Nose (deg)	Depth to Top of Item (in/cm)	Digital Photo Number	Date	Team Leader

Geophysical Dig Sheet and Target History

GRID 4A Unique Target ID	POST-DIG UXO QC RESULTS			POST-DIG PROJECT QC		
	Excavation Hole Cleared?	UXO QC Spec. Initials	Date	Agreement Between Dig Results & Geophysical Data? (G=good, P=poor, U=unacceptable)	Project QC Initials	Date
1	NO	EMD	2/21/06	G	VAS	2-21-06
2						
3						
4						
5						
6						
7						
8						
9						
10	NO > 12"	EMD	2/21/06	G	VAS	2-21-06
11						
12						
13						
14						
15						

Geophysical Dig Sheet and Target History

GRID 4A Unique Target ID	POST-DIG UXO QC RESULTS			POST-DIG PROJECT QC		
	Excavation Hole Cleared?	UXO QC Spec. Initials	Date	Agreement Between Dig Results & Geophysical Data? (G=good, P=poor, U=unacceptable)	Project QC Initials	Date
16						
17						
18						
19						
20	Yes	[illegible]	2/21/06	G	VAS	2-21-06
21						
22						
23						
24						
25						
26						
27						
28						
29						
30	NO	[illegible]	2/21/06	G	VAS	2-21-06

Geophysical Dig Sheet and Target History

GRID 4A Unique Target ID	POST-DIG UXO QC RESULTS Excavation Hole Cleared?	UXO QC Spec. Initials	Date	POST-DIG PROJECT QC Agreement Between Dig Results & Geophysical Data? (G=good, P=poor, U=unacceptable)	Project QC Initials	Date
31						
32						
33						
34						
35						
36						
37						
38						
39						
40	Yes	EMD	2/21/06	G	VAS	2-21-06
41						
42						
43						
44						
45						

Geophysical Dig Sheet and Target History

GRID 4A Unique Target ID	POST-DIG UXO QC RESULTS			POST-DIG PROJECT QC		
	Excavation Hole Cleared?	UXO QC Spec. Initials	Date	Agreement Between Dig Results & Geophysical Data? (G=good, P=poor, U=unacceptable)	Project QC Initials	Date
46						
47						
48						
49						
50	Yes	[illegible]	2/21/06	G	VAS	2-21-06
51						
52						
53						
54						
55						
56						
57						
58						
59						
60	Yes	[illegible]	2/21/06	G	VAS	2-21-06

Geophysical Dig Sheet and Target History

GRID 4A Unique Target ID	POST-DIG UXO QC RESULTS			POST-DIG PROJECT QC		
	Excavation Hole Cleared?	UXO QC Spec. Initials	Date	Agreement Between Dig Results & Geophysical Data? (G=good, P=poor, U=unacceptable)	Project QC Initials	Date
61						
62						
63						
64						
65						
66						
67						
68						
69						
70	yes	EMD	2/21/06	G	VAS	2-21-06
71						
72						
73						
74						
75						

Geophysical Dig Sheet and Target History

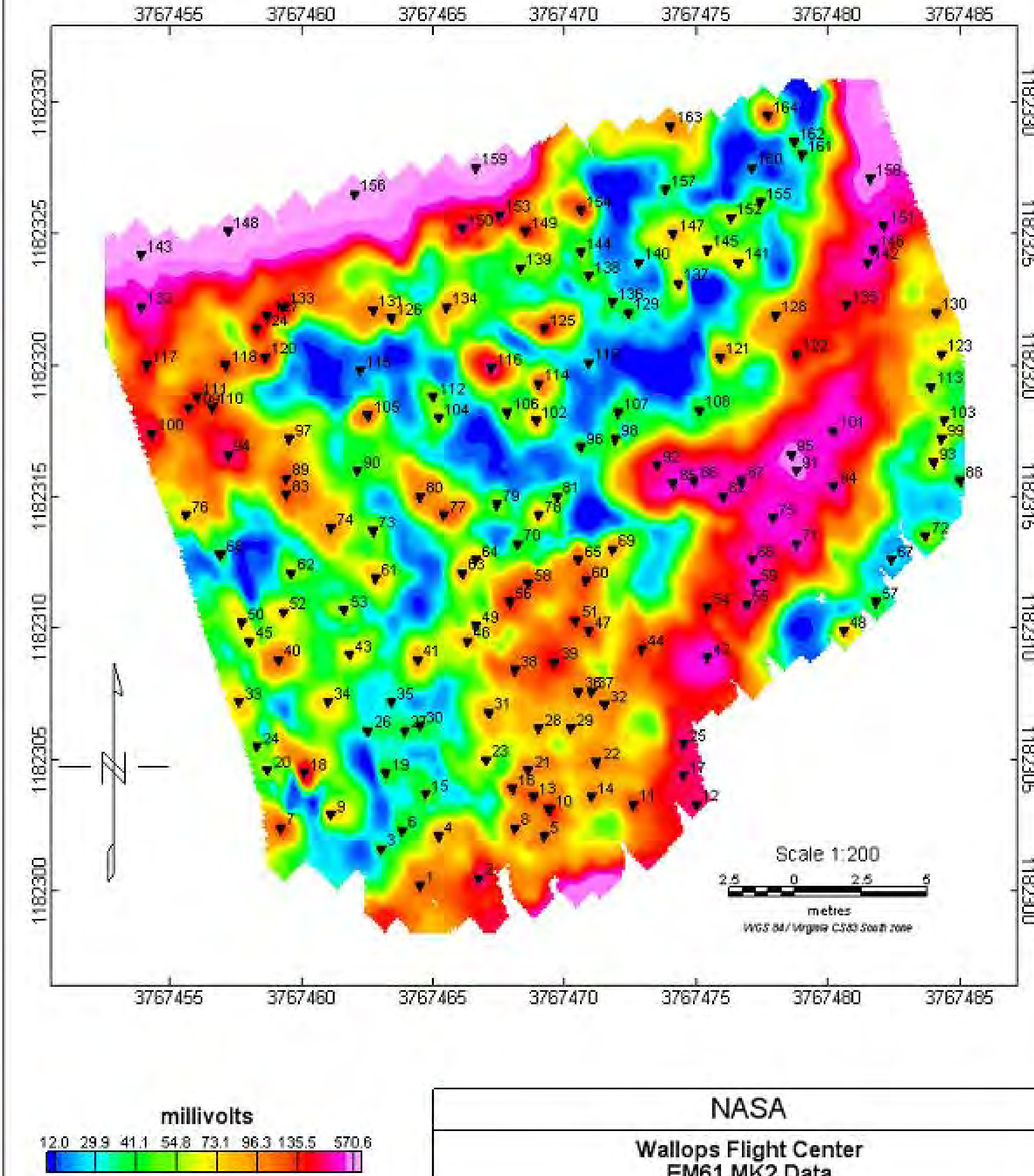
GRID 4A Unique Target ID	POST-DIG UXO QC RESULTS			POST-DIG PROJECT QC		
	Excavation Hole Cleared?	UXO QC Spec. Initials	Date	Agreement Between Dig Results & Geophysical Data? (G=good, P=poor, U=unacceptable)	Project QC Initials	Date
76						
77						
78						
79						
80	Yes	EGD	2/21/06	G	VAS	2-21-06
81						
82						
83						
84						
85						
86						
87						
88						
89						
90	Yes	EGD	2/21/06	G	VAS	2-21-06

Geophysical Dig Sheet and Target History

GRID 4A Unique Target ID	POST-DIG UXO QC RESULTS			POST-DIG PROJECT QC		
	Excavation Hole Cleared?	UXO QC Spec. Initials	Date	Agreement Between Dig Results & Geophysical Data? (G=good, P=poor, U=unacceptable)	Project QC Initials	Date
91						
92						
93						
94						
95						
96						
97						
98						
99						
100	Yes	EMD	2/21/06	G	VAS	2-21-06
101						
102						
103						

Geophysical Dig Sheet and Target History

GRID 4A	POST-DIG UXO QC RESULTS			POST-DIG PROJECT QC		
Unique Target ID	Excavation Hole Cleared?	UXO QC Spec. Initials	Date	Agreement Between Dig Results & Geophysical Data? (G=good, P=poor, U=unacceptable)	Project QC Initials	Date



NASA

Wallops Flight Center
EM61 MK2 Data
Grid 4B

February 9, 2006

Tetra Tech EM Inc.

Geophysical Dig Sheet and Target History

GRID 4B Unique Target ID	ORIGINAL SURVEY									
	Easting Coord. (m)	Northing Coord. (m)	Lat. Coord.	Long. Coord.	X - Local (Grid) Coord. (ft)	Y - Local (Grid) Coord. (ft)	Channel ID (i.e. C1, top senor, gradient)	Response Amplitude (mV)	Dig Priority	Date
1	3767464.5	1182300.2	37.56.13.73	-75.27.24.79	21.01	✓19.24	Z(1-4)	114.2		2/9/2006
2	3767466.7	1182300.5	37.56.13.73	-75.27.24.70	28.14	✓18.53	Z(1-4)	202		2/9/2006
3	3767463	1182301.6	37.56.13.77	-75.27.24.85	17.36	✓24.76	Z(1-4)	42.1		2/9/2006
4	3767465.2	1182302.1	37.56.13.79	-75.27.24.76	24.64	✓24.68	Z(1-4)	89.6		2/9/2006
5	3767469.2	1182302.1	37.56.13.78	-75.27.24.59	37.19	✓21.67	Z(1-4)	113.2		2/9/2006
6	3767463.8	1182302.3	37.56.13.79	-75.27.24.81	20.4	✓26.36	Z(1-4)	46.7		2/9/2006
7	3767459.2	1182302.4	37.56.13.80	-75.27.25.00	6.04	✓30.13	Z(1-4)	144.6		2/9/2006
8	3767468.1	1182302.4	37.56.13.79	-75.27.24.64	33.96	✓23.44	Z(1-4)	107.7		2/9/2006
9	3767461.1	1182302.9	37.56.13.82	-75.27.24.92	12.38	✓30.27	Z(1-4)	85.5		2/9/2006
10	3767469.4	1182303.1	37.56.13.81	-75.27.24.58	38.57	✓24.65	Z(1-4)	148.7		2/9/2006
11	3767472.6	1182303.3	37.56.13.82	-75.27.24.45	48.76	✓22.87	Z(1-4)	137.3		2/9/2006
12	3767475	1182303.3	37.56.13.81	-75.27.24.35	56.29	✓21.07	Z(1-4)	195.4		2/9/2006
13	3767468.8	1182303.6	37.56.13.83	-75.27.24.61	37.06	✓26.67	Z(1-4)	143.2		2/9/2006
14	3767471	1182303.6	37.56.13.83	-75.27.24.52	43.97	✓25.02	Z(1-4)	104.2		2/9/2006
15	3767464.7	1182303.7	37.56.13.84	-75.27.24.77	24.27	✓30.07	Z(1-4)	51.4		2/9/2006

Geophysical Dig Sheet and Target History

GRID 4B Unique Target ID	ORIGINAL SURVEY									
	Easting Coord. (m)	Northing Coord. (m)	Lat. Coord.	Long. Coord.	X - Local (Grid) Coord. (ft)	Y - Local (Grid) Coord. (ft)	Channel ID (i.e. C1, top senor, gradient)	Response Amplitude (mV)	Dig Priority	Date
16	3767468	1182303.9	37.56.13.84	-75.27.24.64	34.78	28.22	Z(1-4)	116		2/9/2006
17	3767474.5	1182304.4	37.56.13.85	-75.27.24.37	55.55	24.9	Z(1-4)	204.3		2/9/2006
18	3767460.1	1182304.5	37.56.13.87	-75.27.24.96	10.44	36.04	Z(1-4)	213.4		2/9/2006
19	3767463.2	1182304.5	37.56.13.87	-75.27.24.83	20.17	33.71	Z(1-4)	46.1		2/9/2006
20	3767458.7	1182304.6	37.56.13.87	-75.27.25.02	6.13	37.41	Z(1-4)	66.1		2/9/2006
21	3767468.6	1182304.6	37.56.13.86	-75.27.24.61	37.19	29.96	Z(1-4)	113.3		2/9/2006
22	3767471.2	1182304.9	37.56.13.87	-75.27.24.51	45.57	28.95	Z(1-4)	108.3		2/9/2006
23	3767467	1182305	37.56.13.88	-75.27.24.68	32.47	32.42	Z(1-4)	81.8		2/9/2006
24	3767458.3	1182305.5	37.56.13.90	-75.27.25.03	5.55	40.54	Z(1-4)	55.1		2/9/2006
25	3767474.5	1182305.6	37.56.13.89	-75.27.24.37	56.45	28.66	Z(1-4)	201.6		2/9/2006
26	3767462.5	1182306.1	37.56.13.92	-75.27.24.86	19.18	39.26	Z(1-4)	39.1		2/9/2006
27	3767463.9	1182306.1	37.56.13.92	-75.27.24.80	23.57	38.21	Z(1-4)	40.8		2/9/2006
28	3767469	1182306.2	37.56.13.91	-75.27.24.59	39.65	34.68	Z(1-4)	90.6		2/9/2006
29	3767470.2	1182306.2	37.56.13.91	-75.27.24.55	43.41	33.78	Z(1-4)	92.2		2/9/2006
30	3767464.5	1182306.3	37.56.13.92	-75.27.24.78	25.6	38.38	Z(1-4)	40.7		2/9/2006

Geophysical Dig Sheet and Target History

GRID 4B Unique Target ID	ORIGINAL SURVEY									
	Easting Coord. (m)	Northing Coord. (m)	Lat. Coord.	Long. Coord.	X - Local (Grid) Coord. (ft)	Y - Local (Grid) Coord. (ft)	Channel ID (i.e. C1, top senor, gradient)	Response Amplitude (mV)	Dig Priority	Date
31	3767467.1	1182306.8	37.56.13.94	-75.27.24.67	34.14	✓37.99	Z(1-4)	86.7		2/9/2006
32	3767471.5	1182307.1	37.56.13.94	-75.27.24.49	48.17	✓35.62	Z(1-4)	103		2/9/2006
33	3767457.6	1182307.2	37.56.13.96	-75.27.25.06	4.63	✓46.4	Z(1-4)	78.8		2/9/2006
34	3767461	1182307.2	37.56.13.96	-75.27.24.92	15.3	✓43.84	Z(1-4)	79.8		2/9/2006
35	3767463.4	1182307.2	37.56.13.95	-75.27.24.82	22.83	✓42.03	Z(1-4)	34.8		2/9/2006
36	3767470.5	1182307.6	37.56.13.96	-75.27.24.53	45.41	✓37.95	Z(1-4)	108.2		2/9/2006
37	3767471	1182307.6	37.56.13.96	-75.27.24.51	46.97	✓37.57	Z(1-4)	104.7		2/9/2006
38	3767468.1	1182308.4	37.56.13.99	-75.27.24.63	38.48	✓42.26	Z(1-4)	123.6		2/9/2006
39	3767469.6	1182308.7	37.56.14.00	-75.27.24.57	43.41	✓42.07	Z(1-4)	172.7		2/9/2006
40	3767459.1	1182308.8	37.56.14.01	-75.27.25.00	10.54	✓50.29	Z(1-4)	117.3		2/9/2006
41	3767464.4	1182308.8	37.56.14.00	-75.27.24.78	27.17	✓46.3	Z(1-4)	90.5		2/9/2006
42	3767475.4	1182308.9	37.56.14.00	-75.27.24.33	61.76	✓38.34	Z(1-4)	275.9		2/9/2006
43	3767461.8	1182309	37.56.14.01	-75.27.24.89	19.16	✓48.88	Z(1-4)	69.7		2/9/2006
44	3767472.9	1182309.2	37.56.14.01	-75.27.24.43	54.14	✓41.16	Z(1-4)	137.8		2/9/2006
45	3767458	1182309.5	37.56.14.03	-75.27.25.04	7.62	✓53.31	Z(1-4)	76.5		2/9/2006

Geophysical Dig Sheet and Target History

GRID 4B Unique Target ID	ORIGINAL SURVEY									
	Easting Coord. (m)	Northing Coord. (m)	Lat. Coord.	Long. Coord.	X - Local (Grid) Coord. (ft)	Y - Local (Grid) Coord. (ft)	Channel ID (i.e. C1, top senor, gradient)	Response Amplitude (mV)	Dig Priority	Date
46	3767466.3	1182309.5	37.56.14.02	-75.27.24.70	33.66	✓47.07	Z(1-4)	84.5		2/9/2006
47	3767470.9	1182309.9	37.56.14.03	-75.27.24.51	48.39	✓44.86	Z(1-4)	136.1		2/9/2006
48	3767480.6	1182309.9	37.56.14.02	-75.27.24.11	78.82	✓37.56	Z(1-4)	84.7		2/9/2006
49	3767466.6	1182310.1	37.56.14.04	-75.27.24.69	35.05	✓48.72	Z(1-4)	81.3		2/9/2006
50	3767457.7	1182310.2	37.56.14.06	-75.27.25.05	7.2	✓55.73	Z(1-4)	75		2/9/2006
51	3767470.4	1182310.3	37.56.14.05	-75.27.24.53	47.12	✓46.49	Z(1-4)	138.4		2/9/2006
52	3767459.3	1182310.6	37.56.14.07	-75.27.24.99	12.52	✓55.78	Z(1-4)	80.6		2/9/2006
53	3767461.6	1182310.7	37.56.14.07	-75.27.24.89	19.82	✓54.37	Z(1-4)	62.5		2/9/2006
54	3767475.4	1182310.8	37.56.14.06	-75.27.24.33	63.19	✓44.3	Z(1-4)	164.8		2/9/2006
55	3767476.9	1182310.9	37.56.14.06	-75.27.24.26	67.97	✓43.48	Z(1-4)	208.5		2/9/2006
56	3767467.9	1182311	37.56.14.07	-75.27.24.63	39.81	✓50.57	Z(1-4)	138.5		2/9/2006
57	3767481.8	1182311	37.56.14.06	-75.27.24.06	83.42	✓40.11	Z(1-4)	46.7		2/9/2006
58	3767468.6	1182311.7	37.56.14.09	-75.27.24.60	42.53	✓52.24	Z(1-4)	134.5		2/9/2006
59	3767477.2	1182311.7	37.56.14.08	-75.27.24.25	69.51	✓45.77	Z(1-4)	221.1		2/9/2006
60	3767470.8	1182311.8	37.56.14.09	-75.27.24.51	49.51	✓50.9	Z(1-4)	137.2		2/9/2006

Geophysical Dig Sheet and Target History

GRID 4B Unique Target ID	ORIGINAL SURVEY Easting Coord. (m)	Northing Coord. (m)	Lat. Coord.	Long. Coord.	X - Local (Grid) Coord. (ft)	Y - Local (Grid) Coord. (ft)	Channel ID (i.e. C1, top senor, gradient)	Response Amplitude (mV)	Dig Priority	Date
61	3767462.8	1182311.9	37.56.14.11	-75.27.24.84	24.48	✓57.23	Z(1-4)	85		2/9/2006
62	3767459.6	1182312.1	37.56.14.12	-75.27.24.97	14.59	✓60.27	Z(1-4)	65.1		2/9/2006
63	3767466.1	1182312.1	37.56.14.11	-75.27.24.71	34.99	✓55.37	Z(1-4)	91.3		2/9/2006
64	3767466.6	1182312.6	37.56.14.12	-75.27.24.68	36.93	✓56.57	Z(1-4)	75.9		2/9/2006
65	3767470.5	1182312.6	37.56.14.12	-75.27.24.52	49.17	✓53.63	Z(1-4)	119		2/9/2006
66	3767477.1	1182312.6	37.56.14.11	-75.27.24.25	69.88	✓48.67	Z(1-4)	218.2		2/9/2006
67	3767482.4	1182312.6	37.56.14.11	-75.27.24.04	86.5	✓44.68	Z(1-4)	31.1		2/9/2006
68	3767456.9	1182312.8	37.56.14.14	-75.27.25.08	6.65	✓64.49	Z(1-4)	45.1		2/9/2006
69	3767471.8	1182313	37.56.14.13	-75.27.24.47	53.55	✓53.91	Z(1-4)	99.8		2/9/2006
70	3767468.2	1182313.2	37.56.14.14	-75.27.24.62	42.4	✓57.25	Z(1-4)	46.7		2/9/2006
71	3767478.8	1182313.2	37.56.14.13	-75.27.24.18	75.66	✓49.27	Z(1-4)	244.1		2/9/2006
72	3767483.7	1182313.5	37.56.14.14	-75.27.23.98	91.26	✓46.52	Z(1-4)	60.7		2/9/2006
73	3767462.7	1182313.7	37.56.14.16	-75.27.24.84	25.52	✓62.95	Z(1-4)	60		2/9/2006
74	3767461.1	1182313.8	37.56.14.17	-75.27.24.91	20.58	✓64.47	Z(1-4)	95.4		2/9/2006
75	3767477.9	1182314.2	37.56.14.16	-75.27.24.22	73.59	✓53.08	Z(1-4)	274.5		2/9/2006

Geophysical Dig Sheet and Target History

GRID 4B Unique Target ID	ORIGINAL SURVEY									
	Easting Coord. (m)	Northing Coord. (m)	Lat. Coord.	Long. Coord.	X - Local (Grid) Coord. (ft)	Y - Local (Grid) Coord. (ft)	Channel ID (i.e. C1, top senor, gradient)	Response Amplitude (mV)	Dig Priority	Date
76	3767455.6	1182314.3	37.56.14.19	-75.27.25.13	3.7	✓70.18	Z(1-4)	84.4		2/9/2006
77	3767465.4	1182314.3	37.56.14.18	-75.27.24.73	34.45	✓62.8	Z(1-4)	131.3		2/9/2006
78	3767469	1182314.3	37.56.14.18	-75.27.24.58	45.74	✓60.09	Z(1-4)	85.3		2/9/2006
79	3767467.4	1182314.7	37.56.14.19	-75.27.24.65	41.02	✓62.55	Z(1-4)	53.3		2/9/2006
80	3767464.5	1182315	37.56.14.20	-75.27.24.77	32.15	✓65.68	Z(1-4)	110		2/9/2006
81	3767469.7	1182315	37.56.14.20	-75.27.24.55	48.46	✓61.76	Z(1-4)	56.8		2/9/2006
82	3767476	1182315	37.56.14.19	-75.27.24.30	68.23	✓57.02	Z(1-4)	227.9		2/9/2006
83	3767459.4	1182315.1	37.56.14.21	-75.27.24.98	16.22	✓69.83	Z(1-4)	124.6		2/9/2006
84	3767480.2	1182315.4	37.56.14.20	-75.27.24.12	81.71	✓55.12	Z(1-4)	233.2		2/9/2006
85	3767474.1	1182315.5	37.56.14.21	-75.27.24.37	62.65	✓60.02	Z(1-4)	280.5		2/9/2006
86	3767474.9	1182315.6	37.56.14.21	-75.27.24.34	65.23	✓59.73	Z(1-4)	273.5		2/9/2006
87	3767476.7	1182315.6	37.56.14.21	-75.27.24.27	70.88	✓58.38	Z(1-4)	230.4		2/9/2006
88	3767485	1182315.6	37.56.14.20	-75.27.23.93	96.92	✓52.13	Z(1-4)	47.7		2/9/2006
89	3767459.4	1182315.7	37.56.14.23	-75.27.24.97	16.68	✓71.71	Z(1-4)	129		2/9/2006
90	3767462.1	1182316	37.56.14.24	-75.27.24.86	25.37	✓70.62	Z(1-4)	46.7		2/9/2006

Geophysical Dig Sheet and Target History

GRID 4B Unique Target ID	ORIGINAL SURVEY									
	Easting Coord. (m)	Northing Coord. (m)	Lat. Coord.	Long. Coord.	X - Local (Grid) Coord. (ft)	Y - Local (Grid) Coord. (ft)	Channel ID (i.e. C1, top senor, gradient)	Response Amplitude (mV)	Dig Priority	Date
91	3767478.8	1182316	37.56.14.22	-75.27.24.18	77.77	✓58.05	Z(1-4)	342.8		2/9/2006
92	3767473.5	1182316.2	37.56.14.23	-75.27.24.40	61.29	✓62.67	Z(1-4)	211.9		2/9/2006
93	3767484	1182316.3	37.56.14.23	-75.27.23.97	94.31	✓55.08	Z(1-4)	70.9		2/9/2006
94	3767457.2	1182316.6	37.56.14.26	-75.27.25.06	10.45	✓76.19	Z(1-4)	200.5		2/9/2006
95	3767478.6	1182316.6	37.56.14.24	-75.27.24.19	77.59	✓60.09	Z(1-4)	331.1		2/9/2006
96	3767470.6	1182316.9	37.56.14.26	-75.27.24.51	52.72	✓67.05	Z(1-4)	46.1		2/9/2006
97	3767459.5	1182317.2	37.56.14.28	-75.27.24.97	18.12	✓76.34	Z(1-4)	95		2/9/2006
98	3767471.9	1182317.2	37.56.14.27	-75.27.24.46	57.02	✓67.01	Z(1-4)	55.3		2/9/2006
99	3767484.3	1182317.2	37.56.14.26	-75.27.23.95	95.93	✓57.68	Z(1-4)	64.9		2/9/2006
100	3767454.3	1182317.4	37.56.14.29	-75.27.25.18	1.95	✓80.88	Z(1-4)	184.3		2/9/2006
101	3767480.2	1182317.5	37.56.14.27	-75.27.24.12	83.29	✓61.71	Z(1-4)	270.6		2/9/2006
102	3767468.9	1182317.9	37.56.14.29	-75.27.24.58	48.14	✓71.46	Z(1-4)	87.7		2/9/2006
103	3767484.4	1182317.9	37.56.14.28	-75.27.23.95	96.77	✓59.8	Z(1-4)	64.1		2/9/2006
104	3767465.2	1182318	37.56.14.30	-75.27.24.73	36.6	✓74.56	Z(1-4)	62.4		2/9/2006
105	3767462.5	1182318.1	37.56.14.31	-75.27.24.84	28.21	✓76.91	Z(1-4)	117.1		2/9/2006

Geophysical Dig Sheet and Target History

GRID 4B Unique Target ID	ORIGINAL SURVEY									
	Easting Coord. (m)	Northing Coord. (m)	Lat. Coord.	Long. Coord.	X - Local (Grid) Coord. (ft)	Y - Local (Grid) Coord. (ft)	Channel ID (i.e. C1, top senor, gradient)	Response Amplitude (mV)	Dig Priority	Date
106	3767467.8	1182318.2	37.56.14.31	-75.27.24.63	44.91	✓73.23	Z(1-4)	59.1		2/9/2006
107	3767472	1182318.2	37.56.14.30	-75.27.24.46	58.09	✓70.07	Z(1-4)	46.9		2/9/2006
108	3767475.1	1182318.3	37.56.14.30	-75.27.24.33	67.89	✓68.05	Z(1-4)	42.2		2/9/2006
109	3767455.7	1182318.4	37.56.14.32	-75.27.25.12	7.1	✓82.97	Z(1-4)	150.4		2/9/2006
110	3767456.6	1182318.4	37.56.14.32	-75.27.25.09	9.92	✓82.29	Z(1-4)	138.6		2/9/2006
111	3767456	1182318.8	37.56.14.34	-75.27.25.11	8.34	✓83.99	Z(1-4)	148.2		2/9/2006
112	3767465	1182318.8	37.56.14.33	-75.27.24.74	36.58	✓77.22	Z(1-4)	62		2/9/2006
113	3767483.9	1182319.2	37.56.14.32	-75.27.23.97	96.18	✓64.26	Z(1-4)	59.6		2/9/2006
114	3767469	1182319.3	37.56.14.34	-75.27.24.58	49.5	✓75.78	Z(1-4)	116.7		2/9/2006
115	3767462.2	1182319.8	37.56.14.36	-75.27.24.85	28.55	✓82.47	Z(1-4)	23		2/9/2006
116	3767467.2	1182319.9	37.56.14.36	-75.27.24.65	44.31	✓79.02	Z(1-4)	227.3		2/9/2006
117	3767454.1	1182320	37.56.14.38	-75.27.25.19	3.28	✓89.19	Z(1-4)	180.5		2/9/2006
118	3767457.1	1182320	37.56.14.37	-75.27.25.06	12.7	✓86.93	Z(1-4)	142.6		2/9/2006
119	3767470.9	1182320.1	37.56.14.36	-75.27.24.50	56.07	✓76.86	Z(1-4)	27.7		2/9/2006
120	3767458.6	1182320.3	37.56.14.38	-75.27.25.00	17.63	✓86.74	Z(1-4)	148.3		2/9/2006

Geophysical Dig Sheet and Target History

GRID 4B Unique Target ID	ORIGINAL SURVEY									
	Easting Coord. (m)	Northing Coord. (m)	Lat. Coord.	Long. Coord.	X - Local (Grid) Coord. (ft)	Y - Local (Grid) Coord. (ft)	Channel ID (i.e. C1, top senor, gradient)	Response Amplitude (mV)	Dig Priority	Date
121	3767475.9	1182320.3	37.56.14.36	-75.27.24.29	71.9	✓73.73	Z(1-4)	101.6		2/9/2006
122	3767478.8	1182320.4	37.56.14.36	-75.27.24.17	81.08	✓71.86	Z(1-4)	160.5		2/9/2006
123	3767484.3	1182320.4	37.56.14.36	-75.27.23.95	98.33	✓67.72	Z(1-4)	77.7		2/9/2006
124	3767458.3	1182321.4	37.56.14.42	-75.27.25.01	17.51	✓90.42	Z(1-4)	171		2/9/2006
125	3767469.2	1182321.4	37.56.14.41	-75.27.24.57	51.71	✓82.22	Z(1-4)	161.3		2/9/2006
126	3767463.4	1182321.8	37.56.14.43	-75.27.24.80	33.82	✓87.84	Z(1-4)	94		2/9/2006
127	3767458.7	1182321.9	37.56.14.43	-75.27.25.00	19.14	✓91.69	Z(1-4)	179.1		2/9/2006
128	3767478	1182321.9	37.56.14.41	-75.27.24.21	79.7	✓77.17	Z(1-4)	101.3		2/9/2006
129	3767472.4	1182322	37.56.14.42	-75.27.24.43	62.2	✓81.69	Z(1-4)	41.3		2/9/2006
130	3767484.1	1182322	37.56.14.41	-75.27.23.96	98.91	✓72.89	Z(1-4)	104.3		2/9/2006
131	3767462.7	1182322.1	37.56.14.44	-75.27.24.83	31.85	✓89.31	Z(1-4)	105.7		2/9/2006
132	3767453.9	1182322.2	37.56.14.45	-75.27.25.19	4.31	✓96.24	Z(1-4)	265		2/9/2006
133	3767459.3	1182322.2	37.56.14.44	-75.27.24.97	21.25	✓92.18	Z(1-4)	175.3		2/9/2006
134	3767465.5	1182322.2	37.56.14.44	-75.27.24.72	40.71	✓87.51	Z(1-4)	96.5		2/9/2006
135	3767480.7	1182322.3	37.56.14.42	-75.27.24.09	88.47	✓76.39	Z(1-4)	175.2		2/9/2006

Geophysical Dig Sheet and Target History

GRID 4B Unique Target ID	ORIGINAL SURVEY									
	Easting Coord. (m)	Northing Coord. (m)	Lat. Coord.	Long. Coord.	X - Local (Grid) Coord. (ft)	Y - Local (Grid) Coord. (ft)	Channel ID (i.e. C1, top senor, gradient)	Response Amplitude (mV)	Dig Priority	Date
136	3767471.8	1182322.4	37.56.14.44	-75.27.24.46	60.62	✓ 83.4	Z(1-4)	43.4		2/9/2006
137	3767474.3	1182323.1	37.56.14.46	-75.27.24.36	68.99	✓ 83.72	Z(1-4)	82		2/9/2006
138	3767470.9	1182323.4	37.56.14.47	-75.27.24.49	58.55	✓ 87.22	Z(1-4)	50		2/9/2006
139	3767468.3	1182323.7	37.56.14.48	-75.27.24.60	50.62	✓ 90.11	Z(1-4)	57.3		2/9/2006
140	3767472.8	1182323.9	37.56.14.48	-75.27.24.42	64.89	✓ 87.35	Z(1-4)	32.2		2/9/2006
141	3767476.6	1182323.9	37.56.14.48	-75.27.24.26	76.81	✓ 84.49	Z(1-4)	72.8		2/9/2006
142	3767481.5	1182323.9	37.56.14.48	-75.27.24.06	92.18	✓ 80.81	Z(1-4)	258		2/9/2006
143	3767453.9	1182324.2	37.56.14.51	-75.27.25.19	5.82	✓ 102.52	Z(1-4)	787.1		2/9/2006
144	3767470.6	1182324.3	37.56.14.50	-75.27.24.51	58.29	✓ 90.26	Z(1-4)	55.9		2/9/2006
145	3767475.4	1182324.4	37.56.14.50	-75.27.24.31	73.42	✓ 86.97	Z(1-4)	78.9		2/9/2006
146	3767481.7	1182324.4	37.56.14.49	-75.27.24.05	93.19	✓ 82.23	Z(1-4)	259.9		2/9/2006
147	3767474.1	1182325	37.56.14.52	-75.27.24.36	69.79	✓ 89.83	Z(1-4)	86.7		2/9/2006
148	3767457.2	1182325.1	37.56.14.54	-75.27.25.05	16.85	✓ 102.86	Z(1-4)	1517		2/9/2006
149	3767468.5	1182325.1	37.56.14.53	-75.27.24.59	52.3	✓ 94.35	Z(1-4)	157.4		2/9/2006
150	3767466.1	1182325.2	37.56.14.53	-75.27.24.69	44.84	✓ 96.47	Z(1-4)	209.3		2/9/2006

Geophysical Dig Sheet and Target History

GRID 4B Unique Target ID	ORIGINAL SURVEY									
	Easting Coord. (m)	Northing Coord. (m)	Lat. Coord.	Long. Coord.	X - Local (Grid) Coord. (ft)	Y - Local (Grid) Coord. (ft)	Channel ID (i.e. C1, top senor, gradient)	Response Amplitude (mV)	Dig Priority	Date
151	3767482.1	1182325.3	37.56.14.52	-75.27.24.03	95.12	84.75	Z(1-4)	282.6		2/9/2006
152	3767476.3	1182325.6	37.56.14.54	-75.27.24.27	77.15	90.05	Z(1-4)	66.7		2/9/2006
153	3767467.5	1182325.7	37.56.14.55	-75.27.24.63	49.61	96.99	Z(1-4)	213.7		2/9/2006
154	3767470.6	1182325.9	37.56.14.55	-75.27.24.50	59.49	95.28	Z(1-4)	140.1		2/9/2006
155	3767477.4	1182326.2	37.56.14.55	-75.27.24.22	81.05	91.11	Z(1-4)	55		2/9/2006
156	3767462	1182326.5	37.56.14.58	-75.27.24.85	32.96	103.64	Z(1-4)	1275		2/9/2006
157	3767473.8	1182326.7	37.56.14.57	-75.27.24.37	70.13	95.39	Z(1-4)	38.7		2/9/2006
158	3767481.6	1182327.1	37.56.14.58	-75.27.24.05	94.9	90.77	Z(1-4)	337.7		2/9/2006
159	3767466.6	1182327.5	37.56.14.61	-75.27.24.66	48.14	103.31	Z(1-4)	870.3		2/9/2006
160	3767477.1	1182327.5	37.56.14.60	-75.27.24.23	81.09	95.41	Z(1-4)	25.1		2/9/2006
161	3767479	1182328	37.56.14.61	-75.27.24.16	87.42	95.55	Z(1-4)	40.8		2/9/2006
162	3767478.7	1182328.5	37.56.14.63	-75.27.24.17	86.86	97.35	Z(1-4)	48.1		2/9/2006
163	3767474	1182329.1	37.56.14.65	-75.27.24.36	72.56	102.77	Z(1-4)	101.9		2/9/2006
164	3767477.7	1182329.5	37.56.14.66	-75.27.24.21	84.47	101.24	Z(1-4)	133.7		2/9/2006

Geophysical Dig Sheet and Target History

GRID 4B Unique Target ID	ORIGINAL SURVEY									
	Easting Coord. (m)	Northing Coord. (m)	Lat. Coord.	Long. Coord.	X - Local (Grid) Coord. (ft)	Y - Local (Grid) Coord. (ft)	Channel ID (i.e. C1, top senor, gradient)	Response Amplitude (mV)	Dig Priority	Date

Note: *Fill in Acceptable Units (mV, nT/m, ppt, etc).

**Optional field – refer to SOW for applicability to specific project.

***For Anomaly type, U = UXO, F = frag, MD = munitions debris, S = scrap, A = small arms ammunition, NC = no contact, O = other.

Geophysical Dig Sheet and Target History

GRID 4B	REACQUISITION SURVEY				
Unique Target ID	Geophysical Instrument **	GPS Instrument**	Date	Comment	Response Amplitude (units*)**
1	Schondstedt	NA	2-18-06	used x/y coordinates to locate targets	NA
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					
14					
15					

Geophysical Dig Sheet and Target History

	REACQUISITION SURVEY				
GRID 4B Unique Target ID	Geophysical Instrument **	GPS Instrument**	Date	Comment	Response Amplitude (units*)**
16	Schondstedt	NA	2-18-06	used x/y coordinates to locate targets	NA
17					
18					
19					
20					
21					
22					
23					
24					
25					
26					
27					
28					
29					
30					

Geophysical Dig Sheet and Target History

GRID 4B	REACQUISITION SURVEY				
Unique Target ID	Geophysical Instrument **	GPS Instrument**	Date	Comment	Response Amplitude (units*)**
31	Schondstedt	NA	2-18-06	used x/y coordinates to locate targets	NA
32					
33					
34					
35					
36					
37					
38					
39					
40					
41					
42					
43					
44					
45					

Geophysical Dig Sheet and Target History

GRID 4B Unique Target ID	REACQUISITION SURVEY				
	Geophysical Instrument **	GPS Instrument**	Date	Comment	Response Amplitude (units*)**
46	Schondstedt	NA	2-18-06	used x/y coordinates to locate targets	NA
47					
48					
49					
50					
51					
52					
53					
54					
55					
56					
57					
58					
59					
60					

Geophysical Dig Sheet and Target History

GRID 4B Unique Target ID	REACQUISITION SURVEY				
	Geophysical Instrument **	GPS Instrument**	Date	Comment	Response Amplitude (units*)**
61	Schondstedt	NA	2-18-06	used x/y coordinates to locate targets	NA
62					
63					
64					
65					
66					
67					
68					
69					
70					
71					
72					
73					
74					
75					

Geophysical Dig Sheet and Target History

GRID 4B Unique Target ID	REACQUISITION SURVEY Geophysical Instrument **	GPS Instrument**	Date	Comment	Response Amplitude (units*)**
76	Schondstedt	NA	2-18-06	used x/y coordinates to locate targets	NA
77					
78					
79					
80					
81					
82					
83					
84					
85					
86					
87					
88					
89					
90					

Geophysical Dig Sheet and Target History

GRID 4B Unique Target ID	REACQUISITION SURVEY				
	Geophysical Instrument **	GPS Instrument**	Date	Comment	Response Amplitude (units*)**
91	Schondstedt	NA	2-18-06	used x/y coordinates to locate targets	NA
92					
93					
94					
95					
96					
97					
98					
99					
100					
101					
102					
103					
104					
105					

Geophysical Dig Sheet and Target History

GRID 4B Unique Target ID	REACQUISITION SURVEY				
	Geophysical Instrument **	GPS Instrument**	Date	Comment	Response Amplitude (units*)**
106	Schondstedt	NA	2-18-06	used x/y coordinates to locate targets	NA
107					
108					
109					
110					
111					
112					
113					
114					
115					
116					
117					
118					
119					
120					

Geophysical Dig Sheet and Target History

GRID 4B Unique Target ID	REACQUISITION SURVEY				
	Geophysical Instrument **	GPS Instrument**	Date	Comment	Response Amplitude (units*)**
121	Schondstedt	NA	2-18-06	used x/y coordinats to locate targets	NA
122					
123					
124					
125					
126					
127					
128					
129					
130					
131					
132					
133					
134					
135					

Geophysical Dig Sheet and Target History

GRID 4B Unique Target ID	REACQUISITION SURVEY				
	Geophysical Instrument **	GPS Instrument**	Date	Comment	Response Amplitude (units*)**
136	Schondstedt	NA	2-18-06	used x/y coordinates to locate targets	NA
137					
138					
139					
140					
141					
142					
143					
144					
145					
146					
147					
148					
149					
150					

Geophysical Dig Sheet and Target History

GRID 4B Unique Target ID	REACQUISITION SURVEY				
	Geophysical Instrument **	GPS Instrument**	Date	Comment	Response Amplitude (units*)**
151	Schondstedt	NA	2-18-06	used x/y coordinates to locate targets	NA
152					
153					
154					
155					
156					
157					
158					
159					
160					
161					
162					
163					
164					

Geophysical Dig Sheet and Target History

GRID 4B Unique Target ID	REACQUISITION SURVEY				
	Geophysical Instrument **	GPS Instrument**	Date	Comment	Response Amplitude (units*)**

Geophysical Dig Sheet and Target History

GRID 4B Unique Target ID	DIG RESULTS										
	Anomaly Type ***	Approx. Weight (lbs-oz/kg-g)	Comments (e.g., response below 1 foot)	Offset Distance (ft)	Offset Direction (N, NE, etc.)	Orientation of Nose (Azimuth deg)	Inclination of Nose (deg)	Depth to Top of Item (in/cm)	Digital Photo Number	Date	Team Leader
1	S	1	SCRAP	0.				4		2/21/06	[illegible]
2	MD	.2	20MM	0				5		2/21/06	[illegible]
3	MD	.3	20MM	0				1		2/21/06	[illegible]
4	MD	.1	20MM	0.5				6		2/21/06	[illegible]
5	MD	.3	20MM	0				3		2/21/06	[illegible]
6	MD	.3	20MM	0				4		2/21/06	[illegible]
7	MD	.6	20MM X2	0				3		2/21/06	[illegible]
8	S	.9	REBAR	0				9		2/21/06	[illegible]
9	MD	.7	30MM CTG CASE	0				5		2/21/06	[illegible]
10	MD	.3	20MM	0				11		2/21/06	[illegible]
11	MD	.4	20MM	0				3		2/21/06	[illegible]
12	MD	.3	20MM	0				8		2/21/06	[illegible]
13	MD	.4	20MM	0				3		2/21/06	[illegible]
14	MD	.8	20MM, 30MM	0				11		2/21/06	[illegible]
15	MD	.2	20MM	1.0				5		2/21/06	[illegible]

Geophysical Dig Sheet and Target History

GRID 4B Unique Target ID	Anomaly Type ***	Approx. Weight (lbs-oz/kg-g)	Comments (e.g., response below 1 foot)	Offset Distance (ft)	Offset Direction (N, NE, etc.)	Orientation of Nose (Azimuth deg)	Inclination of Nose (deg)	Depth to Top of Item (in/cm)	Digital Photo Number	Date	Team Leader
	DIG RESULTS										
16	MD	.2	20MM	0				12		2/21/05	[illegible]
17	S	.1	NAIL	0.5				3		2/21/05	[illegible]
18	MD	.3	20 MM	0				4		2/21/05	[illegible]
19	MD	.4	20 MM	0				7		2/21/05	[illegible]
20	S	1.2	REBAR	0				4		2/21/05	[illegible]
21	MD	.2	20MM	0				6		2/21/05	[illegible]
22	MD	.3	20MM	0				7		2/21/05	[illegible]
23	MD	.4	20MM	0				5		2/21/05	[illegible]
24	MD	.3	20MM	0				3		2/21/05	[illegible]
25	MD	.4	20MM	0				7		2/21/05	[illegible]
26			<12" LIP	0				<12"		2/21/05	[illegible]
27	S	.1	NAIL	1.0				2		2/21/05	[illegible]
28	MD	.3	20MM	0				1		2/21/05	[illegible]
29	MD	.5	20 MM	0				2		2/21/05	[illegible]
30	MD	.3	20MM	0				4		2/21/05	[illegible]

Geophysical Dig Sheet and Target History

GRID 4B Unique Target ID	DIG RESULTS Anomaly Type ***	Approx. Weight (lbs-oz/kg-g)	Comments (e.g., response below 1 foot)	Offset Distance (ft)	Offset Direction (N, NE, etc.)	Orientation of Nose (Azimuth deg)	Inclination of Nose (deg)	Depth to Top of Item (in/cm)	Digital Photo Number	Date	Team Leader
31			<12" LIP	0				<12"		2/21/05	[illegible]
32	MD	.5	20MM	0				4		2/21/05	[illegible]
33	MD	.4	20 MM	0				1		2/21/05	[illegible]
34	MD	.3	20MM	0				5		2/21/05	[illegible]
35			<12" LIP	0				<12"		2/21/05	[illegible]
36	MD	.3	20MM	0				8		2/21/05	[illegible]
37	MD	.2	20 MM	1.0				2		2/21/05	[illegible]
38	MD	.8	20MM x 2	0				9		2/21/05	[illegible]
39	MD	.3	20MM	0				8		2/21/05	[illegible]
40			<12" LIP	0				<12"		2/21/05	[illegible]
41	MD	.3	20MM	0				8		2/21/05	[illegible]
42	MD	1.2	20MM x 3	0				5		2/21/05	[illegible]
43			<12" LIP					<12"		2/21/05	[illegible]
44	MD	1.6	20MM x 4	0				8		2/21/05	[illegible]
45			<12" LIP	0				<12"		2/21/05	[illegible]

Geophysical Dig Sheet and Target History

GRID 4B Unique Target ID	Anomaly Type ***	Approx. Weight (lbs-oz/kg-g)	Comments (e.g., response below 1 foot)	Offset Distance (ft)	Offset Direction (N, NE, etc.)	Orientation of Nose (Azimuth deg)	Inclination of Nose (deg)	Depth to Top of Item (in/cm)	Digital Photo Number	Date	Team Leader
	DIG RESULTS										
46	MD	.3	20MM	0				7		2/21/05	[illegible]
47	MD	.4	20MM	0				5		2/21/05	[illegible]
48	MD	.5	20MM	0				12		2/21/05	[illegible]
49	MD	.3	20MM	0				5		2/21/05	[illegible]
50	MD	.6	20MM X2	0				3		2/21/05	[illegible]
51	S	.5	RE BAR	0				8		2/21/05	[illegible]
52	MD	.9	20MM X 2	0				2		2/21/05	[illegible]
53	MD	.4	20MM	0				4		2/21/05	[illegible]
54	MD	.4	20 MM	0				2		2/21/05	[illegible]
55	MD	.5	20MM	0				8		2/21/05	[illegible]
56	MD	.3	20MM	0				7		2/21/05	[illegible]
57	MD	.2	20MM	0				9		2/21/05	[illegible]
58	MD	.6	20MM X 2	0				7		2/21/05	[illegible]
59	MD	.4	20MM	0				3		2/21/05	[illegible]
60	S	1	SCRAP	0.5				8		2/21/05	[illegible]

Geophysical Dig Sheet and Target History

GRID 4B Unique Target ID	DIG RESULTS										
	Anomaly Type ***	Approx. Weight (lbs/oz/kg-g)	Comments (e.g., response below 1 foot)	Offset Distance (ft)	Offset Direction (N, NE, etc.)	Orientation of Nose (Azimuth deg)	Inclination of Nose (deg)	Depth to Top of Item (in/cm)	Digital Photo Number	Date	Team Leader
61	MD	.1	20MM	1.0				4		2/21/05	[illegible]
62	MD	.2	20MM	0				8		2/21/05	[illegible]
63	MD	.1	20MM	0				2		2/21/05	[illegible]
64	MD	.1	20MM	1.0				11		2/21/05	[illegible]
65	MD	.4	20 MM	0				6		2/21/05	[illegible]
66	MD	.8	20MM X 2	0				3		2/21/05	[illegible]
67	MD	.5	20MM	0				8		2/21/05	[illegible]
68	MD	.7	20MM X2	0				5		2/21/05	[illegible]
69	MD	.8	20MM X 2	0				3		2/21/05	[illegible]
70	MD	.3	20MM	0				12		2/21/05	[illegible]
71	MD	.3	20MM	1.0				5		2/21/05	[illegible]
72	MD	.8	20MM X 2	0				7		2/21/05	[illegible]
73	MD	.2	20MM	1.0				2		2/21/05	[illegible]
74	MD	.4	20MM	0				8		2/21/05	[illegible]
75	MD	.3	20MM	0				4		2/21/05	[illegible]

Geophysical Dig Sheet and Target History

GRID 4B Unique Target ID	DIG RESULTS										
	Anomaly Type ***	Approx. Weight (lbs/ oz/kg-g)	Comments (e.g., response below 1 foot)	Offset Distance (ft)	Offset Direction (N, NE, etc.)	Orientation of Nose (Azimuth deg)	Inclination of Nose (deg)	Depth to Top of Item (in/cm)	Digital Photo Number	Date	Team Leader
76	MD	.9	20MM X 2	0				2		2/21/05	[illegible]
77	S	.8	SAME AS 80 REBAR	0				11		2/21/05	[illegible]
78	MD	.1	20MM	0.5				4		2/21/05	[illegible]
79	MD	.3	20MM	0				5		2/21/05	[illegible]
80	S	.8	SAME AS 77 REBAR	0				11		2/21/05	[illegible]
81	MD	.5	20MM	0				2		2/21/05	[illegible]
82	MD	.3	20MM	0				3		2/21/05	[illegible]
83	MD	.3	20MM	0				5		2/21/05	[illegible]
84	MD	.4	20MM	0				4		2/21/05	[illegible]
85	MM	.2	20MM	0.5				8		2/21/05	[illegible]
86	MD	.5	20 MM	0				1		2/21/05	[illegible]
87	MD	.2	20MM	0				3		2/21/05	[illegible]
88	S	3	REBAR	0				2		2/21/05	[illegible]
89	S	1.2	SCRAP	0				4		2/21/05	[illegible]
90	MD	.4	20 MM	0				3		2/21/05	[illegible]

Geophysical Dig Sheet and Target History

GRID 4B Unique Target ID	DIG RESULTS Anomaly Type ***	Approx. Weight (lbs oz/kg-g)	Comments (e.g., response below 1 foot)	Offset Distance (ft)	Offset Direction (N, NE, etc.)	Orientation of Nose (Azimuth deg)	Inclination of Nose (deg)	Depth to Top of Item (in/cm)	Digital Photo Number	Date	Team Leader
91	S	.8	RE BAR	0				3		2/21/05	[illegible]
92	MD	.3	20MM	0				4		2/21/05	[illegible]
93	MD	.2	20MM	0				2		2/21/05	[illegible]
94	MD	.4	20MM	0				1		2/21/05	[illegible]
95	MD	.5	20MM	0				4		2/21/05	[illegible]
96	MD	.3	20MM	0				1		2/21/05	[illegible]
97	MD	.4	20MM	0				8		2/21/05	[illegible]
98	MD	.2	20MM	.05				3		2/21/05	[illegible]
99	MD	.4	20MM	0				2		2/21/05	[illegible]
100	MD	.4	20MM	0				8		2/21/05	[illegible]
101	MD	1.4	20MM X 3	0				11		2/21/05	[illegible]
102	S	1	SCRAP	0				5		2/21/05	[illegible]
103	MD	.3	20 MM	0				3		2/21/05	[illegible]
104	S	.2	WIRE	1.0				5		2/21/05	[illegible]
105	S	1	SCRAP	0				4		2/21/05	[illegible]

Geophysical Dig Sheet and Target History

GRID 4B Unique Target ID	DIG RESULTS										
	Anomaly Type ***	Approx. Weight (lbs/oz/kg-g)	Comments (e.g., response below 1 foot)	Offset Distance (ft)	Offset Direction (N, NE, etc.)	Orientation of Nose (Azimuth deg)	Inclination of Nose (deg)	Depth to Top of Item (in/cm)	Digital Photo Number	Date	Team Leader
106	S	.1	NAIL	0.5				3		2/21/05	[illegible]
107	MD	.3	20MM	0				4		2/21/05	[illegible]
108	MD	.6	20MM X 2	0				7		2/21/05	[illegible]
109	MD	.4	20MM	0				3		2/21/05	[illegible]
110	MD	.4	20MM	0				8		2/21/05	[illegible]
111	MD	.3	20 MM	0				4		2/21/05	[illegible]
112	MD	.8	20MM X 2	0				9		2/21/05	[illegible]
113	MD	.2	20MM	1.0				7		2/21/05	[illegible]
114	MD	.3	20MM	0				2		2/21/05	[illegible]
115	MD	.4	20 MM	0				4		2/21/05	[illegible]
116	S	1.3	SCRAP					8		2/21/05	[illegible]
117			7 12"	0				7 12"		2/21/05	[illegible]
118	MD	.3	20MM	0				5		2/21/05	[illegible]
119	MD	.4	20 MM	0				5		2/21/05	[illegible]
120	MD	.3	20MM	0				7		2/21/05	[illegible]

Geophysical Dig Sheet and Target History

GRID 4B Unique Target ID	DIG RESULTS										
	Anomaly Type ***	Approx. Weight (lbs/ oz/kg-g)	Comments (e.g., response below 1 foot)	Offset Distance (ft)	Offset Direction (N, NE, etc.)	Orientation of Nose (Azimuth deg)	Inclination of Nose (deg)	Depth to Top of Item (in/cm)	Digital Photo Number	Date	Team Leader
121	MD	.4	20MM	0				7		2/21/05	[illegible]
122	MD	.2	20MM	0.5				4		2/21/05	[illegible]
123	MD	.8	20MM x 2	0				7		2/21/05	[illegible]
124	S	1.5	SCRAP	0				3		2/21/05	[illegible]
125	S	1.1	SCRAP	0				7		2/21/05	[illegible]
126	MD	.2	20MM	0				4		2/21/05	[illegible]
127	S	.1	NAIL	0.5				2		2/21/05	[illegible]
128	MD	.4	20MM	0				3		2/21/05	[illegible]
129	S	.8	SCRAP	0				1		2/21/05	[illegible]
130	MD	.6	20MM	0				4		2/21/05	[illegible]
131	MD	.3	20MM	0				8		2/21/05	[illegible]
132			7/12	0				7/12"		2/21/05	[illegible]
133	S	1.5	REBAR	0				8		2/21/05	[illegible]
134	MD	.3	20MM	0.5				4		2/21/05	[illegible]
135	MD	1.2	20MM x 4	0				11		2/21/05	[illegible]

Geophysical Dig Sheet and Target History

GRID 4B Unique Target ID	DIG RESULTS										
	Anomaly Type ***	Approx. Weight (lbs-oz/kg-g)	Comments (e.g., response below 1 foot)	Offset Distance (ft)	Offset Direction (N, NE, etc.)	Orientation of Nose (Azimuth deg)	Inclination of Nose (deg)	Depth to Top of Item (in/cm)	Digital Photo Number	Date	Team Leader
136	S	.1	NAIL	1.0				8		2/21/05	[illegible]
137	MD	.8	20MM X 2	0				4		2/21/05	[illegible]
138			>12" LIP	0				>12"		2/21/05	[illegible]
139	S	.7	SAME AS 149 SCRAP	0				9		2/21/05	[illegible]
140	MD	.3	20MM	0.5				4		2/21/05	[illegible]
141	MD	.3	20MM	0				3		2/21/05	[illegible]
142	MD	.9	20MM X 3	0				8		2/21/05	[illegible]
143			>12" LIP	0				>12"		2/21/05	[illegible]
144	S	.1	NAIL	1.0				3		2/21/05	[illegible]
145	MD	.8	20MM, 30MM	0				4		2/21/05	[illegible]
146	MD	1.2	20MM X 3	0				12		2/21/05	[illegible]
147	MD	.3	20MM	0				2		2/21/05	[illegible]
148			>12" LIP	0				>12"		2/21/05	[illegible]
149	S	.7	SAME AS 139 SCRAP	0				9		2/21/05	[illegible]
150	S	.6	SAME AS 153 REBAR	0				5		2/21/05	[illegible]

Geophysical Dig Sheet and Target History

GRID 4B Unique Target ID	DIG RESULTS										
	Anomaly Type ***	Approx. Weight (lbs-oz/kg-g)	Comments (e.g., response below 1 foot)	Offset Distance (ft)	Offset Direction (N, NE, etc.)	Orientation of Nose (Azimuth deg)	Inclination of Nose (deg)	Depth to Top of Item (in/cm)	Digital Photo Number	Date	Team Leader
151	MD	1.1	20MM x 4	0				11		2/21/05	[illegible]
152	MD	.3	20MM	0				4		2/21/05	[illegible]
153	S	.6	SAME AS 156 REBAR	0				6		2/21/05	[illegible]
154	MD	.3	20 MM	0				2		2/21/05	[illegible]
155	MD	.6	20MM x 2	0				5		2/21/05	[illegible]
156	MD	.4	20MM	0				8		2/21/05	[illegible]
157	MD	.8	20MM x 2	0				3		2/21/05	[illegible]
158	MD	.2	20MM	1.0				9		2/21/05	[illegible]
159	MD	.3	20MM	0				8		2/21/05	[illegible]
160	MD	.4	20MM	0				4		2/21/05	[illegible]
161	MD	.4	20MM	0				6		2/21/05	[illegible]
162	MD	.3	20MM	1.0				7		2/21/05	[illegible]
163	MD	.4	20MM	0				3		2/21/05	[illegible]
164	MD	.4	20MM	0				10		2/21/05	[illegible]

Geophysical Dig Sheet and Target History

GRID 4B Unique Target ID	DIG RESULTS										
	Anomaly Type ***	Approx. Weight (lbs-oz/kg-g)	Comments (e.g., response below 1 foot)	Offset Distance (ft)	Offset Direction (N, NE, etc.)	Orientation of Nose (Azimuth deg)	Inclination of Nose (deg)	Depth to Top of Item (in/cm)	Digital Photo Number	Date	Team Leader

Geophysical Dig Sheet and Target History

GRID 4B Unique Target ID	POST-DIG UXO QC RESULTS			POST-DIG PROJECT QC		
	Excavation Hole Cleared?	UXO QC Spec. Initials	Date	Agreement Between Dig Results & Geophysical Data? (G=good, P=poor, U=unacceptable)	Project QC Initials	Date
1	Yes	EMD	2/21/06	G	VAS	2-21-06
2						
3						
4						
5						
6						
7						
8						
9						
10	Yes	EMD	2/21/06	G	VAS	2-21-06
11						
12						
13						
14						
15						

Geophysical Dig Sheet and Target History

GRID 4B Unique Target ID	POST-DIG UXO QC RESULTS			POST-DIG PROJECT QC		
	Excavation Hole Cleared?	UXO QC Spec. Initials	Date	Agreement Between Dig Results & Geophysical Data? (G=good, P=poor, U=unacceptable)	Project QC Initials	Date
16						
17						
18						
19						
20	Yes	EMD	2/21/06	G	VAS	2-21-06
21						
22						
23						
24						
25						
26						
27						
28						
29						
30	Yes	EMD	2/21/06	G	VAS	2-21-06

Geophysical Dig Sheet and Target History

GRID 4B Unique Target ID	POST-DIG UXO QC RESULTS			POST-DIG PROJECT QC		
	Excavation Hole Cleared?	UXO QC Spec. Initials	Date	Agreement Between Dig Results & Geophysical Data? (G=good, P=poor, U=unacceptable)	Project QC Initials	Date
31						
32						
33						
34						
35						
36						
37						
38						
39						
40	NO >12"	[illegible]	2/21/06	G	VAS	2-21-06
41						
42						
43						
44						
45						

Geophysical Dig Sheet and Target History

GRID 4B Unique Target ID	POST-DIG UXO QC RESULTS			POST-DIG PROJECT QC		
	Excavation Hole Cleared?	UXO QC Spec. Initials	Date	Agreement Between Dig Results & Geophysical Data? (G=good, P=poor, U=unacceptable)	Project QC Initials	Date
46						
47						
48						
49						
50	Yes	EMD	2/21/06	G	VAS	2-21-06
51						
52						
53						
54						
55						
56						
57						
58						
59						
60	Yes	EMD	2/21/06	G	VAS	2-21-06

Geophysical Dig Sheet and Target History

GRID 4B Unique Target ID	POST-DIG UXO QC RESULTS			POST-DIG PROJECT QC		
	Excavation Hole Cleared?	UXO QC Spec. Initials	Date	Agreement Between Dig Results & Geophysical Data? (G=good, P=poor, U=unacceptable)	Project QC Initials	Date
61						
62						
63						
64						
65						
66						
67						
68						
69						
70	Yes	EGD	2/21/06	G	VAS	2-21-06
71						
72						
73						
74						
75						

Geophysical Dig Sheet and Target History

GRID 4B Unique Target ID	POST-DIG UXO QC RESULTS			POST-DIG PROJECT QC		
	Excavation Hole Cleared?	UXO QC Spec. Initials	Date	Agreement Between Dig Results & Geophysical Data? (G=good, P=poor, U=unacceptable)	Project QC Initials	Date
76						
77						
78						
79						
80	Yes	EMD	2/21/06	G	VAS	2-21-06
81						
82						
83						
84						
85						
86						
87						
88						
89						
90	Yes	EMD	2/21/06	G	VAS	2-21-06

Geophysical Dig Sheet and Target History

GRID 4B Unique Target ID	POST-DIG UXO QC RESULTS			POST-DIG PROJECT QC		
	Excavation Hole Cleared?	UXO QC Spec. Initials	Date	Agreement Between Dig Results & Geophysical Data? (G=good, P=poor, U=unacceptable)	Project QC Initials	Date
91						
92						
93						
94						
95						
96						
97						
98						
99						
100	Yes	EWD	2/21/06	G	VAS	2-21-06
101						
102						
103						
104						
105						

Geophysical Dig Sheet and Target History

GRID 4B Unique Target ID	POST-DIG UXO QC RESULTS			POST-DIG PROJECT QC		
	Excavation Hole Cleared?	UXO QC Spec. Initials	Date	Agreement Between Dig Results & Geophysical Data? (G=good, P=poor, U=unacceptable)	Project QC Initials	Date
106						
107						
108						
109						
110	Yes	EMD	2/21/06	G	VAS	2-21-06
111						
112						
113						
114						
115						
116						
117						
118						
119						
120						

Geophysical Dig Sheet and Target History

GRID 4B Unique Target ID	POST-DIG UXO QC RESULTS Excavation Hole Cleared?	UXO QC Spec. Initials	Date	POST-DIG PROJECT QC Agreement Between Dig Results & Geophysical Data? (G=good, P=poor, U=unacceptable)	Project QC Initials	Date
121						
122						
123						
124						
125						
126						
127						
128						
129						
130	Yes	[illegible]	2/21/06	G	VAS	2-21-06
131						
132						
133						
134						
135						

Geophysical Dig Sheet and Target History

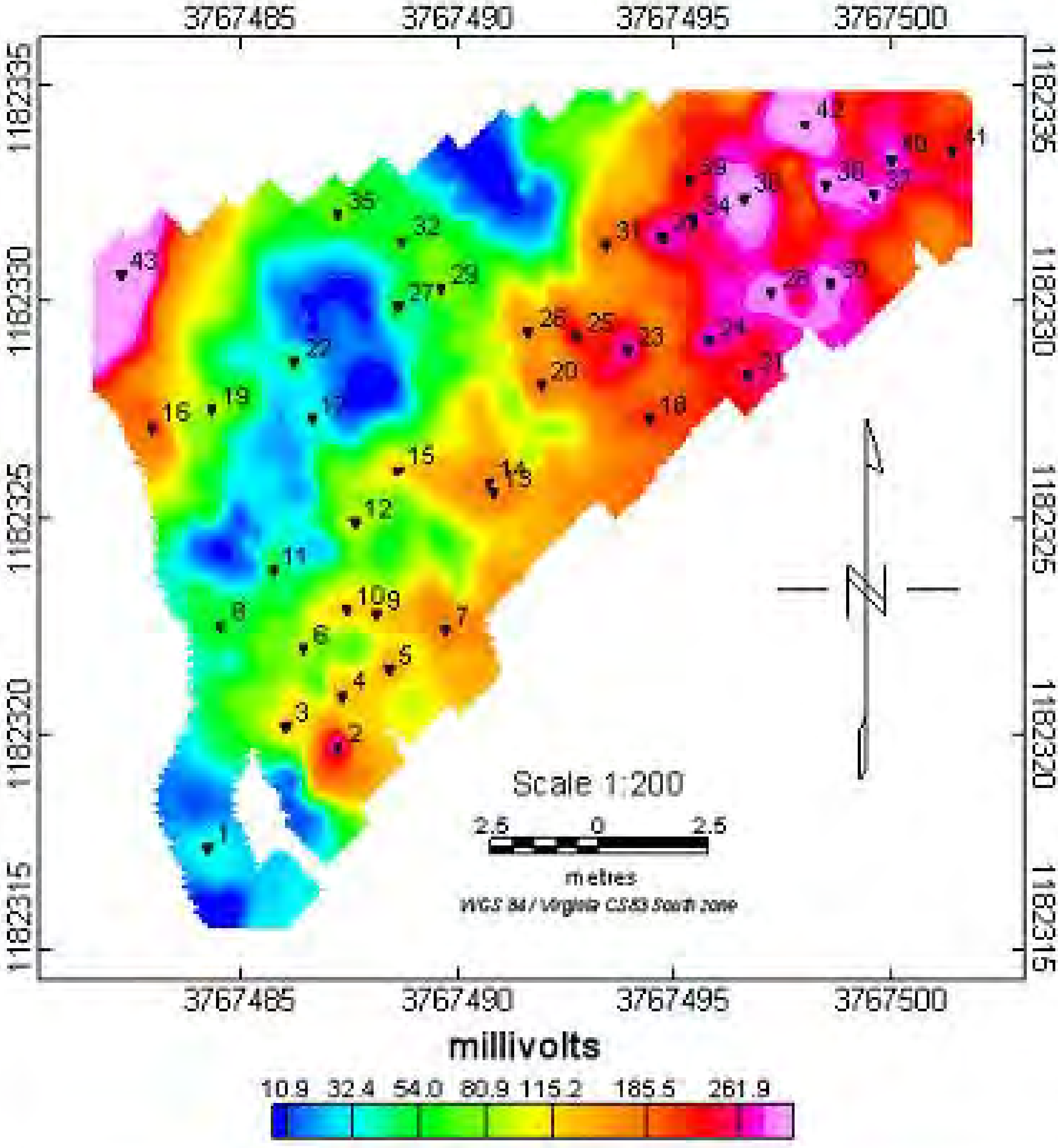
GRID 4B Unique Target ID	POST-DIG UXO QC RESULTS			POST-DIG PROJECT QC		
	Excavation Hole Cleared?	UXO QC Spec. Initials	Date	Agreement Between Dig Results & Geophysical Data? (G=good, P=poor, U=unacceptable)	Project QC Initials	Date
136						
137						
138						
139						
140	Yes	EMD	2/21/06	G	VAS	2-21-06
141						
142						
143						
144						
145						
146						
147						
148						
149						
150	Yes	EMD	2/21/06	G	VAS	2-21-06

Geophysical Dig Sheet and Target History

GRID 4B Unique Target ID	POST-DIG UXO QC RESULTS			POST-DIG PROJECT QC		
	Excavation Hole Cleared?	UXO QC Spec. Initials	Date	Agreement Between Dig Results & Geophysical Data? (G=good, P=poor, U=unacceptable)	Project QC Initials	Date
151						
152						
153						
154						
155						
156						
157						
158						
159						
160	~~MD~~ EW Yes	EWD	2/21/06	G	VAS	2-21-06
161						
162						
163						
164						

Geophysical Dig Sheet and Target History

GRID 4B	POST-DIG UXO QC RESULTS			POST-DIG PROJECT QC		
Unique Target ID	Excavation Hole Cleared?	UXO QC Spec. Initials	Date	Agreement Between Dig Results & Geophysical Data? (G=good, P=poor, U=unacceptable)	Project QC Initials	Date



NASA

Wallops Flight Center
EM61 MK2 Data
Grid 4C

February 9, 2006

Tetra Tech EM Inc.

Geophysical Dig Sheet and Target History

GRID 4C Unique Target ID	ORIGINAL SURVEY									
	Easting Coord. (m)	Northing Coord. (m)	Lat. Coord.	Long. Coord.	X - Local (Grid) Coord. (ft)	Y - Local (Grid) Coord. (ft)	Channel ID (i.e. C1, top senor, gradient)	Response Amplitude (mV)	Dig Priority	Date
1	3767484.2	1182317.4	37.56.14.26	-75.27.23.96	-2.27	✓ 58.67	Z(1-4)	38.6		2/9/2006
2	3767487.2	1182319.7	37.56.14.33	-75.27.23.83	8.8	✓ 63.59	Z(1-4)	287		2/9/2006
3	3767486	1182320.2	37.56.14.35	-75.27.23.88	5.44	✓ 66.04	Z(1-4)	126.8		2/9/2006
4	3767487.3	1182320.9	37.56.14.37	-75.27.23.83	10.02	✓ 67.25	Z(1-4)	128.7		2/9/2006
5	3767488.4	1182321.5	37.56.14.39	-75.27.23.78	13.89	✓ 68.29	Z(1-4)	148.3		2/9/2006
6	3767486.4	1182322	37.56.14.41	-75.27.23.86	8.04	✓ 71.35	Z(1-4)	92.6		2/9/2006
7	3767489.7	1182322.4	37.56.14.42	-75.27.23.73	18.62	✓ 70.12	Z(1-4)	181.4		2/9/2006
8	3767484.5	1182322.5	37.56.14.43	-75.27.23.94	2.49	✓ 74.33	Z(1-4)	61.6		2/9/2006
9	3767488.1	1182322.8	37.56.14.43	-75.27.23.79	13.93	✓ 72.57	Z(1-4)	123.6		2/9/2006
10	3767487.4	1182322.9	37.56.14.44	-75.27.23.82	11.83	✓ 73.4	Z(1-4)	127.5		2/9/2006
11	3767485.7	1182323.8	37.56.14.47	-75.27.23.89	7.21	✓ 77.48	Z(1-4)	52.9		2/9/2006
12	3767487.6	1182324.9	37.56.14.50	-75.27.23.81	13.95	✓ 79.48	Z(1-4)	94.6		2/9/2006
13	3767490.8	1182325.6	37.56.14.52	-75.27.23.68	24.45	✓ 79.26	Z(1-4)	172.4		2/9/2006
14	3767490.7	1182325.8	37.56.14.53	-75.27.23.68	24.28	✓ 79.96	Z(1-4)	171.8		2/9/2006
15	3767488.6	1182326.1	37.56.14.54	-75.27.23.77	17.97	✓ 82.47	Z(1-4)	120		2/9/2006

Geophysical Dig Sheet and Target History

GRID 4C Unique Target ID	ORIGINAL SURVEY									
	Easting Coord. (m)	Northing Coord. (m)	Lat. Coord.	Long. Coord.	X - Local (Grid) Coord. (ft)	Y - Local (Grid) Coord. (ft)	Channel ID (i.e. C1, top senor, gradient)	Response Amplitude (mV)	Dig Priority	Date
16	3767482.9	1182327.1	37.56.14.58	-75.27.24.00	0.96	✓ 89.86	Z(1-4)	201.5		2/9/2006
17	3767486.6	1182327.3	37.56.14.58	-75.27.23.85	12.64	✓ 87.71	Z(1-4)	39.5		2/9/2006
18	3767494.4	1182327.3	37.56.14.57	-75.27.23.53	36.94	✓ 81.85	Z(1-4)	221.3		2/9/2006
19	3767484.3	1182327.5	37.56.14.59	-75.27.23.94	5.63	✓ 90.06	Z(1-4)	90		2/9/2006
20	3767491.9	1182328.1	37.56.14.60	-75.27.23.63	29.75	✓ 86.22	Z(1-4)	189.6		2/9/2006
21	3767496.7	1182328.3	37.56.14.60	-75.27.23.43	44.85	✓ 83.24	Z(1-4)	262.3		2/9/2006
22	3767486.2	1182328.6	37.56.14.62	-75.27.23.86	12.37	✓ 92.06	Z(1-4)	47.2		2/9/2006
23	3767493.9	1182328.9	37.56.14.62	-75.27.23.55	36.58	✓ 87.21	Z(1-4)	279.4		2/9/2006
24	3767495.8	1182329.1	37.56.14.63	-75.27.23.47	42.65	✓ 86.41	Z(1-4)	281.2		2/9/2006
25	3767492.7	1182329.2	37.56.14.64	-75.27.23.59	33.07	✓ 89.05	Z(1-4)	237.3		2/9/2006
26	3767491.6	1182329.3	37.56.14.64	-75.27.23.64	29.72	✓ 90.18	Z(1-4)	153.8		2/9/2006
27	3767488.6	1182329.9	37.56.14.66	-75.27.23.76	20.82	✓ 94.31	Z(1-4)	47.9		2/9/2006
28	3767497.2	1182330.2	37.56.14.66	-75.27.23.41	47.83	✓ 88.78	Z(1-4)	315.4		2/9/2006
29	3767489.6	1182330.3	37.56.14.67	-75.27.23.72	24.24	✓ 94.8	Z(1-4)	83.4		2/9/2006
30	3767498.6	1182330.4	37.56.14.67	-75.27.23.35	52.34	✓ 88.36	Z(1-4)	328.3		2/9/2006

Geophysical Dig Sheet and Target History

GRID 4C Unique Target ID	ORIGINAL SURVEY									
	Easting Coord. (m)	Northing Coord. (m)	Lat. Coord.	Long. Coord.	X - Local (Grid) Coord. (ft)	Y - Local (Grid) Coord. (ft)	Channel ID (i.e. C1, top senor, gradient)	Response Amplitude (mV)	Dig Priority	Date
31	3767493.4	1182331.3	37.56.14.70	-75.27.23.56	36.82	95.06	Z(1-4)	197.9		2/9/2006
32	3767488.7	1182331.4	37.56.14.71	-75.27.23.75	22.26	98.9	Z(1-4)	65.8		2/9/2006
33	3767494.7	1182331.5	37.56.14.71	-75.27.23.51	41.02	94.71	Z(1-4)	273.1		2/9/2006
34	3767495.4	1182331.9	37.56.14.72	-75.27.23.48	43.5	95.43	Z(1-4)	268.7		2/9/2006
35	3767487.2	1182332	37.56.14.73	-75.27.23.82	18.04	101.9	Z(1-4)	72.2		2/9/2006
36	3767496.6	1182332.4	37.56.14.74	-75.27.23.43	47.62	96.09	Z(1-4)	462		2/9/2006
37	3767499.6	1182332.5	37.56.14.74	-75.27.23.31	57.04	94.15	Z(1-4)	305.7		2/9/2006
38	3767498.5	1182332.7	37.56.14.74	-75.27.23.35	53.76	95.59	Z(1-4)	317.7		2/9/2006
39	3767495.3	1182332.8	37.56.14.75	-75.27.23.48	43.87	98.31	Z(1-4)	251.3		2/9/2006
40	3767500	1182333.3	37.56.14.76	-75.27.23.29	58.88	96.34	Z(1-4)	300.5		2/9/2006
41	3767501.4	1182333.5	37.56.14.77	-75.27.23.23	63.39	95.91	Z(1-4)	254.1		2/9/2006
42	3767498	1182334.1	37.56.14.79	-75.27.23.37	53.25	100.33	Z(1-4)	692		2/9/2006
43	3767482.2	1182330.63	37.56.14.69	-75.27.24.02	1.43	101.39	Z(1-4)	620.4		2/9/2006

Geophysical Dig Sheet and Target History

GRID 4C	ORIGINAL SURVEY									
Unique Target ID	Easting Coord. (m)	Northing Coord. (m)	Lat. Coord.	Long. Coord.	X - Local (Grid) Coord. (ft)	Y - Local (Grid) Coord. (ft)	Channel ID (i.e. C1, top senor, gradient)	Response Amplitude (mV)	Dig Priority	Date

Note: *Fill in Acceptable Units (mV, nT/m, ppt, etc).

**Optional field – refer to SOW for applicability to specific project.

***For Anomaly type, U = UXO, F = frag, MD = munitions debris, S = scrap, A = small arms ammunition, NC = no contact, O = other.

Geophysical Dig Sheet and Target History

GRID 4C Unique Target ID	REACQUISITION SURVEY				
	Geophysical Instrument **	GPS Instrument**	Date	Comment	Response Amplitude (units*)**
1	Schondstedt	NA	2-18-06	Used x/y coordinates to locate targets	NA
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					
14					
15					

Geophysical Dig Sheet and Target History

GRID 4C Unique Target ID	REACQUISITION SURVEY				
	Geophysical Instrument **	GPS Instrument**	Date	Comment	Response Amplitude (units*)**
16	Schonstedt	NA	2-18-06	used x/y coordinates to locate targets	NA
17					
18					
19					
20					
21					
22					
23					
24					
25					
26					
27					
28					
29					
30					

Geophysical Dig Sheet and Target History

GRID 4C	REACQUISITION SURVEY				
Unique Target ID	Geophysical Instrument **	GPS Instrument**	Date	Comment	Response Amplitude (units*)**
31	Schondstedt	NA	2-18-06	used x, y coordinates to locate targets	NA
32					
33					
34					
35					
36					
37					
38					
39					
40					
41					
42					
43					

Geophysical Dig Sheet and Target History

GRID 4C	REACQUISITION SURVEY				
Unique Target ID	Geophysical Instrument **	GPS Instrument**	Date	Comment	Response Amplitude (units*)**

Geophysical Dig Sheet and Target History

GRID 4C Unique Target ID	DIG RESULTS										
	Anomaly Type ***	Approx. Weight (lbs/~~oz/kg-g~~)	Comments (e.g., response below 1 foot)	Offset Distance (ft)	Offset Direction (N, NE, etc.)	Orientation of Nose (Azimuth deg)	Inclination of Nose (deg)	Depth to Top of Item (in/~~cm~~)	Digital Photo Number	2006 Date	Team Leader
1	MD	.5	20 mm	0				4.0		2/20	W
2	S	3.0	rod * other end #3	0				10.0			W
3	S	3.0	rod * other end #2	0				10.0			W
4	MD	.3	20 mm	1.0				4.0			W
5	MD	.9	20 mm x 2	0				8.0			W
6	MD	.1	20 mm	1.0				2.0			W
7	MD	.3	20 mm	1.0				2.0			W
8	MD	.8	20 mm	0				8.0			W
9	MD	1.0	20 mm x 2	0				10.0			W
10	MD	1.0	20 mm x 2	0				8.0			W
11	MD	.6	20 mm	0				6.0			W
12	S	1.0	rebar other end #16	0				6.0			W
13	MD	.6	20 mm	0				4.0			W
14	MD	.3	20 mm	1.0				2.0			W
15	S	1.2	scrap	0				8.0		2/20	W

Geophysical Dig Sheet and Target History

GRID 4C Unique Target ID	DIG RESULTS										
	Anomaly Type ***	Approx. Weight (lbs ~~oz/kg-g~~)	Comments (e.g., response below 1 foot)	Offset Distance (ft)	Offset Direction (N, NE, etc.)	Orientation of Nose (Azimuth deg)	Inclination of Nose (deg)	Depth to Top of Item (in/~~cm~~)	Digital Photo Number	2006 Date	Team Leader
16	S	1.0	rebar other end #12	0				6.0		2/20	W
17	MD	.4	20 mm	0				6.0			W
18	MD	.7	20 mm	0				6.0			W
19	S	.6	scrap	0				6.0			W
20	MD	.3	20 mm	1.0				2.0			W
21	MD	.9	20 mm x 2	0				8.0			W
22	MD	.5	20 mm	0				6.0			W
23	MD	.6	20 mm	0				6.0			W
24	MD	1.1	20 mm x 2	0				10.0			W
25	MD	.7	20 mm	0				6.0			W
26	MD	.8	20 mm x 2	0				10.0			W
27	MD	.7	20 mm	0				8.0			W
28	MD	.7	20 mm	0				6.0			W
29	MD	.8	20 mm	0				8.0			W
30	S	.8	rebar	0				8.0		2/20	W

Geophysical Dig Sheet and Target History

GRID 4C Unique Target ID	DIG RESULTS										
	Anomaly Type ***	Approx. Weight (lbs ~~oz/kg g~~)	Comments (e.g., response below 1 foot)	Offset Distance (ft)	Offset Direction (N, NE, etc.)	Orientation of Nose (Azimuth deg)	Inclination of Nose (deg)	Depth to Top of Item (in ~~/cm~~)	Digital Photo Number	2006 Date	Team Leader
31	MD	.7	20 mm	0				8.0		2/20	W
32	MD	.4	20 mm	0				4.0			W
33	MD	1.0	20 mm x2	0				8.0			W
34	MD	.7	20 mm	0				6.0			W
35	MD	.8	20mm	0				10.0			W
36	MD	.8	20 mm	0				8.0			W
37	S	1.0	rebar	0				8.0			W
38	MD	1.1	20mm x2	0				12.0			W
39	MD	.6	20 mm	0				6.0			W
40	S	.4	scrap	0				4.0			W
41	MD	.3	20 mm	1.0				2.0			W
42	MD	.8	20 mm x2	0				8.0			W
43	MD	.9	20mm x2	0				10.0			W
										2/20	W

Geophysical Dig Sheet and Target History

GRID 4C Unique Target ID	DIG RESULTS										
	Anomaly Type ***	Approx. Weight (lbs-oz/kg-g)	Comments (e.g., response below 1 foot)	Offset Distance (ft)	Offset Direction (N, NE, etc.)	Orientation of Nose (Azimuth deg)	Inclination of Nose (deg)	Depth to Top of Item (in/cm)	Digital Photo Number	Date	Team Leader

Geophysical Dig Sheet and Target History

GRID 4C Unique Target ID	POST-DIG UXO QC RESULTS			POST-DIG PROJECT QC		
	Excavation Hole Cleared?	UXO QC Spec. Initials	Date	Agreement Between Dig Results & Geophysical Data? (G=good, P=poor, U=unacceptable)	Project QC Initials	Date
1	Yes	[illegible]	2/20/06	G	VAS	2-20-06
2						
3						
4						
5						
6						
7						
8						
9						
10	Yes	[illegible]	2/20/06	G	VAS	2-20-06
11						
12						
13						
14						
15						

Geophysical Dig Sheet and Target History

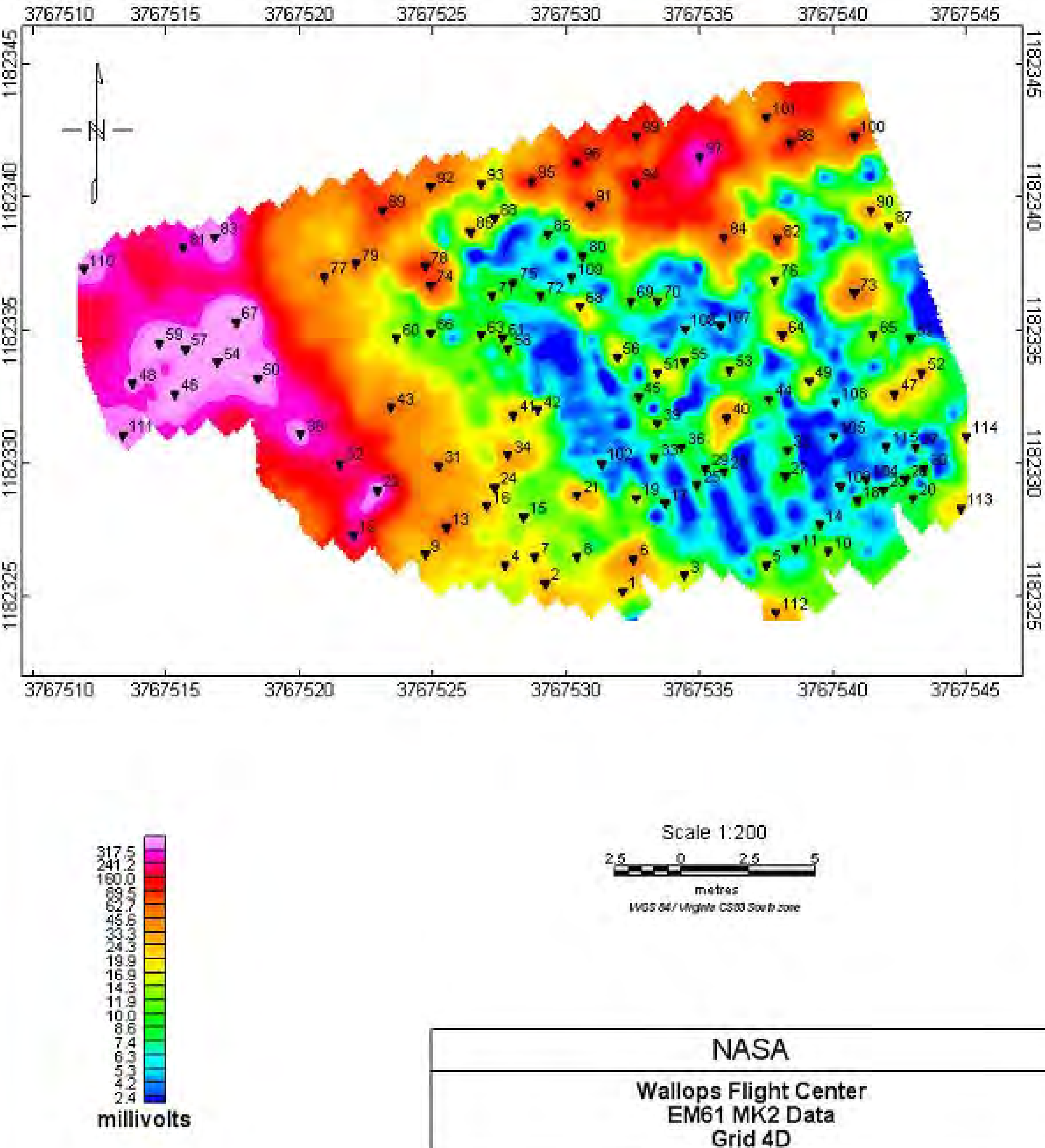
GRID 4C Unique Target ID	POST-DIG UXO QC RESULTS			POST-DIG PROJECT QC		
	Excavation Hole Cleared?	UXO QC Spec. Initials	Date	Agreement Between Dig Results & Geophysical Data? (G=good, P=poor, U=unacceptable)	Project QC Initials	Date
16						
17						
18						
19						
20	Yes	[illegible]	2/20/06	G	VAS	2-20-06
21						
22						
23						
24						
25						
26						
27						
28						
29						
30	Yes	[illegible]	2/20/06	G	VAS	2-20-06

Geophysical Dig Sheet and Target History

GRID 4C	POST-DIG UXO QC RESULTS			POST-DIG PROJECT QC		
Unique Target ID	Excavation Hole Cleared?	UXO QC Spec. Initials	Date	Agreement Between Dig Results & Geophysical Data? (G=good, P=poor, U=unacceptable)	Project QC Initials	Date
31						
32						
33						
34						
35						
36						
37						
38						
39						
40	Yes	EAD	2/20/06	G	VAS	2-20-06
41						
42						
43						

Geophysical Dig Sheet and Target History

GRID 4C	POST-DIG UXO QC RESULTS			POST-DIG PROJECT QC		
Unique Target ID	Excavation Hole Cleared?	UXO QC Spec. Initials	Date	Agreement Between Dig Results & Geophysical Data? (G=good, P=poor, U=unacceptable)	Project QC Initials	Date



NASA

Wallops Flight Center
EM61 MK2 Data
Grid 4D

February 9, 2006

Tetra Tech EM Inc.

Geophysical Dig Sheet and Target History

GRID 4D Unique Target ID	ORIGINAL SURVEY									
	Easting Coord. (m)	Northing Coord. (m)	Lat. Coord.	Long. Coord.	X - Local (Grid) Coord. (ft)	Y - Local (Grid) Coord. (ft)	Channel ID (i.e. C1, top senor, gradient)	Response Amplitude (mV)	Dig Priority	Date
1	3767532.1	1182325.2	37.56.14.46	-75.27.21.99	55.2	46.91	Z(1-4)	26.8		2/9/2006
2	3767529.2	1182325.5	37.56.14.48	-75.27.22.10	46.34	50.01	Z(1-4)	23.6		2/9/2006
3	3767534.4	1182325.8	37.56.14.48	-75.27.21.89	62.85	47.07	Z(1-4)	16.7		2/9/2006
4	3767527.7	1182326.2	37.56.14.50	-75.27.22.17	42.16	53.32	Z(1-4)	22.5		2/9/2006
5	3767537.5	1182326.2	37.56.14.49	-75.27.21.76	72.85	46.02	Z(1-4)	15.4		2/9/2006
6	3767532.5	1182326.4	37.56.14.50	-75.27.21.97	57.34	50.37	Z(1-4)	42.2		2/9/2006
7	3767528.8	1182326.5	37.56.14.51	-75.27.22.12	45.83	53.44	Z(1-4)	20.8		2/9/2006
8	3767530.4	1182326.5	37.56.14.51	-75.27.22.05	50.84	52.25	Z(1-4)	16.3		2/9/2006
9	3767524.7	1182326.6	37.56.14.52	-75.27.22.29	33.07	56.81	Z(1-4)	28.8		2/9/2006
10	3767539.8	1182326.7	37.56.14.51	-75.27.21.67	80.43	45.87	Z(1-4)	14.6		2/9/2006
11	3767538.6	1182326.8	37.56.14.51	-75.27.21.72	76.75	47.07	Z(1-4)	9.1		2/9/2006
12	3767522	1182327.3	37.56.14.54	-75.27.22.40	25.13	61.02	Z(1-4)	293.8		2/9/2006
13	3767525.5	1182327.6	37.56.14.55	-75.27.22.25	36.32	59.35	Z(1-4)	85.5		2/9/2006
14	3767539.5	1182327.7	37.56.14.54	-75.27.21.68	80.24	49.22	Z(1-4)	8.3		2/9/2006
15	3767528.4	1182328	37.56.14.56	-75.27.22.13	45.7	58.44	Z(1-4)	18		2/9/2006

Geophysical Dig Sheet and Target History

GRID 4D Unique Target ID	ORIGINAL SURVEY									
	Easting Coord. (m)	Northing Coord. (m)	Lat. Coord.	Long. Coord.	X - Local (Grid) Coord. (ft)	Y - Local (Grid) Coord. (ft)	Channel ID (i.e. C1, top senor, gradient)	Response Amplitude (mV)	Dig Priority	Date
16	3767527	1182328.4	37.56.14.57	-75.27.22.19	41.61	✓ 60.73	Z(1-4)	24.3		2/9/2006
17	3767533.7	1182328.5	37.56.14.57	-75.27.21.92	62.67	✓ 56.05	Z(1-4)	8.3		2/9/2006
18	3767540.9	1182328.6	37.56.14.57	-75.27.21.62	85.29	✓ 51	Z(1-4)	11.1		2/9/2006
19	3767532.6	1182328.7	37.56.14.58	-75.27.21.96	59.37	✓ 57.5	Z(1-4)	15		2/9/2006
20	3767543	1182328.7	37.56.14.57	-75.27.21.54	91.94	✓ 49.74	Z(1-4)	10.1		2/9/2006
21	3767530.4	1182328.8	37.56.14.58	-75.27.22.05	52.56	✓ 59.45	Z(1-4)	34.3		2/9/2006
22	3767522.9	1182329	37.56.14.60	-75.27.22.36	29.22	✓ 65.67	Z(1-4)	386.7		2/9/2006
23	3767541.9	1182329	37.56.14.58	-75.27.21.58	88.72	✓ 51.5	Z(1-4)	9.1		2/9/2006
24	3767527.3	1182329.1	37.56.14.60	-75.27.22.18	43.07	✓ 62.7	Z(1-4)	21.4		2/9/2006
25	3767534.9	1182329.2	37.56.14.59	-75.27.21.87	66.95	✓ 57.35	Z(1-4)	8		2/9/2006
26	3767542.7	1182329.4	37.56.14.59	-75.27.21.55	91.53	✓ 52.16	Z(1-4)	9.9		2/9/2006
27	3767538.2	1182329.5	37.56.14.60	-75.27.21.73	77.51	✓ 55.83	Z(1-4)	9.9		2/9/2006
28	3767535.9	1182329.7	37.56.14.61	-75.27.21.83	70.45	✓ 58.17	Z(1-4)	9		2/9/2006
29	3767535.2	1182329.8	37.56.14.61	-75.27.21.85	68.34	✓ 59.01	Z(1-4)	9.1		2/9/2006
30	3767543.4	1182329.8	37.56.14.60	-75.27.21.52	94.02	✓ 52.89	Z(1-4)	10.1		2/9/2006

Geophysical Dig Sheet and Target History

GRID 4D Unique Target ID	ORIGINAL SURVEY									
	Easting Coord. (m)	Northing Coord. (m)	Lat. Coord.	Long. Coord.	X - Local (Grid) Coord. (ft)	Y - Local (Grid) Coord. (ft)	Channel ID (i.e. C1, top senor, gradient)	Response Amplitude (mV)	Dig Priority	Date
31	3767525.2	1182329.9	37.56.14.62	-75.27.22.26	37.09	66.77	Z(1-4)	52.7		2/9/2006
32	3767521.5	1182330	37.56.14.63	-75.27.22.41	25.58	69.85	Z(1-4)	242.6		2/9/2006
33	3767533.3	1182330.2	37.56.14.63	-75.27.21.93	62.68	61.67	Z(1-4)	9.2		2/9/2006
34	3767527.8	1182330.3	37.56.14.63	-75.27.22.16	45.53	66.09	Z(1-4)	38.8		2/9/2006
35	3767538.3	1182330.5	37.56.14.63	-75.27.21.73	78.57	58.89	Z(1-4)	10.1		2/9/2006
36	3767534.3	1182330.6	37.56.14.64	-75.27.21.89	66.11	62.18	Z(1-4)	10.7		2/9/2006
37	3767543.1	1182330.6	37.56.14.63	-75.27.21.53	93.67	55.62	Z(1-4)	8.5		2/9/2006
38	3767520	1182331.1	37.56.14.67	-75.27.22.47	21.7	74.41	Z(1-4)	411		2/9/2006
39	3767533.4	1182331.5	37.56.14.67	-75.27.21.93	63.97	65.67	Z(1-4)	14.1		2/9/2006
40	3767536	1182331.7	37.56.14.67	-75.27.21.82	72.26	64.36	Z(1-4)	36.1		2/9/2006
41	3767528	1182331.8	37.56.14.68	-75.27.22.15	47.28	70.64	Z(1-4)	23.6		2/9/2006
42	3767528.9	1182332	37.56.14.69	-75.27.22.11	50.25	70.59	Z(1-4)	20.7		2/9/2006
43	3767523.4	1182332.1	37.56.14.70	-75.27.22.33	33.1	75.01	Z(1-4)	55.8		2/9/2006
44	3767537.6	1182332.4	37.56.14.69	-75.27.21.75	77.79	65.36	Z(1-4)	10.4		2/9/2006
45	3767532.7	1182332.5	37.56.14.70	-75.27.21.95	62.52	69.32	Z(1-4)	9		2/9/2006

Geophysical Dig Sheet and Target History

GRID 4D Unique Target ID	ORIGINAL SURVEY									
	Easting Coord. (m)	Northing Coord. (m)	Lat. Coord.	Long. Coord.	X - Local (Grid) Coord. (ft)	Y - Local (Grid) Coord. (ft)	Channel ID (i.e. C1, top senor, gradient)	Response Amplitude (mV)	Dig Priority	Date
46	3767515.3	1182332.6	37.56.14.72	-75.27.22.66	8.1	82.61	Z(1-4)	451.1		2/9/2006
47	3767542.3	1182332.6	37.56.14.69	-75.27.21.56	92.66	62.48	Z(1-4)	27.2		2/9/2006
48	3767513.7	1182333	37.56.14.74	-75.27.22.73	3.39	85.06	Z(1-4)	352.1		2/9/2006
49	3767539.1	1182333.1	37.56.14.71	-75.27.21.69	83.01	66.43	Z(1-4)	18.9		2/9/2006
50	3767518.4	1182333.2	37.56.14.74	-75.27.22.54	18.26	82.18	Z(1-4)	435.3		2/9/2006
51	3767533.4	1182333.4	37.56.14.73	-75.27.21.92	65.38	71.62	Z(1-4)	20.1		2/9/2006
52	3767543.3	1182333.4	37.56.14.72	-75.27.21.52	96.39	64.24	Z(1-4)	28.5		2/9/2006
53	3767536.1	1182333.5	37.56.14.73	-75.27.21.81	73.91	69.92	Z(1-4)	16.7		2/9/2006
54	3767516.9	1182333.8	37.56.14.76	-75.27.22.60	14.01	85.18	Z(1-4)	476.9		2/9/2006
55	3767534.4	1182333.8	37.56.14.74	-75.27.21.88	68.81	72.13	Z(1-4)	13.8		2/9/2006
56	3767531.9	1182334	37.56.14.75	-75.27.21.98	61.13	74.62	Z(1-4)	20.2		2/9/2006
57	3767515.7	1182334.3	37.56.14.78	-75.27.22.65	10.62	87.64	Z(1-4)	453.4		2/9/2006
58	3767527.8	1182334.3	37.56.14.76	-75.27.22.15	48.52	78.62	Z(1-4)	11.8		2/9/2006
59	3767514.7	1182334.5	37.56.14.78	-75.27.22.69	7.64	89.01	Z(1-4)	450.7		2/9/2006
60	3767523.6	1182334.7	37.56.14.78	-75.27.22.32	35.66	83	Z(1-4)	17.6		2/9/2006

Geophysical Dig Sheet and Target History

GRID 4D Unique Target ID	ORIGINAL SURVEY									
	Easting Coord. (m)	Northing Coord. (m)	Lat. Coord.	Long. Coord.	X - Local (Grid) Coord. (ft)	Y - Local (Grid) Coord. (ft)	Channel ID (i.e. C1, top senor, gradient)	Response Amplitude (mV)	Dig Priority	Date
61	3767527.6	1182334.7	37.56.14.78	-75.27.22.16	48.19	80.02	Z(1-4)	12.1		2/9/2006
62	3767542.9	1182334.7	37.56.14.76	-75.27.21.53	96.1	68.61	Z(1-4)	9.2		2/9/2006
63	3767526.8	1182334.8	37.56.14.78	-75.27.22.19	45.76	80.93	Z(1-4)	11.7		2/9/2006
64	3767538.1	1182334.8	37.56.14.77	-75.27.21.73	81.15	72.5	Z(1-4)	32.2		2/9/2006
65	3767541.5	1182334.8	37.56.14.77	-75.27.21.59	91.79	69.97	Z(1-4)	13.9		2/9/2006
66	3767524.9	1182334.9	37.56.14.79	-75.27.22.27	39.88	82.66	Z(1-4)	15.3		2/9/2006
67	3767517.6	1182335.3	37.56.14.81	-75.27.22.57	17.32	89.35	Z(1-4)	747		2/9/2006
68	3767530.5	1182335.9	37.56.14.81	-75.27.22.04	58.16	81.61	Z(1-4)	21.5		2/9/2006
69	3767532.4	1182336.1	37.56.14.82	-75.27.21.96	64.26	80.82	Z(1-4)	11.4		2/9/2006
70	3767533.4	1182336.1	37.56.14.82	-75.27.21.92	67.4	80.08	Z(1-4)	12.3		2/9/2006
71	3767527.2	1182336.3	37.56.14.83	-75.27.22.17	48.13	85.33	Z(1-4)	12.2		2/9/2006
72	3767529	1182336.3	37.56.14.83	-75.27.22.10	53.76	83.98	Z(1-4)	10.9		2/9/2006
73	3767540.8	1182336.4	37.56.14.82	-75.27.21.62	90.79	75.5	Z(1-4)	47.7		2/9/2006
74	3767524.9	1182336.7	37.56.14.85	-75.27.22.27	41.22	88.29	Z(1-4)	90		2/9/2006
75	3767528	1182336.8	37.56.14.85	-75.27.22.14	51.01	86.3	Z(1-4)	10.2		2/9/2006

Geophysical Dig Sheet and Target History

GRID 4D Unique Target ID	ORIGINAL SURVEY									
	Easting Coord. (m)	Northing Coord. (m)	Lat. Coord.	Long. Coord.	X - Local (Grid) Coord. (ft)	Y - Local (Grid) Coord. (ft)	Channel ID (i.e. C1, top senor, gradient)	Response Amplitude (mV)	Dig Priority	Date
76	3767537.8	1182336.9	37.56.14.84	-75.27.21.74	81.77	79.3	Z(1-4)	19.2		2/9/2006
77	3767520.9	1182337	37.56.14.86	-75.27.22.43	28.92	92.22	Z(1-4)	48.1		2/9/2006
78	3767524.7	1182337.4	37.56.14.87	-75.27.22.27	41.12	90.63	Z(1-4)	102.4		2/9/2006
79	3767522.1	1182337.5	37.56.14.87	-75.27.22.38	33.05	92.89	Z(1-4)	52.6		2/9/2006
80	3767530.6	1182337.8	37.56.14.87	-75.27.22.03	59.89	87.49	Z(1-4)	9.9		2/9/2006
81	3767515.6	1182338.1	37.56.14.90	-75.27.22.65	13.14	99.61	Z(1-4)	295.8		2/9/2006
82	3767537.9	1182338.4	37.56.14.89	-75.27.21.73	83.2	83.93	Z(1-4)	82.4		2/9/2006
83	3767516.8	1182338.5	37.56.14.91	-75.27.22.60	17.2	99.97	Z(1-4)	380.6		2/9/2006
84	3767535.9	1182338.5	37.56.14.89	-75.27.21.81	77.01	85.73	Z(1-4)	75.4		2/9/2006
85	3767529.3	1182338.6	37.56.14.90	-75.27.22.08	56.42	90.96	Z(1-4)	8.8		2/9/2006
86	3767526.4	1182338.7	37.56.14.91	-75.27.22.20	47.41	93.44	Z(1-4)	26.7		2/9/2006
87	3767542.1	1182338.9	37.56.14.90	-75.27.21.56	96.73	82.36	Z(1-4)	19.3		2/9/2006
88	3767527.3	1182339.2	37.56.14.92	-75.27.22.16	50.6	94.33	Z(1-4)	19.8		2/9/2006
89	3767523.1	1182339.5	37.56.14.94	-75.27.22.34	37.67	98.4	Z(1-4)	95		2/9/2006
90	3767541.4	1182339.5	37.56.14.92	-75.27.21.59	94.98	84.76	Z(1-4)	35.1		2/9/2006

Geophysical Dig Sheet and Target History

GRID 4D Unique Target ID	ORIGINAL SURVEY									
	Easting Coord. (m)	Northing Coord. (m)	Lat. Coord.	Long. Coord.	X - Local (Grid) Coord. (ft)	Y - Local (Grid) Coord. (ft)	Channel ID (i.e. C1, top senor, gradient)	Response Amplitude (mV)	Dig Priority	Date
106	3767540.09	1182332.29	37.56.14.69	-75.27.21.65	85.51	63.17	Z(1-4)	7.1		2/9/2006
107	3767535.76	1182335.18	37.56.14.78	-75.27.21.82	74.11	75.43	Z(1-4)	6.4		2/9/2006
108	3767534.44	1182335.06	37.56.14.78	-75.27.21.88	69.88	76.04	Z(1-4)	6.4		2/9/2006
109	3767530.17	1182336.98	37.56.14.85	-75.27.22.05	57.95	85.25	Z(1-4)	6.8		2/9/2006
110	3767511.89	1182337.31	37.56.14.88	-75.27.22.80	0.93	99.89	Z(1-4)	384.8		2/9/2006
111	3767513.35	1182331.07	37.56.14.67	-75.27.22.75	0.86	79.27	Z(1-4)	375.3		2/9/2006
112	3767537.86	1182324.4	37.56.14.43	-75.27.21.75	72.63	40.12	Z(1-4)	29.4		2/9/2006
113	3767544.79	1182328.31	37.56.14.55	-75.27.21.46	97.27	47.17	Z(1-4)	20.6		2/9/2006
114	3767545.01	1182331.02	37.56.14.64	-75.27.21.45	99.97	55.5	Z(1-4)	*		2/9/2006
115	3767541.98	1182330.64	37.56.14.63	-75.27.21.58	90.18	56.58	Z(1-4)	6.6		2/9/2006

Note: *Fill in Acceptable Units (mV, nT/m, ppt, etc).

**Optional field – refer to SOW for applicability to specific project.

***For Anomaly type, U = UXO, F = frag, MD = munitions debris, S = scrap, A = small arms ammunition, NC = no contact, O = other.

Geophysical Dig Sheet and Target History

GRID 4D Unique Target ID	REACQUISITION SURVEY				
	Geophysical Instrument **	GPS Instrument**	Date	Comment	Response Amplitude (units*)**
1	Schondstedt	NA	2-18-06	used x/y coordinates to locate targets	NA
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					
14					
15					

Geophysical Dig Sheet and Target History

GRID 4D Unique Target ID	REACQUISITION SURVEY				
	Geophysical Instrument **	GPS Instrument**	Date	Comment	Response Amplitude (units*)**
16	Schondstedt	NA	2-18-06	used x,y coordinates to locate targets	NA
17					
18					
19					
20					
21					
22					
23					
24					
25					
26					
27					
28					
29					
30					

Geophysical Dig Sheet and Target History

GRID 4D Unique Target ID	REACQUISITION SURVEY				
	Geophysical Instrument **	GPS Instrument**	Date	Comment	Response Amplitude (units*)**
31	Schondstedt	NA	2-18-06	used x/y coordinates to locate targets	NA
32					
33					
34					
35					
36					
37					
38					
39					
40					
41					
42					
43					
44					
45					

Geophysical Dig Sheet and Target History

GRID 4D Unique Target ID	REACQUISITION SURVEY				
	Geophysical Instrument **	GPS Instrument**	Date	Comment	Response Amplitude (units*)**
46	Schondstedt	NA	2-18-06	used x/y coordinates to locate targets	NA
47					
48					
49					
50					
51					
52					
53					
54					
55					
56					
57					
58					
59					
60					

Geophysical Dig Sheet and Target History

GRID 4D Unique Target ID	REACQUISITION SURVEY				
	Geophysical Instrument **	GPS Instrument**	Date	Comment	Response Amplitude (units*)**
61	Schondstedt	NA	2-18-06	used x/y coordinates to locate targets	NA
62					
63					
64					
65					
66					
67					
68					
69					
70					
71					
72					
73					
74					
75					

Geophysical Dig Sheet and Target History

GRID 4D Unique Target ID	REACQUISITION SURVEY				
	Geophysical Instrument **	GPS Instrument**	Date	Comment	Response Amplitude (units*)**
76	Schondstedt	NA	2-18-06	used x/y coordinates to locate targets	NA
77					
78					
79					
80					
81					
82					
83					
84					
85					
86					
87					
88					
89					
90					

Geophysical Dig Sheet and Target History

GRID 4D Unique Target ID	REACQUISITION SURVEY				
	Geophysical Instrument **	GPS Instrument**	Date	Comment	Response Amplitude (units*)**
91	Schondstedt	NA	2-18-06	used x/y coordinates to locate targets	NA
92					
93					
94					
95					
96					
97					
98					
99					
100					
101					
102					
103					
104					
105					

Geophysical Dig Sheet and Target History

GRID 4D Unique Target ID	REACQUISITION SURVEY				
	Geophysical Instrument **	GPS Instrument**	Date	Comment	Response Amplitude (units*)**
106	Schondstedt	NA	2-18-06	used x/y coordinates to locate targets	NA
107					
108					
109					
110					
111					
112					
113					
114					
115					

Geophysical Dig Sheet and Target History

lw

GRID 4D Unique Target ID	DIG RESULTS Anomaly Type ***	Approx. Weight (lbs-~~oz/kg-g~~)	Comments (e.g., response below 1 foot)	Offset Distance (ft)	Offset Direction (N, NE, etc.)	Orientation of Nose (Azimuth deg)	Inclination of Nose (deg)	Depth to Top of Item (in/cm)	Digital Photo Number	2006 Date	Team Leader
1	MD	.5	20 mm	0				4.0		~~20~~ 19 Feb06	lw
2			LIP	0				>12.0"			lw
3	MD	.2	20 mm	1.0				2.0			lw
4	MD	.5	20 mm	0				4.0			lw
5	MD	.6	20 mm	0				10.0			lw
6	MD	.2	20 mm	0				2.0			lw
7	MD	.2	20 mm	1.0				4.0			lw
8	MD	.7	20 mm	0				8.0			lw
9	MD	.8	20 mm	0				8.0			lw
10	S	1.5	rusted cap	0				8.0			lw
11			LIP	0				>12.0"			lw
12	MD	.9	30 mm	0				4.0			lw
13	MD	.3	20 mm	0.5				6.0			lw
14			LIP	0				>12.0"			lw
15	MD	.4	20 mm	0				6.0		~~20~~ 19 Feb06	lw

Geophysical Dig Sheet and Target History

GRID 4D Unique Target ID	DIG RESULTS										
	Anomaly Type ***	Approx. Weight (lbs/~~oz/kg-g~~)	Comments (e.g., response below 1 foot)	Offset Distance (ft)	Offset Direction (N, NE, etc.)	Orientation of Nose (Azimuth deg)	Inclination of Nose (deg)	Depth to Top of Item (in/~~cm~~)	Digital Photo Number	2006 Date	Team Leader
16	MD	.2	20 mm	1.0				4.0		19 ~~20~~ Feb 06	W
17	MD	.5	20 mm	0				4.0			W
18			LIP	0				>12.0"			W
19	MD	.6	20 mm	0				8.0			W
20			LIP	0				>12.0"			W
21	MD	.5	20 mm	0				6.0			W
22	MD	.3	20 mm	0				4.0			W
23			LIP	0				>12.0"			W
24	MD	.5	20 mm	0				6.0			W
25			LIP	0				>12.0"			W
26	MD	.4	20 mm	0				8.0			W
27			LIP	0				>12.0"			W
28	MD	.4	20 mm	0.5				8.0			W
29			LIP	0				>12.0"			W
30			LIP	0				>12.0"		19 ~~20~~ Feb 06	W

Geophysical Dig Sheet and Target History

GRID 4D Unique Target ID	DIG RESULTS										
	Anomaly Type ***	Approx. Weight (lbs/~~oz/kg-g~~)	Comments (e.g., response below 1 foot)	Offset Distance (ft)	Offset Direction (N, NE, etc.)	Orientation of Nose (Azimuth deg)	Inclination of Nose (deg)	Depth to Top of Item (in/~~cm~~)	Digital Photo Number	2006 Date	Team Leader
31	MD	.5	20mm	0				6.0		19 ~~20~~ Feb 06	
32	MD	.3	20 mm	0				2.0			
33	MD	.7	20 mm	0				10.0			
34	MD	.2	20 mm	1.0				2.0			
35			LIP	0				>12.0"			
36			LIP	0				>12.0"			
37			LIP	0				>12.0"			
38	MD	.8	20mm x2	0				10.0			
39			LIP	0				>12.0"			
40	MD	.5	20 mm	0				4.0			
41	MD	.5	20mm	0				6.0			
42	MD	.3	20 mm	1.0				8.0			
43	MD	.6	20mm	0				8.0			
44			LIP	0				>12.0"			
45	S	.2	nail	1.0				2.0		19 ~~20~~ Feb 06	

Geophysical Dig Sheet and Target History

GRID 4D Unique Target ID	DIG RESULTS										
	Anomaly Type ***	Approx. Weight (lbs/ ~~oz/kg-g~~)	Comments (e.g., response below 1 foot)	Offset Distance (ft)	Offset Direction (N, NE, etc.)	Orientation of Nose (Azimuth deg)	Inclination of Nose (deg)	Depth to Top of Item (in/cm)	Digital Photo Number	2006 Date	Team Leader
46	MD	.9	20 mm x 2	0				10.0		20Feb06	[illegible]
47			LIP	0				>12.0"			[illegible]
48	MD	.9	20 mm x 2	0				8.0			[illegible]
49	MD	.5	20 mm	0				8.0			[illegible]
50	MD	1.4	20 mm x 4	0				12.0			[illegible]
51			LIP	0				>12.0"			[illegible]
52	MD	.5	20mm	0				4.0			[illegible]
53	MD	.7	20mm	0				6.0			[illegible]
54	MD	.5	20mm	0				6.0			[illegible]
55	S	.3	pencil	1.0				6.0			[illegible]
56			LIP	0				>12.0"			[illegible]
57	MD	1.8	20 mm x5	0				10.0			[illegible]
58	MD	.5	20 mm	0				6.0			[illegible]
59	MD	.4	20 mm	0				4.0			[illegible]
60	MD	.6	20 mm	0				4.0		~~20~~19Feb06	[illegible]

Geophysical Dig Sheet and Target History

GRID 4D Unique Target ID	DIG RESULTS Anomaly Type ***	Approx. Weight (lbs/ ~~oz/kg-g~~)	Comments (e.g., response below 1 foot)	Offset Distance (ft)	Offset Direction (N, NE, etc.)	Orientation of Nose (Azimuth deg)	Inclination of Nose (deg)	Depth to Top of Item (in/~~cm~~)	Digital Photo Number	2006 Date	Team Leader
61			LIP	0				>12.0"		19 20Feb06	[illegible]
62	MD	.5	30 mm	0				8.0			[illegible]
63	MD	.5	20 mm	0				8.0			[illegible]
64	MD	.9	20 mm x2	0				10.0			[illegible]
65	MD	.6	20 mm	0				10.0			[illegible]
66	MD	.5	20 mm	0				4.0			[illegible]
67	MD	.8	20 mm	0				10.0			[illegible]
68	MD	.6	20 mm	0				8.0			[illegible]
69	MD	.4	20 mm	0				6.0			[illegible]
70			LIP	0				>12.0"			[illegible]
71	MD	.2	20 mm	1.0				4.0			[illegible]
72	MD	.4	20 mm	0				4.0			[illegible]
73	MD	.4	20 mm	0				6.0			[illegible]
74	S	1.0	scrap *other end item #78	0				6.0			[illegible]
75			LIP	0				>12.0"		19 26Feb06	[illegible]

Geophysical Dig Sheet and Target History

GRID 4D Unique Target ID	DIG RESULTS										
	Anomaly Type ***	Approx. Weight (lbs-~~oz/kg-g~~)	Comments (e.g., response below 1 foot)	Offset Distance (ft)	Offset Direction (N, NE, etc.)	Orientation of Nose (Azimuth deg)	Inclination of Nose (deg)	Depth to Top of Item (in/~~cm~~)	Digital Photo Number	2006 Date	Team Leader
76	MD	.5	30 mm	0				4.0		~~20~~ 19 Feb06	RW
77	MD	.5	20 mm	0				6.0			RW
78	S	1.0	Scrap *#74	0				4.0			RW
79	MD	.4	20 mm	0				4.0			RW
80			LIP	0				>12.0"			RW
81	MD	.6	20 mm	0				6.0			RW
82	MD	.7	20 mm	0				8.0			RW
83	MD	.4	20 mm	0				6.0			RW
84	MD	.7	20 mm	0				8.0			RW
85	MD	.2	20 mm	1.0				4.0			RW
86	MD	.1	20 mm	0				4.0			RW
87	S	.1	nail	1.0				2.0			RW
88	MD	.2	20 mm	1.0				4.0			RW
89	MD	.4	20 mm	0				6.0			RW
90	MD	.4	20 mm	0				4.0		20Feb06	RW

Geophysical Dig Sheet and Target History

GRID 4D Unique Target ID	DIG RESULTS										
	Anomaly Type ***	Approx. Weight (lbs/~~oz/kg g)~~	Comments (e.g., response below 1 foot)	Offset Distance (ft)	Offset Direction (N, NE, etc.)	Orientation of Nose (Azimuth deg)	Inclination of Nose (deg)	Depth to Top of Item (in/~~cm~~)	Digital Photo Number	2006 Date	Team Leader
91	MD	.8	20 mm	0				10.0		~~20~~ 19 Feb06	W
92	MD	.6	20 mm	0				6.0			W
93	MD	.6	20 mm	0.5				8.0			W
94	MD	1.4	20 mm X3	0				10.0			W
95	MD	1.2	30 mm x2	0				12.0			W
96	MD	.6	20 mm	0				6.0			W
97	MD	1.0	20 mm X2	0				8.0			W
98	MD	.8	20 mm	0				8.0			W
99	MD	.9	20 mm X2	0				10.0			W
100	MD	.6	20 mm	0				4.0			W
101	MD	.7	20 mm X2	0				6.0			W
102	MD	.2	20 mm	1.0				4.0			W
103			LIP	0				>12.0"			W
104			LIP	0				>12.0"			W
105	MD	.6	20 mm	0				6.0		~~20~~ 19 Feb06	W

Geophysical Dig Sheet and Target History

GRID 4D Unique Target ID	DIG RESULTS											
	Anomaly Type ***	Approx. Weight (lbs ~~oz/kg-g~~)	Comments (e.g., response below 1 foot)	Offset Distance (ft)	Offset Direction (N, NE, etc.)	Orientation of Nose (Azimuth deg)	Inclination of Nose (deg)	Depth to Top of Item (in/~~cm~~)	Digital Photo Number	2006 Date	Team Leader
106	MD	.3	20 mm	1.0				6.0		~~20~~ 19 Feb06	N
107	MD	.4	20 mm	0				6.0			N
108			LIP	0				>12.0"			N
109			LIP	0				>12.0"			N
110	MD	.5	20 mm	0				6.0			N
111	S	2.0	bolt & washers	0				10.0			N
112	MD	.7	20 mm	0				8.0			N
113			LIP	0				>12.0"			N
114	MD	.6	20 mm	0				6.0			N
115			LIP	0				>12.0"		~~20~~ 19 Feb06	N

Geophysical Dig Sheet and Target History

GRID 4D Unique Target ID	POST-DIG UXO QC RESULTS			POST-DIG PROJECT QC		
	Excavation Hole Cleared?	UXO QC Spec. Initials	Date	Agreement Between Dig Results & Geophysical Data? (G=good, P=poor, U=unacceptable)	Project QC Initials	Date
1	Yes	EWD	2/19/06	G	VAS	2-19-06
2						
3						
4						
5						
6						
7						
8						
9						
10	Yes	EWD	2/19/06	G	VAS	2-19-06
11						
12						
13						
14						
15						

Geophysical Dig Sheet and Target History

GRID 4D Unique Target ID	POST-DIG UXO QC RESULTS			POST-DIG PROJECT QC		
	Excavation Hole Cleared?	UXO QC Spec. Initials	Date	Agreement Between Dig Results & Geophysical Data? (G=good, P=poor, U=unacceptable)	Project QC Initials	Date
16						
17						
18						
19						
20	NO Deeper Than 12"	EMD	2/19/06	G	VAS	2-19-06
21						
22						
23						
24						
25						
26						
27						
28	Yes	EMD	2/19/06	G	VAS	2-19-06
29						
30						

Geophysical Dig Sheet and Target History

GRID 4D Unique Target ID	POST-DIG UXO QC RESULTS			POST-DIG PROJECT QC		
	Excavation Hole Cleared?	UXO QC Spec. Initials	Date	Agreement Between Dig Results & Geophysical Data? (G=good, P=poor, U=unacceptable)	Project QC Initials	Date
31						
32						
33						
34						
35						
36						
37						
38						
39						
40	Yes	[illegible]	2/19/06	G	VAS	2-19-06
41						
42						
43						
44						
45						

Geophysical Dig Sheet and Target History

GRID 4D Unique Target ID	POST-DIG UXO QC RESULTS			POST-DIG PROJECT QC		
	Excavation Hole Cleared?	UXO QC Spec. Initials	Date	Agreement Between Dig Results & Geophysical Data? (G=good, P=poor, U=unacceptable)	Project QC Initials	Date
46						
47						
48						
49						
50	Yes	EMD	2/19/06	G	VAS	2-19-06
51						
52						
53						
54						
55						
56						
57						
58						
59						
60	Yes	EMD	2/19/06	G	VAS	2-19-06

Geophysical Dig Sheet and Target History

GRID 4D Unique Target ID	POST-DIG UXO QC RESULTS			POST-DIG PROJECT QC		
	Excavation Hole Cleared?	UXO QC Spec. Initials	Date	Agreement Between Dig Results & Geophysical Data? (G=good, P=poor, U=unacceptable)	Project QC Initials	Date
61						
62						
63						
64						
65						
66						
67						
68						
69						
70	NO >12"	[illegible]	2/19/06	G	VAS	2-19-06
71						
72						
73						
74						
75						

Geophysical Dig Sheet and Target History

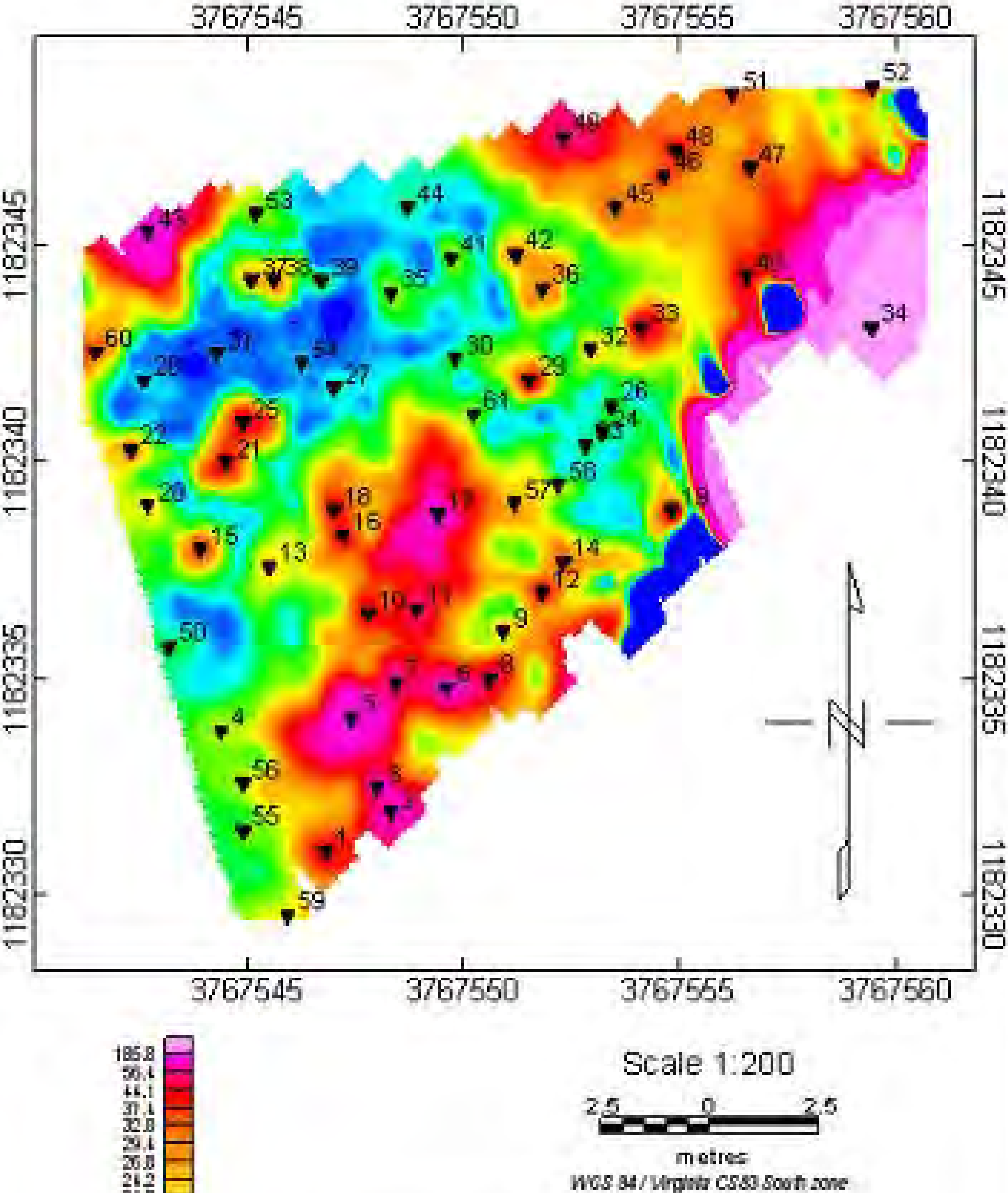
GRID 4D Unique Target ID	POST-DIG UXO QC RESULTS			POST-DIG PROJECT QC		
	Excavation Hole Cleared?	UXO QC Spec. Initials	Date	Agreement Between Dig Results & Geophysical Data? (G=good, P=poor, U=unacceptable)	Project QC Initials	Date
76						
77						
78						
79						
80	ND > 12"	E. MD	2/19/06	G	VAS	2-19-06
81						
82						
83						
84						
85						
86						
87						
88						
89						
90	Yes → [illegible]	E. MD	2/19/06	G	VAS	2-19-06

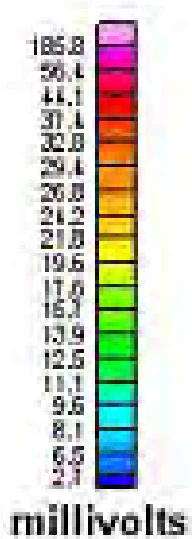
Geophysical Dig Sheet and Target History

GRID 4D Unique Target ID	POST-DIG UXO QC RESULTS			POST-DIG PROJECT QC		
	Excavation Hole Cleared?	UXO QC Spec. Initials	Date	Agreement Between Dig Results & Geophysical Data? (G=good, P=poor, U=unacceptable)	Project QC Initials	Date
91						
92						
93						
94						
95						
96						
97						
98						
99						
100	Yes	[illegible]	2/14/06	G	VAS	2-19-06
101						
102						
103						
104						
105						

Geophysical Dig Sheet and Target History

GRID 4D Unique Target ID	POST-DIG UXO QC RESULTS			POST-DIG PROJECT QC		
	Excavation Hole Cleared?	UXO QC Spec. Initials	Date	Agreement Between Dig Results & Geophysical Data? (G=good, P=poor, U=unacceptable)	Project QC Initials	Date
106						
107						
108						
109						
110	Yes	EUD	2/19/06	G	VAS	2-19-06
111						
112						
113						
114						
115	N/D >12"	EAD	2/19/06	G	VAS	2-19-06





NASA

Wallops Flight Center
EM61 MK2 Data
Grid 4E

February 9, 2006

Tetra Tech EM Inc.

Geophysical Dig Sheet and Target History

GRID 4E Unique Target ID	ORIGINAL SURVEY									
	Easting Coord. (m)	Northing Coord. (m)	Lat. Coord.	Long. Coord.	X - Local (Grid) Coord. (ft)	Y - Local (Grid) Coord. (ft)	Channel ID (i.e. C1, top senor, gradient)	Response Amplitude (mV)	Dig Priority	Date
46	3767554.6	1182346.6	37.56.15.14	-75.27.21.04	44.04	97.87	Z(1-4)	37.8		2/9/2006
47	3767556.6	1182346.8	37.56.15.14	-75.27.20.96	50.52	97.11	Z(1-4)	35.2		2/9/2006
48	3767554.9	1182347.2	37.56.15.15	-75.27.21.02	45.41	99.56	Z(1-4)	40.1		2/9/2006
49	3767552.3	1182347.5	37.56.15.17	-75.27.21.13	37.37	102.33	Z(1-4)	56.9		2/9/2006
50	3767543.19	1182335.74	37.56.14.80	-75.27.21.52	0.26	71.41	Z(1-4)	11.3		2/9/2006
51	3767556.19	1182348.48	37.56.15.19	-75.27.20.97	50.39	102.73	Z(1-4)	32.1		2/9/2006
52	3767559.42	1182348.66	37.56.15.20	-75.27.20.84	60.75	101.03	Z(1-4)	*		2/9/2006
53	3767545.2	1182345.73	37.56.15.12	-75.27.21.42	13.61	101.7	Z(1-4)	16.7		2/9/2006
54	3767546.24	1182342.29	37.56.15.00	-75.27.21.39	14.52	90.03	Z(1-4)	7.5		2/9/2006
55	3767544.89	1182331.51	37.56.14.66	-75.27.21.45	2.72	56.81	Z(1-4)	15.7		2/9/2006
56	3767544.89	1182332.6	37.56.14.69	-75.27.21.45	3.48	60.26	Z(1-4)	18.6		2/9/2006
57	3767551.16	1182339.07	37.56.14.89	-75.27.21.19	27.85	76.39	Z(1-4)	26.1		2/9/2006
58	3767552.18	1182339.47	37.56.14.91	-75.27.21.15	31.37	76.97	Z(1-4)	16.3		2/9/2006
59	3767545.91	1182329.54	37.56.14.59	-75.27.21.42	4.57	49.84	Z(1-4)	19.9		2/9/2006
60	3767541.49	1182342.54	37.56.15.02	-75.27.21.58	-0.37	94.15	Z(1-4)	33.3		2/9/2006

Geophysical Dig Sheet and Target History

GRID 4E Unique Target ID	ORIGINAL SURVEY									
	Easting Coord. (m)	Northing Coord. (m)	Lat. Coord.	Long. Coord.	X - Local (Grid) Coord. (ft)	Y - Local (Grid) Coord. (ft)	Channel ID (i.e. C1, top senor, gradient)	Response Amplitude (mV)	Dig Priority	Date
61	3767550.2	1182341.11	37.56.14.96	-75.27.21.22	26.25	✓ 83.53	Z(1-4)	16.5		2/9/2006

Note: *Fill in Acceptable Units (mV, nT/m, ppt, etc).

**Optional field – refer to SOW for applicability to specific project.

***For Anomaly type, U = UXO, F = frag, MD = munitions debris, S = scrap, A = small arms ammunition, NC = no contact, O = other.

Geophysical Dig Sheet and Target History

GRID 4E Unique Target ID	ORIGINAL SURVEY									
	Easting Coord. (m)	Northing Coord. (m)	Lat. Coord.	Long. Coord.	X - Local (Grid) Coord. (ft)	Y - Local (Grid) Coord. (ft)	Channel ID (i.e. C1, top senor, gradient)	Response Amplitude (mV)	Dig Priority	Date
1	3767546.8	1182331	37.56.14.64	-75.27.21.38	8.4	53.85	Z(1-4)	44.4		2/9/2006
2	3767548.3	1182331.9	37.56.14.67	-75.27.21.31	13.79	55.66	Z(1-4)	70		2/9/2006
3	3767548	1182332.5	37.56.14.68	-75.27.21.33	13.26	57.77	Z(1-4)	68.3		2/9/2006
4	3767544.4	1182333.8	37.56.14.73	-75.27.21.47	2.75	64.41	Z(1-4)	18.2		2/9/2006
5	3767547.4	1182334.1	37.56.14.74	-75.27.21.35	12.47	63.26	Z(1-4)	102.4		2/9/2006
6	3767549.6	1182334.8	37.56.14.76	-75.27.21.26	19.94	63.95	Z(1-4)	72.1		2/9/2006
7	3767548.4	1182334.9	37.56.14.76	-75.27.21.31	16.2	65.1	Z(1-4)	57.8		2/9/2006
8	3767550.6	1182335	37.56.14.76	-75.27.21.22	23.25	63.88	Z(1-4)	49.8		2/9/2006
9	3767550.9	1182336.1	37.56.14.80	-75.27.21.20	24.97	67.16	Z(1-4)	24.1		2/9/2006
10	3767547.8	1182336.5	37.56.14.81	-75.27.21.33	15.42	70.59	Z(1-4)	48.7		2/9/2006
11	3767548.9	1182336.6	37.56.14.82	-75.27.21.28	18.97	70.14	Z(1-4)	51.2		2/9/2006
12	3767551.8	1182337	37.56.14.83	-75.27.21.16	28.45	69.39	Z(1-4)	45.3		2/9/2006
13	3767545.5	1182337.6	37.56.14.85	-75.27.21.42	8.89	75.69	Z(1-4)	22.3		2/9/2006
14	3767552.3	1182337.7	37.56.14.85	-75.27.21.14	30.52	71.26	Z(1-4)	33.6		2/9/2006
15	3767543.9	1182338	37.56.14.87	-75.27.21.49	4.1	78.08	Z(1-4)	41.5		2/9/2006

Geophysical Dig Sheet and Target History

GRID 4E Unique Target ID	ORIGINAL SURVEY									
	Easting Coord. (m)	Northing Coord. (m)	Lat. Coord.	Long. Coord.	X - Local (Grid) Coord. (ft)	Y - Local (Grid) Coord. (ft)	Channel ID (i.e. C1, top senor, gradient)	Response Amplitude (mV)	Dig Priority	Date
16	3767547.2	1182338.3	37.56.14.87	-75.27.21.35	14.77	76.72	Z(1-4)	43.4		2/9/2006
17	3767549.4	1182338.8	37.56.14.89	-75.27.21.26	22.1	76.77	Z(1-4)	84		2/9/2006
18	3767547	1182338.9	37.56.14.89	-75.27.21.36	14.56	78.76	Z(1-4)	41.2		2/9/2006
19	3767554.8	1182338.9	37.56.14.89	-75.27.21.04	39.29	73.31	Z(1-4)	46.7		2/9/2006
20	3767542.7	1182339	37.56.14.90	-75.27.21.53	0.99	82.09	Z(1-4)	21.2		2/9/2006
21	3767544.5	1182340	37.56.14.93	-75.27.21.46	7.4	84	Z(1-4)	41.7		2/9/2006
22	3767542.3	1182340.3	37.56.14.94	-75.27.21.55	0.63	86.49	Z(1-4)	28.5		2/9/2006
23	3767552.8	1182340.4	37.56.14.94	-75.27.21.12	34	79.47	Z(1-4)	12.2		2/9/2006
24	3767553.2	1182340.7	37.56.14.95	-75.27.21.10	35.47	80.14	Z(1-4)	12		2/9/2006
25	3767544.9	1182340.9	37.56.14.96	-75.27.21.44	9.29	86.57	Z(1-4)	48.8		2/9/2006
26	3767553.4	1182341.3	37.56.14.96	-75.27.21.09	36.53	81.9	Z(1-4)	12.7		2/9/2006
27	3767547	1182341.7	37.56.14.98	-75.27.21.36	16.51	87.64	Z(1-4)	10.5		2/9/2006
28	3767542.6	1182341.9	37.56.15.00	-75.27.21.53	2.7	91.35	Z(1-4)	8.2		2/9/2006
29	3767551.5	1182341.9	37.56.14.99	-75.27.21.17	30.92	85.13	Z(1-4)	46		2/9/2006
30	3767549.8	1182342.4	37.56.15.00	-75.27.21.24	25.88	87.91	Z(1-4)	13.1		2/9/2006

Geophysical Dig Sheet and Target History

GRID 4E Unique Target ID	ORIGINAL SURVEY									
	Easting Coord. (m)	Northing Coord. (m)	Lat. Coord.	Long. Coord.	X - Local (Grid) Coord. (ft)	Y - Local (Grid) Coord. (ft)	Channel ID (i.e. C1, top senor, gradient)	Response Amplitude (mV)	Dig Priority	Date
31	3767544.3	1182342.5	37.56.15.01	-75.27.21.46	8.51	92.07	Z(1-4)	8.2		2/9/2006
32	3767552.9	1182342.6	37.56.15.01	-75.27.21.11	35.85	86.38	Z(1-4)	24.3		2/9/2006
33	3767554.1	1182343.1	37.56.15.02	-75.27.21.06	40.01	87.12	Z(1-4)	52.8		2/9/2006
34	3767559.4	1182343.1	37.56.15.02	-75.27.20.85	56.81	83.42	Z(1-4)	27188		2/9/2006
35	3767548.3	1182343.9	37.56.15.05	-75.27.21.30	22.17	93.71	Z(1-4)	16.3		2/9/2006
36	3767551.8	1182344	37.56.15.05	-75.27.21.16	33.34	91.58	Z(1-4)	29.3		2/9/2006
37	3767545.1	1182344.2	37.56.15.07	-75.27.21.43	12.23	96.9	Z(1-4)	27.1		2/9/2006
38	3767545.6	1182344.2	37.56.15.07	-75.27.21.41	13.82	96.55	Z(1-4)	27.9		2/9/2006
39	3767546.7	1182344.2	37.56.15.07	-75.27.21.36	17.31	95.78	Z(1-4)	14.1		2/9/2006
40	3767556.5	1182344.3	37.56.15.06	-75.27.20.96	48.45	89.25	Z(1-4)	44		2/9/2006
41	3767549.7	1182344.7	37.56.15.08	-75.27.21.24	27.17	95.27	Z(1-4)	17.1		2/9/2006
42	3767551.2	1182344.8	37.56.15.08	-75.27.21.18	32	94.54	Z(1-4)	31.1		2/9/2006
43	3767542.7	1182345.3	37.56.15.11	-75.27.21.53	5.39	102.06	Z(1-4)	89.9		2/9/2006
44	3767548.7	1182345.9	37.56.15.12	-75.27.21.28	24.84	99.77	Z(1-4)	11.2		2/9/2006
45	3767553.5	1182345.9	37.56.15.11	-75.27.21.08	40.06	96.42	Z(1-4)	31.6		2/9/2006

Geophysical Dig Sheet and Target History

GRID 4E Unique Target ID	REACQUISITION SURVEY				
	Geophysical Instrument **	GPS Instrument**	Date	Comment	Response Amplitude (units*)**
1	Schondstedt	NA	2-19-06	used x/y coordinates to locate targets	NA
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					
14					
15					

Geophysical Dig Sheet and Target History

GRID 4E Unique Target ID	REACQUISITION SURVEY				
	Geophysical Instrument **	GPS Instrument**	Date	Comment	Response Amplitude (units*)**
16	Schondstedt	NA	2-19-06	used x, y coordinates to locate targets	NA
17					
18					
19					
20					
21					
22					
23					
24					
25					
26					
27					
28					
29					
30					

Geophysical Dig Sheet and Target History

GRID 4E Unique Target ID	REACQUISITION SURVEY				
	Geophysical Instrument **	GPS Instrument**	Date	Comment	Response Amplitude (units*)**
31	Schondstedt	NA	2-19-06	used x/y coordinates to locate targets	NA
32					
33					
34					
35					
36					
37					
38					
39					
40					
41					
42					
43					
44					
45					

Geophysical Dig Sheet and Target History

GRID 4E Unique Target ID	REACQUISITION SURVEY				
	Geophysical Instrument **	GPS Instrument**	Date	Comment	Response Amplitude (units*)**
46	Schonstedt	NA	2-19-06	used x/y coordinates to locate targets	NA
47					
48					
49					
50					
51					
52					
53					
54					
55					
56					
57					
58					
59					
60					

Geophysical Dig Sheet and Target History

GRID 4E Unique Target ID	REACQUISITION SURVEY				
	Geophysical Instrument **	GPS Instrument**	Date	Comment	Response Amplitude (units*)**
61					

Geophysical Dig Sheet and Target History

GRID 4E Unique Target ID	DIG RESULTS										
	Anomaly Type ***	Approx. Weight (lbs-~~oz/kg-g~~)	Comments (e.g., response below 1 foot)	Offset Distance (ft)	Offset Direction (N, NE, etc.)	Orientation of Nose (Azimuth deg)	Inclination of Nose (deg)	Depth to Top of Item (in/~~cm~~)	Digital Photo Number	2006 Date	Team Leader
1			LIP	0				>12.0"		20Feb06	[illegible]
2	MD	.7	20 mm	0				8.0			[illegible]
3	MD	.7	20 mm	0				8.0			[illegible]
4	MD	.5	20 mm	0				6.0			[illegible]
5			LIP	0				>12.0"			[illegible]
6	S	.6	board w/ nails	0				6.0			[illegible]
7	MD	.7	20 mm	0				6.0			[illegible]
8	MD	1.1	20 mm x2	0				10.0			[illegible]
9	S	.1	nail	1.0				2.0			[illegible]
10	S	.1	wire	1.0				1.0			[illegible]
11	MD	.6	20 mm	0				4.0			[illegible]
12	MD	.8	20 mm x2	0				8.0			[illegible]
13			LIP	0				>12.0"			[illegible]
14	MD	.2	20 mm	1.0				4.0			[illegible]
15	MD	.3	20 mm	0				4.0		20Feb06	[illegible]

Geophysical Dig Sheet and Target History

GRID 4E Unique Target ID	DIG RESULTS										
	Anomaly Type ***	Approx. Weight (lbs/~~oz/kg/g~~)	Comments (e.g., response below 1 foot)	Offset Distance (ft)	Offset Direction (N, NE, etc.)	Orientation of Nose (Azimuth deg)	Inclination of Nose (deg)	Depth to Top of Item (in/~~cm~~)	Digital Photo Number	2006 Date	Team Leader
16	S	.1	Scrap	1.0				1.0		20 Feb 06	[illegible]
17	MD	.4	20 mm	0				2.0			[illegible]
18	S	.1	Scrap	1.0				2.0			[illegible]
19	MD	.7	20 mm	0				8.0			[illegible]
20	MD	.5	20 mm	0				6.0			[illegible]
21			LIP	0				>12.0"			[illegible]
22	MD	.6	20 mm	0				6.0			[illegible]
23	MD	.5	20 mm	0				6.0			[illegible]
24	MD	.2	20 mm	1.0				4.0			[illegible]
25	MD	.6	20 mm	0				6.0			[illegible]
26	MD	.2	20 mm	1.0				2.0			[illegible]
27	S	.1	Scrap	1.0				2.0			[illegible]
28	MD	.7	20 mm	0				8.0			[illegible]
29	MD	.8	20 mm	0				10.0			[illegible]
30	S	.1	Scrap	1.0				2.0		20 Feb 06	[illegible]

Geophysical Dig Sheet and Target History

GRID 4E Unique Target ID	DIG RESULTS										
	Anomaly Type ***	Approx. Weight (lbs/~~oz/kg/g~~)	Comments (e.g., response below 1 foot)	Offset Distance (ft)	Offset Direction (N, NE, etc.)	Orientation of Nose (Azimuth deg)	Inclination of Nose (deg)	Depth to Top of Item (in/~~cm~~)	Digital Photo Number	2006 Date	Team Leader
31	MD	.2	20 mm	1.0				2.0		20 Feb 06	[illegible]
32			LIP	0				>12.0"			[illegible]
33	S	.4	Scrap	0				4.0			[illegible]
34			LIP	0				>12.0"			[illegible]
35	MD	.5	20 mm	0				6.0			[illegible]
36	MD	.4	20 mm	0				4.0			[illegible]
37	MD	.5	20 mm	0				6.0			[illegible]
38	MD	.3	20 mm	1.0				2.0			[illegible]
39			LIP	0				>12.0"			[illegible]
40			LIP	0				>12.0"			[illegible]
41	MD	.3	20 mm	0				2.0			[illegible]
42	MD	.2	20 mm	1.0				4.0			[illegible]
43	MD	.5	20 mm	0				4.0			[illegible]
44			LIP	0				>12.0"			[illegible]
45			LIP	0				>12.0"		20 Feb 06	[illegible]

Geophysical Dig Sheet and Target History

GRID 4E Unique Target ID	DIG RESULTS										
	Anomaly Type ***	Approx. Weight (lbs-~~oz/kg-g~~)	Comments (e.g., response below 1 foot)	Offset Distance (ft)	Offset Direction (N, NE, etc.)	Orientation of Nose (Azimuth deg)	Inclination of Nose (deg)	Depth to Top of Item (in/~~cm~~)	Digital Photo Number	2006 Date	Team Leader
46			LIP	0				>12.0"		20 Feb06	[illegible]
47	S	.3	Scrap	0				4.0			[illegible]
48	S	.2	nail	1.0				4.0			[illegible]
49	MD	.6	20 mm	0				2.0			[illegible]
50	S	.1	Scrap	1.0				4.0			[illegible]
51			LIP	0				>12.0"			[illegible]
52			LIP	0				>12.0"			[illegible]
53			LIP	0				>12.0"			[illegible]
54	S	.1	Scrap	1.0				2.0			[illegible]
55	S	.1	Scrap	1.0				4.0			[illegible]
56	MD	.3	20 mm	0				6.0			[illegible]
57	S	.2	Scrap	1.0				2.0			[illegible]
58			LIP	0				>12.0"			[illegible]
59			LIP	0				>12.0"			[illegible]
60	MD	.5	20 mm	0				6.0		20 Feb06	[illegible]

Geophysical Dig Sheet and Target History

GRID 4E Unique Target ID	DIG RESULTS										
	Anomaly Type ***	Approx. Weight (lbs ~~oz/kg g~~)	Comments (e.g., response below 1 foot)	Offset Distance (ft)	Offset Direction (N, NE, etc.)	Orientation of Nose (Azimuth deg)	Inclination of Nose (deg)	Depth to Top of Item (in ~~/cm~~)	Digital Photo Number	2006 Date	Team Leader
61	MD	.8	20 mm	0				10.0		20 Feb 06	[illegible]

Geophysical Dig Sheet and Target History

GRID 4E Unique Target ID	POST-DIG UXO QC RESULTS			POST-DIG PROJECT QC		
	Excavation Hole Cleared?	UXO QC Spec. Initials	Date	Agreement Between Dig Results & Geophysical Data? (G=good, P=poor, U=unacceptable)	Project QC Initials	Date
1	NO Deeper Than 12"	EMD	2/20/06	G	VAS	2-20-06
2						
3						
4						
5						
6						
7						
8						
9						
10	Yes	EMD	2/20/06	G	VAS	2-20-06
11						
12						
13						
14						
15						

Geophysical Dig Sheet and Target History

GRID 4E Unique Target ID	POST-DIG UXO QC RESULTS			POST-DIG PROJECT QC		
	Excavation Hole Cleared?	UXO QC Spec. Initials	Date	Agreement Between Dig Results & Geophysical Data? (G=good, P=poor, U=unacceptable)	Project QC Initials	Date
16						
17						
18						
19						
20	Yes	EMD	2/20/06	G	VAS	2-20-06
21						
22						
23						
24						
25						
26						
27						
28						
29						
30	Yes	EMD	2/20/06	G	VAS	2-20-06

Geophysical Dig Sheet and Target History

GRID 4E Unique Target ID	POST-DIG UXO QC RESULTS			POST-DIG PROJECT QC		
	Excavation Hole Cleared?	UXO QC Spec. Initials	Date	Agreement Between Dig Results & Geophysical Data? (G=good, P=poor, U=unacceptable)	Project QC Initials	Date
31						
32						
33						
34						
35						
36						
37						
38						
39						
40	NO Deeper than 12"	EMD	2/20/06	G	VAS	2-20-06
41						
42						
43						
44						
45						

Geophysical Dig Sheet and Target History

GRID 4E Unique Target ID	POST-DIG UXO QC RESULTS Excavation Hole Cleared?	UXO QC Spec. Initials	Date	POST-DIG PROJECT QC Agreement Between Dig Results & Geophysical Data? (G=good, P=poor, U=unacceptable)	Project QC Initials	Date
46						
47						
48						
49						
50	Yes	[illegible]	2/20/06	G	VAS	2-20-06
51						
52						
53						
54						
55						
56						
57						
58						
59						
60	Yes	[illegible]	2/20/06	G	VAS	2-20-06

Geophysical Dig Sheet and Target History

GRID 4E	POST-DIG UXO QC RESULTS			POST-DIG PROJECT QC		
Unique Target ID	Excavation Hole Cleared?	UXO QC Spec. Initials	Date	Agreement Between Dig Results & Geophysical Data? (G=good, P=poor, U=unacceptable)	Project QC Initials	Date
61						

APPENDIX E

EXPLOSIVE CONSUMPTION CERTIFICATE

(ON CD)

AMMUNITION CONSUMPTION CERTIFICATE

For use of this form, see AR 710-2-1, the proponent agency is DCSLOG

UNIT		RANGE AND LOCATION
TetraTech NUS		Wallops Flight Facility Visitor Center
DOCUMENT NO.	DATE	
	Feb 22, 06	

ITEM	DODIC	NOMENCLATURE	LOT NUMBER	QUANTITY CONSUMED
1		16 Ft. Nonel shock Tube with Caps		25 each
2		Nonel shock Tube		2,500 Ft. (1 roll)
3		Helix 1.1 lb Binary Charges		24 each.

No Further entries

CERTIFYING OFFICIAL

I certify that I saw the above items consumed during training on *(indicate date)* → DATE 2/22/06

NAME *(Typed or Printed)*	SIGNATURE
Edward G. Deibert	Edward G Deibert
UNIT	POSITION
Tetra Tech NUS	54X05

DA FORM 5692-R, MAY 88

USAPPC V1.00

APPENDIX F

MUNITIONS CERTIFICATION FORM

(ON CD)

CALCULATION WORKSHEET Order No. 19116 (01-91) Tetra Tech NUS

CLIENT: NASA Wallops Flight Facility	JOB NUMBER: CTO-36 Visitor Center Site
SUBJECT: Scrap Munitions Debris	
BASED ON	DRAWING NUMBER

BY	CHECKED BY	APPROVED BY	DATE
			2-22-06

Items

One 55-gallon drum (½ full) containing scrap 20mm and 30mm Fragments / projectiles

Drum has been under custody of Ed Deibert during length of all site activities and has been maintained under lock / Key onsite.

We(I) certify that the munitions debris have been 100% inspected and to the best of our Knowledge and belief, are inert and or free of explosives or related material.

Edward G Deibert Edward M Deibert 7576725128

MARK D. SOHA Mark D. Soha (c)321-431-1768

All activities at the NASA Wallops Flight Facility Visitor Center Site were conducted by Tetra Tech NUS.
Address: 600 Clark Avenue, King of Prussia, PA. 19406
Contact: Garth Glenn (610) 491-9688.

SITE INSPECTION REPORT FOR WALLOPS FLIGHT FACILITY, PROJECT 07, ACCOMACK COUNTY, VIRGINIA (HUMAN FACTORS APPLICATIONS, INC., 2012)

FINAL

Site Inspection Report for Wallops Flight Facility Project 07, Accomack County, Virginia

DERP FUDS Project No. **C03VA030107**

Prepared for:
U.S. Army Engineering and Support Center, Huntsville
4280 University Square
Huntsville, AL 35807

U.S. Army Corps of Engineers, Baltimore District
City Crescent Building
10 S. Howard St. 10th Floor
Baltimore, MD 21201

U.S. Army Corps of Engineers, Norfolk District
803 Front Street
Norfolk, Virginia 23510

Boat Basin at MRS 7

The views, opinions, and/or findings contained in this report are those of the author(s) and should not be construed as an official Department of the Army position, policy, or decision, unless so designated by other documentation.

June 2012

FINAL

Site Inspection Report for Wallops Flight Facility Project 07, Accomack County, Virginia

MMRP Project No. **C03VA030107**

Prepared Under: **Contract No. W912DY-04-D-0017**
Task Order # 00170001

Prepared for:

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Norfolk, Virginia 23510

Prepared by:

TerranearPMC, LLC/Human Factors Applications, Inc.
560 Herndon Parkway, Suite 120
Herndon, Virginia 20170

June 29, 2012

Cheryl Pruiett Gannon — Date
Deputy Program Manager

June 29, 2012

Curtis Mitchell — Date
Corporate Quality Management Reviewer

June 2012

CONTRACTOR STATEMENT OF AUTHORSHIP AND INDEPENDENT TECHNICAL REVIEW

Human Factors Applications, Inc. (HFA), a wholly-owned subsidiary of TerranearPMC, LLC (TPMC), prepared this Site Inspection Report for Wallops Flight Facility (WFF) Project 07, Formerly Used Defense Site (FUDS), Project No. C03VA030107. An independent technical review has been conducted that is appropriate to the level of risk and complexity inherent in the project, as defined in the Programmatic Work Plan. During the independent technical review, compliance with established policy principles and procedures, utilizing justified and valid assumptions, was verified. This included review of assumptions; methods, procedures, and material used in analyses; the appropriateness of data used and level of data obtained; and reasonableness of the results, including whether the product meets the customer's needs consistent with existing Corps policy. In accordance with Corps requirements, significant authors to this report are presented below.

AUTHORS / REVIEWERS	**DATE**	**SIGNATURE**
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Jim Lape Risk Assessor Integral Consulting, Inc. (Under contract to TPMC/HFA)	6/29/2012	James F. Lape, Jr.
Curtis "Rusty" Mitchell Corporate Quality Management Reviewer TPMC/HFA	6/29/2012	
Gerald Moore, P.G. Independent Technical Review Team Leader TPMC/HFA	6/29/2012	

Significant concerns and explanation of the resolutions are documented within the project file.

TABLE OF CONTENTS

LIST OF APPENDICES

LIST OF TABLES

LIST OF FIGURES

LIST OF ACRONYMS AND ABBREVIATIONS

ADR	Automated Data Review
Alion	Alion Science and Technology Corporation
AN	Standardized for Army and Navy
AP	Armor-Piercing
ASR	Archives Search Report
BG	Background
bgs	Below ground surface
BHG-1	Borehole Gradiometer
°C	Degrees Celsius
CAS	Chemical Abstract Service
CDQAR	Chemical Data Quality Assessment Report
CENAB	Corps of Engineers North Atlantic Division Baltimore District
CENAO	Corps of Engineers North Atlantic Division Norfolk District
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CHE	Chemical Warfare Materiel Hazard Evaluation
CONUS	Continental United States
COPC	Chemical of Potential Concern
COPEC	Chemical of Potential Ecological Concern
CNAAS	Chincoteague Naval Auxiliary Air Station
CQAR	Chemical Quality Assurance Report
CSM	Conceptual Site Model
CTT	Closed Transferring and Transferred
CWM	Chemical Warfare Materiel
CX	Center of Expertise
DA	Department of the Army
DC	Design Center
DCR	Department of Conservation and Recreation
DERP	Defense Environmental Restoration Program
DMM	Discarded Military Munitions
DNT	Dinitrotoluene
DoD	Department of Defense
DoI	Department of Interior
DQI	Data Quality Indicator
DQO	Data Quality Objective
Eco-SSL	Ecological Soil Screening Level
EDD	Electronic Data Deliverable
EDMS	Environmental Data Management Systems
EDS	Environmental Data Services, Inc.

LIST OF ACRONYMS AND ABBREVIATIONS

EHE	Explosive Hazard Evaluation
EM	Engineering Manual
EOD	Explosive Ordnance Disposal
EP	Engineering Pamphlet
ER	Engineering Regulation
°F	Degree (s) Fahrenheit
FDE	Findings of Determination and Eligibility
ft	Foot or Feet
FUDS	Formerly Used Defense Site(s)
FUDSMIS	FUDS Management Information System
GIS	Geographic Information Systems
GPS	Global Positioning System
HFA	Human Factors Applications, Inc.
HHE	Health Hazard Evaluation
HHRA	Human Health Risk Assessment
HRS	Hazard Ranking System
HTRW	Hazardous Toxic and Radioactive Waste
HQ	Hazard Quotient
ID	Identification
IDW	Investigative Derived Waste
In.	Inch (es)
Inc.	Incorporated
INPR	Inventory Project Report
ITRC	Interstate Technology and Regulatory Council
J	Analyte is present. Reported value may not be accurate or precise.
K	Analyte is present and that the reported value may be biased high
K_{ow}	Octanol-water partitioning coefficient
L	Analyte is present and that the reported value may be biased low
LLC	Limited Liability Company
LOQ	Limit of Quantitation
Ltd.	Limited
m	Meter
MC	Munitions Constituents
MCL	Maximum Contaminant Level
MD	Munitions Debris
MDL	Method Detection Limit

LIST OF ACRONYMS AND ABBREVIATIONS

MEC	Munitions and Explosives of Concern
mg/kg	Milligram per kilogram
mi	mile(s)
Mk	Mark
mm	millimeter(s)
MMRP	Military Munitions Response Program
Mod	Model
MPPEH	Material Potentially Presenting an Explosive Hazard
MQO	Measurement Quality Objective
MRA	Munitions Response Area
MRS	Munitions Response Site
MRSPP	Munitions Response Site Prioritization Protocol
MS/MSD	Matrix Spike/Matrix Spike Duplicate
Msl	Mean Sea Level
NAAS	Naval Auxiliary Air Station
NACA	National Advisory Committee for Aeronautics
NAD	North American Datum
NAOTS	Naval Aviation Ordnance Test Station
NASA	National Aeronautics and Space Administration
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
ND	No Detection
NDAI	No Department of Defense Action Indicated
NG	Nitroglycerin
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NSL	No Screening Level
NTCRA	Non-Time Critical Removal Action
NWIS	National Water Information System
PA	Preliminary Assessment
PAH	Polycyclic Aromatic Hydrocarbon
PFSP	Programmatic Field Sampling Plan
PGM	Program Manager
PM	Project Manager
PMMQL	Preferred Maximum Method Quantitation Limits
PWP	Programmatic Work Plan
PWS	Performance Work Statement
QA	Quality Assurance
QC	Quality Control
QR	Qualitative Reconnaissance
QSM	Quality Systems Manual

LIST OF ACRONYMS AND ABBREVIATIONS

R	Analyte is rejected. Reported value may or may not be present.
RAC	Risk Assessment Code
RDX	Hexahydro-1,3,5-trinitro-1,3,5-triazine
RI/FS	Remedial Investigation/Feasibility Study
RL	Reporting Limit
RMIS	Restoration Management Information System
RPD	Relative Percent Difference
RSL	USEPA Regional Screening Level
SEDD	Staged Electronic Data Deliverable
SHPO	State Historic Preservation Office
SI	Site Inspection
SLERA	Screening Level Ecological Risk Assessment
SS	Surface Soil
SSL	Soil Screening Level
SS-WP	Final Site-Specific Work Plan Addendum to the MMRP Programmatic Work Plan for the Site Inspection of WFF Project 07
T&E	Threatened and Endangered
TAL	Target Analyte List
Tetryl	Methyl-2,4,6-trinitrophenylnitramine
TNT	Trinitrotoluene
ToC	Town of Chincoteague
TPMC	TerranearPMC, LLC
TCRA	Time Critical Removal Action
TPP	Technical Project Planning
U	Not detected
UJ	Not detected. The associated detection limit is an estimate and may be inaccurate or imprecise. Value are reporting limits (RLs)
UL	Not detected. The quantitation limit may actually be higher.
U.S.	United States
USACE	U.S. Army Corps of Engineers
USAESCH	U.S. Army Engineering and Support Center, Huntsville
USDA	U.S. Department of Agriculture
USEPA	U.S. Environmental Protection Agency
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
UTM	Universal Transverse Mercator
UXO	Unexploded Ordnance
VDEQ	Virginia Department of Environmental Quality
VDGIF	Virginia Department of Game and Inland Fisheries

LIST OF ACRONYMS AND ABBREVIATIONS

WFF	Wallops Flight Facility
WOE	Weight-of-Evidence

GLOSSARY OF TERMS

Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) – Congress enacted CERCLA, commonly known as Superfund, on 11 December 1980. This law created a tax on the chemical and petroleum industries and provided broad Federal authority to respond directly to releases or threatened releases of hazardous substances that may endanger public health or the environment (USACE 2004b).

Discarded Military Munitions (DMM) – Military munitions that have been abandoned without proper disposal or removed from storage in a military magazine or other storage area for the purpose of disposal. The term does not include unexploded ordnance, military munitions that are being held for future use or planned disposal, or military munitions that have been properly disposed of, consistent with applicable environmental laws and regulations. (10 USC 2710(e)(2)) (Department of the Army [DA] 2005).

Explosive Ordnance Disposal (EOD) – The detection, identification, on-site evaluation, rendering safe, recovery, and final disposal of unexploded explosive ordnance and of other munitions that have become an imposing danger, for example, by damage or deterioration (DA 2005).

Explosives Safety – A condition where operational capability and readiness, people, property, and the environment are protected from the unacceptable effects or risks of potential mishaps involving military munitions (DA 2005).

Formerly Used Defense Site (FUDS) – A FUDS is defined as a facility or site (property) that was under the jurisdiction of the Secretary of Defense and owned by, leased to, or otherwise possessed by the United States at the time of actions leading to contamination by hazardous substances. By the Department of Defense Environmental Restoration Program (DERP) policy, the FUDS program is limited to those real properties that were transferred from Department of Defense (DoD) control prior to 17 October 1986. FUDS properties can be located within the 50 States, District of Columbia, Territories, Commonwealths, and possessions of the United States. ER 200-3-1 (May 10, 2004).

Material Potentially Presenting an Explosive Hazard (MPPEH) – Material potentially containing explosives or munitions (e.g., munitions containers and packaging material; munitions debris remaining after munitions use, demilitarization, or disposal; and range-related debris); or material potentially containing a high enough concentration of explosives such that the material presents an explosive hazard (e.g., equipment, drainage systems, holding tanks, piping, or ventilation ducts that were associated with munitions production, demilitarization or disposal operations). Excluded from MPPEH are munitions within DoD's established munitions management system and other hazardous items that may present explosion hazards (e.g., gasoline cans, compressed gas cylinders) that are not munitions and are not intended for use as munitions (DA 2005).

GLOSSARY OF TERMS

Military Munitions – All ammunition products and components produced for or used by the armed forces for national defense and security, including ammunition products or components under the control of the DoD, the Coast Guard, the Department of Energy, and the National Guard. The term includes confined gaseous, liquid, and solid propellants; explosives, pyrotechnics, chemical and riot control agents, smokes, and incendiaries, including bulk explosives, and chemical warfare agents; chemical munitions, rockets, guided and ballistic missiles, bombs, warheads, mortar rounds, artillery ammunition, small arms ammunition, grenades, mines, torpedoes, depth charges, cluster munitions and dispensers, demolition charges; and devices and components thereof. The term does not include wholly inert items; improvised explosive devices; and nuclear weapons, nuclear devices, and nuclear components, other then nonnuclear components of nuclear devices that are managed under the nuclear weapons program of the Department of Energy after all required sanitization operations under the Atomic Energy Act of 1954 (42 USC 2011 et seq.) have been completed. (10 USC 101(e)(4)(A) through (C)) (DA 2005).

Munitions and Explosives of Concern (MEC) – This term, which distinguishes specific categories of military munitions that may pose unique explosives safety risks means: (A) Unexploded ordnance (UXO), as defined in 10 USC 101(e)(5); (B) DMM, as defined in 10 USC 2710(e)(2); or (C) Munitions constituents (e.g., trinitrotoluene, hexahydro-1,3,5-trinitro-1,3,5-triazine), as defined in 10 USC 2710(e)(3), present in high enough concentrations to pose an explosive hazard (DA 2005).

Munitions Constituents (MC) – Any materials originating from UXO, DMM, or other military munitions, including explosive and non-explosive materials, and emission, degradation, or breakdown elements of such ordnance or munitions. (10 USC 2710(e)(3)) (DA 2005).

Munitions Debris (MD) – Remnants of munitions (e.g., fragments, penetrators, projectiles, shell casings, links, fins) remaining after munitions use, demilitarization, or disposal (DA 2005).

Munitions Response Area (MRA) – Any area on a defense site that is known or suspected to contain UXO, DMM, or MC. Examples include former ranges and munitions burial areas. A munitions response area is comprised of one or more munitions response sites (32 Code of Federal Regulations [CFR] 179.3).

Munitions Response Site (MRS) – A discrete location within a Munitions Response Area that is known to require a munitions response (32 CFR 179.3).

GLOSSARY OF TERMS

Munitions Response Site Prioritization Protocol (MRSPP) – The MRSPP was published as a rule on 5 October 2005. This rule implements the requirement established in Section 311(b) of the National Defense Authorization Act for Fiscal Year 2002 for the DoD to assign a relative priority for munitions responses to each location in the DoD's inventory of defense sites known or suspected of containing UXO, DMM, or MC. The DoD adopted the MRSPP under the authority of 10 USC 2710(b). Provisions of 10 USC 2710(b) require that the DoD assign to each defense site in the inventory a relative priority for response activities based on the overall conditions at each location and taking into consideration various factors related to safety and environmental hazards.

Non-Time Critical Removal Action (NTCRA) – Actions initiated in response to a release or threat of a release that poses a risk to human health or the environment where more than six months planning time is available (USACE 2007).

Range – A designated land or water area that is set aside, managed, and used for range activities of the DoD. The term includes firing lines and positions, maneuver areas, firing lanes, test pads, detonation pads, impact areas, electronic scoring sites, buffer zones with restricted access and exclusionary areas. The term also includes airspace areas designated for military use in accordance with regulations and procedures prescribed by the Administrator of the Federal Aviation Administration. (10 USC 101(e)(1)(A) and (B)) (DA 2005).

Range Activities – Research, development, testing, and evaluation of military munitions, other ordnance, and weapons systems; and the training of members of the armed forces in the use and handling of military munitions, other ordnance, and weapons systems. (10 USC 101(e)(2)(A) and (B)) (DA 2005).

Range Related Debris – Debris, other than munitions debris, collected from operational ranges or from former ranges (e.g. target debris, military munitions packaging, and crating material).

Risk Assessment Code (RAC) – An expression of the risk associated with a hazard. The RAC combines the hazard severity and accident probability into a single Arabic number on a scale from 1 to 5, with 1 being the greatest risk and 5 the lowest risk. The RAC is used to prioritize response actions (USACE 2004b).

Time Critical Removal Action (TCRA) – Removal actions conducted to respond to an imminent danger posed by the release or threat of a release, where cleanup or stabilization actions must be initiated within 6 months to reduce risk to public health or the environment (DA 2005).

Unexploded Ordnance (UXO) – Military munitions that (A) have been primed, fuzed, armed, or otherwise prepared for action; (B) have been fired, dropped, launched, projected, or placed in such a manner as to constitute a hazard to operations, installations, personnel, or material; and (C) remain unexploded whether by malfunction, design, or any other cause. (10 USC 101(e)(5)(A) through (C)) (DA 2005).

EXECUTIVE SUMMARY

ES.1 Under contract with the United States Army Corps of Engineers (USACE), TerranearPMC, LLC prepared this Site Inspection (SI) Report to document SI activities and findings for the Wallops Flight Facility (WFF) Project 07 Formerly Used Defense Site (FUDS), Property No. C03VA0301, located in Accomack County, Virginia (VA). The Department of Defense (DoD) has established the Military Munitions Response Program (MMRP) under the Defense Environmental Restoration Program (DERP) to address potential Munitions and Explosives of Concern (MEC) and Munitions Constituents (MC) remaining at FUDS properties, including WFF Project 07. This SI was completed under MMRP Project No. C03VA030107 and addresses potential MMRP hazards remaining at the WFF Project 07.

ES.2 **Site Inspection Objectives and Scope**. The primary objective of the MMRP SI is to determine whether or not the FUDS project warrants further response action under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). The SI collects the minimum amount of information necessary to make this determination. The SI also (i) determines the potential need for a Time Critical Removal Action (TCRA); (ii) collects or develops additional data, as appropriate, for potential Hazard Ranking System (HRS) scoring by the United States Environmental Protection Agency (USEPA); and (iii) collects data, as appropriate, to characterize the hazardous substance release for effective and rapid initiation of the remedial investigation/feasibility study (RI/FS). An additional objective of the SI is to collect the additional data necessary to evaluate munitions response sites (MRSs) using the Munitions Response Site Prioritization Protocol (MRSPP).

ES.3 The scope of the SI is restricted to the evaluation of the presence of MEC or MC related to historical use of the WFF Project 07 prior to property transfer. Potential releases of hazardous, toxic, and/or radioactive waste (HTRW) are not within the SI scope.

ES.4 **WFF Project 07.** The WFF Project 07 is approximately 1.53 acres of land that includes four areas located in the Main Base Sector. The WFF Project 07 areas were used by the Naval Aviation Ordnance Test Station (NAOTS) between 1946 and 1959. In June 1959, the U.S. Navy ceased training and flight operations and the installation was declared excess and leased to the newly formed National Aeronautics and Space Administration (NASA). The Main Base was formally transferred to NASA on 1 December 1961.

ES.5 **Technical Project Planning.** The SI approach was developed in concert with stakeholders through USACE's technical project planning (TPP) framework, which was applied at the initial

TPP meeting on 6 May 2010. Stakeholders agreed to the SI approach, as presented and modified during the TPP meeting and finalized in the Site-Specific Work Plan (SS-WP). In summary, these agreements were to inspect the MRS and complete multimedia sampling in accordance with the Data Quality Objectives (DQOs) and Final SS-WP.

ES.6 **Munitions Response Site.** USACE programmatic documents identified one MRS at WFF Project 07: MRS 7, Boat Basin/Visitors Information Center, which includes the Pyrotechnics Burn Area, Gun Butt No. 1, Gun Butt No. 2, and South Bank of Boat Basin.

ES.7 **Site Qualitative Reconnaissance**. SI field activities were performed on 12 through 14 December 2011. Qualitative reconnaissance (QR) in and around MRS 7 was performed over approximately 1.76 acres of land during which analog geophysics was conducted and visual observations were made. The approach included magnetometer-assisted reconnaissance following a meandering path in and around sample locations to identify the presence/absence of MEC/Munitions Debris (MD) or other areas of interest (i.e., areas having indications of munitions use). Only expended and inert MD have been observed historically and no confirmed MEC was found during the SI field activities. Numerous surface anomalies were detected during QR at MRS 7 including military-related items (marston matting at South Bank of Boat Basin) and three MD at Gun Butts No. 1 and 2. Seven Material Potentially Presenting an Explosive Hazard (MPPEH) (20mm, larger than 20mm, burnt pyrotechnic items) were observed on the surface that could not be determined to not contain energetic material. NASA was notified and the UXO technician recommended the items be removed as soon as possible. Also, 37 distinct subsurface anomalies were detected on land in MRS 7. Five areas of concentrated subsurface anomalies (i.e., the UXO technician was unable to count individual anomaly points) were identified, two at the Gun Butts and three at the Pyrotechnics Burn Area (including the entire area within the Pyrotechnics Burn Area fence). In addition, approximately 0.31 acres of analog geophysics was completed within the water at the Boat Basin using a Bore Hole Gradiometer (BHG-1). Two underwater anomalies were noted during reconnaissance of the boat basin, and an undefined area along the South Bank of the Boat Basin was noted as having a large quantity (more than 50) of surface anomalies identified as rusty metal debris.

ES.8 **Munitions and Explosives of Concern Hazard Assessment**. A qualitative MEC hazard assessment for the land portion of MRS 7 was conducted based on the SI QR, as well as historical information documented in the Inventory Project Report (INPR) and Preliminary Assessment (PA). The MEC explosive safety hazard is based on the presence or absence of a MEC source, the accessibility or pathway to that source, and potential receptor contact with the source. Since military use ended, no confirmed MEC items are known to have been found at

MRS 7; however, MD and MPPEH have been observed. No MEC was observed during the 2005, 2007, and 2009 inspections and no confirmed MEC was observed during the 2011 SI field activities. Based on the known historical finds (inert) of the MD observed at MRS 7, and the condition of the MPPEH items found during SI field activities (too rusty to confirm identification), the possible presence of a MEC source is moderate. Currently the land associated with WFF Project 07 is owned by NASA. Portions of WFF Project 07 (Gun Butts No. 1 and 2) are open to the general public and have no access restrictions to the surrounding grounds. Portions (South Bank of Boat Basin and Pyrotechnics Burn Area) are fenced and not accessible to the public. The boat basin is used occasionally by NASA and the Marine Science Consortium. The future use is not expected to change. Therefore, the human interaction and accessibility categories have been rated as moderate. The site stability category was rated as moderate hazard due to the possibility of erosion and frost-heave. Based on this qualitative MEC hazard evaluation, the hazard to human receptors via contact with MEC at MRS 7 is moderate.

ES.9 **Munitions Constituents Sampling.** A total of 32 soil (21 surface and 11 subsurface), five sediment, one surface water, and four groundwater samples were collected at MRS 7, not including QA. A list of MC associated with munitions potentially used at each of the four areas at MRS 7 was developed and used to support sample analysis and assessment of results for the risk screening. The specific analyte list for each sample varied based on the location of sample collection, but the general list of analytes for MRS 7 included a select list of explosive constituents (2,4-Dinitrotoluene [DNT]; 2,6-DNT; 2-nitrotoluene; 3-nitrotoluene; 2-amino-4,6-DNT; 4-amino-2,6-DNT; and 4-nitrotoluene; 2,4,6-Trinitrotoluene [TNT]; 1,3,5-Trinitrobenzene; 1,3-Dinitrobenzene; Pentaerythritol Tetranitrate [PETN], Hexahydro-1,3,5-trinitro-1,3,5-triazine [RDX], Nitrobenzene, Tetryl, and Nitroglycerin [NG]) and a select list of metals (aluminum, antimony, barium, copper, iron, lead, magnesium, nickel, and zinc). Two of the surface soil samples collected from the Pyrotechnics Burn Area were analyzed for Polycyclic Aromatic Hydrocarbons (PAHs). The four groundwater samples were collected (one at each Gun Butt and two at the Pyrotechnics Burn Area) and analyzed for select metals, select explosive constituents, and perchlorate. Additionally, one surface water sample was collected from the Boat Basin and analyzed for select explosive constituents and perchlorate.

ES.10 **Munitions Constituents Risk Screening.** No explosive constituents, perchlorate, or PAHs were detected at concentrations above their respective Reporting Limits (RLs). Several metals were detected above their respective screening levels in samples collected at MRS 7. Iron detections in surface soil, subsurface soil, and groundwater exceeded the screening criterion selected for the Human Health Risk Assessment (HHRA). Therefore, iron was identified as a Chemical of Potential Concern (COPC) in surface soil, subsurface soil, and groundwater at

MRS 7. However, most iron detections in surface and subsurface soil did not exceed background concentrations; therefore, no additional risk to human receptors was identified in these media as a result of the munitions used at MRS 7. Detections of iron in groundwater collected from the Pyrotechnics Burn Area were below background concentrations and therefore not expected to present additional risk as a result of former military use. However, iron was detected in groundwater collected from the Gun Butts No. 1 and 2 area above background concentrations and determined to present a potentially unacceptable risk to human receptors. Aluminum was detected above screening criteria and identified as a COPC in subsurface soil and antimony was detected in groundwater above the screening criteria and designated a COPC. Aluminum in subsurface soil and antimony in groundwater were determined not to present a potentially unacceptable risk based on the conservatism of the screening levels. No COPCs were identified in sediment or surface water at MRS 7.

ES.11 The maximum concentrations of antimony, copper, lead, and zinc in surface soil exceeded the ecological soil screening levels (eco-SSLs) selected for the Screening Level Ecological Risk Assessment (SLERA) and were identified as a Chemicals of Potential Ecological Concern (COPECs) for surface soil at MRS 7. These detections also exceeded background concentrations, and potentially unacceptable risks to ecological receptors were identified in surface soil at MRS 7. Copper was also detected in sediment above the eco-SSLs and identified as a COPEC; however, based on the infrequent and negligible exceedance, copper in sediment is not expected to present an unacceptable risk to ecological receptors at MRS 7. No COPECs were identified in surface water.

ES.12 **Site Inspection Conclusions and Recommendations.** An RI/FS is recommended at MRS 7. Additional studies should focus on MEC and MC. MD items have been observed historically at MRS 7, and MD and MPPEH were observed during the 2011 SI field activities. Seven of the items observed during the SI field activities were in such condition that the UXO technician could not confirm that energetic material did not remain. Based on the continued finds of munitions items, human interaction, and accessibility, a qualitative MEC hazard assessment indicates that the explosive hazard is moderate at MRS 7. In addition, numerous subsurface anomalies were detected, including distinct anomalies and areas containing dense concentrations of anomalies. The SI is a limited scope study and does not include the intrusive investigation of subsurface anomalies. Iron was detected in groundwater collected at Gun Butt No 1 and 2 (COPC) above the background concentrations and may present a potentially unacceptable risk to human receptors; however, iron is not a CERCLA hazardous substance, so it was not used as the sole basis for an RI/FS recommendation. Antimony, copper, lead, and zinc were detected (COPECs) in surface soil and may present potentially unacceptable risks to ecological receptors at MRS 7. During field activities, samples were collected just outside the fenced Pyrotechnics Burn Area due to the high concentration of subsurface anomalies (i.e., an anomaly free sample location inside the fenced area could not be identified). Therefore, samples could not be collected from the location most likely to contain the highest MC concentrations. This limitation, and that subsurface anomalies could not be investigated, were considered when recommending further work at MRS 7.

ES.13 A TCRA or Non-TCRA (NTCRA) is not recommended at the WFF Project 07 (Table ES-1).

ES.14 The Pyrotechnics Burn Area was found to be incorrectly positioned in the USACE-provided GIS. The correct location, as confirmed by visual evidence of burning contained within a deteriorated fence matching the description of the area cited in historical documents, was observed to be near the southwestern corner of the Pyrotechnic Burn Area. GPS coordinates were collected at each corner of the fence, which was approximately 500 square ft (20 ft by 25 ft). USACE should revise the MRS 7 GIS to reorient the Pyrotechnics Burn Area to encompass the four GPS coordinates collected during the 2011 SI field activities, as shown on the figures and Table 3-1 in this SI.

Table ES-1. Summary of Site Recommendations for WFF Project 07 (FUDS Project No. C03VA030107)

MRS	Recommendation	Basis for Recommendation	
		MEC	MC*
MRS 7- Boat Basin/Visitors Information Center	RI/FS to focus on MEC and MC TCRA/NTCRA not recommended	MEC Assessment: Moderate hazard Three MD and seven MPPEH items that could not be determined to not contain energetic material were observed during the 2011 SI field event. Numerous surface and subsurface anomalies and five areas of concentrated subsurface anomalies were detected during the 2011 SI field event.	*Risk Screening Assessment:* Iron* in groundwater may present a potentially unacceptable risk to human receptors and antimony, copper, lead, and zinc in surface soil may present potentially unacceptable risks to ecological receptors at MRS 7. *Surface soil:* Iron* was detected above the screening level selected for the HHRA and was identified as a COPC. However, most of the iron detections were below background concentrations, and no FUDS-related or potentially unacceptable risks were identified for human receptors in surface soil. Antimony, copper, lead, and zinc exceeded the screening level selected for the SLERA and were identified as a COPECs. These detections also exceeded background concentrations, and potentially unacceptable risks to ecological receptors were identified in surface soil at MRS 7. *Subsurface soil:* Based on the HHRA, aluminum* and iron* were identified as COPCs. However, based on the conservatism of the HHRA, aluminum in subsurface soil is not expected to present an unacceptable risk to human receptors. Also, iron detections were below background concentrations; therefore, no FUDS-related risk was identified to human receptors in subsurface soil. *Sediment:* Based on the HHRA, no COPCs were identified. Based on the SLERA, copper was identified as a COPEC. However, due to the infrequency and magnitude of detection, copper in sediment is not expected to present an unacceptable risk to ecological receptors. *Surface Water:* Based on the HHRA and SLERA, no COPCs or COPECs,were identified.

Table ES-1. Summary of Site Recommendations for WFF Project 07 (FUDS Project No. C03VA030107)

MRS	Recommendation	Basis for Recommendation	
		MEC	MC*
			Groundwater: Based on the HHRA, antimony and iron* were identified as COPCs. Antimony is not expected to present an unacceptable risk to human receptors based on the conservatism of the HHRA. However, iron* in groundwater may present a potentially unacceptable risk to human receptors.

*Chemicals that are not CERCLA hazardous substances (e.g., iron., aluminum) can be reported in the SI; however, the SI risk evaluation and conclusions includes a discussion of the limitations of the FUDS program to respond to such chemicals. Non-CERCLA chemical concentrations do not provide the basis for a RI/FS recommendation for MCs in this SI Report.

COPC – Chemical of Potential Concern
COPEC – Chemical of Potential Ecological Concern
FUDS – Formerly Used Defense Site
HHRA – Human Health Risk Assessment
MC – Munitions Constituents
MD – Munitions Debris
MEC – Munitions and Explosives of Concern
MPPEH – Material Potentially Presenting and Explosive Hazard
MRS – Munitions Response Site
NTCRA – Non-Time Critical Removal Action
RI/FS – Remedial Investigation/Feasibility Study
SI – Site Inspection
SLERA – Screening Level Ecological Risk Assessment
TCRA – Time Critical Removal Action
WFF – Wallops Flight Facility

1. INTRODUCTION

1.0.1 This report documents the findings of the Military Munitions Response Program (MMRP) Site Inspection (SI) performed at the Wallops Flight Facility (WFF) Formerly Used Defense Site (FUDS) located in Accomack County, Virginia (VA) with the MMRP Project No. C03VA030107, abbreviated as WFF Project 07. Human Factors Applications, Inc. (HFA), a wholly-owned subsidiary of TerranearPMC, LLC (TPMC), along with support from its subcontractors (Environmental Data Services, Inc. [EDS]; Integral Consulting, Inc.; and TestAmerica, Inc.) prepared this report under contract to the United States Army Engineering and Support Center, Huntsville (USAESCH). This work is being performed in accordance with Contract No. W912DY-04-D-0017, Task Order 00170001 for FUDS in the Northeast Region of the Continental United States. This contract was transferred to TPMC from Alion Science and Technology Corporation (Alion) in February 2011; HFA was formerly a subsidiary of Alion. USAESCH transferred management of the contract to the Corps of Engineers North Atlantic Division Baltimore District (CENAB). CENAB is working with Corps of Engineers North Atlantic Division, Norfolk District (CENAO) and its contractor on the completion of this project in accordance with the SI Performance Work Statement (Appendix A).

1.0.2 The technical approach to this SI is based on the *Programmatic Work Plan for Formerly Used Defense Sites Military Munitions Response Program Site Inspections at Multiple Sites the Northeast Region* (Alion 2005) and the *Final Site-Specific Work Plan* (SS-WP) *Addendum to the MMRP Programmatic Work Plan for the Site Inspection of WFF Project 07* (TPMC 2011).

1.1 Project Authorization

1.1.1 The Department of Defense (DoD) has established the MMRP to address sites suspected of containing Munitions and Explosives of Concern (MEC) or Munitions Constituents (MC). Under the MMRP, the U.S. Army Corps of Engineers (USACE) is conducting environmental response activities for the Army, as DoD's Executive Agent for the FUDS program.

1.1.2 Pursuant to USACE's Engineer Regulation 200-3-1 (USACE 2004a) and the *Management Guidance for the Defense Environmental Response Program (DERP)* (DoD 2001), FUDS response activities are being conducted in accordance with the DERP statute (10 USC 2701 et seq.), the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) (42 USC Section 9620), Executive Orders 12580 and 13016, and the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) (40 Code of Federal Regulations

Part 300). As such, USACE is conducting SIs, as set forth in the NCP, to evaluate hazardous substance releases or threatened releases from eligible FUDS.

1.1.3 While not every MEC/MC constitute CERCLA hazardous substances, pollutants, or contaminants, the DERP statute provides DoD the authority to respond to releases of MEC/MC, and policy states that such responses shall be conducted in accordance with CERCLA and the NCP.

1.2 Project Scope and Objectives

1.2.1 The primary objective of the MMRP SI is to determine whether or not the FUDS project warrants further response action under CERCLA. The SI collects the minimum amount of information necessary to make this determination. The SI also (i) determines the potential need for a removal action; (ii) collects or develops additional data, as appropriate, for potential Hazard Ranking System (HRS) scoring by the U.S. Environmental Protection Agency (USEPA); and (iii) collects data, as appropriate, to characterize the hazardous substance release for effective and rapid initiation of the remedial investigation/feasibility study (RI/FS). An additional objective of the MMRP SI is to collect data necessary to evaluate munitions response sites (MRSs) using the Munitions Response Site Prioritization Protocol (MRSPP).

1.2.2 The scope of the SI is restricted to the evaluation of the presence of MEC or MC related to historical use of this MRS prior to property transfer. The evaluation is performed through records review, site qualitative reconnaissance (QR) to assess MEC presence/absence, and sampling where MC might be expected based on the conceptual site model (CSM). Evaluation of potential releases of hazardous, toxic, and radioactive waste (HTRW) is not within the scope of this SI.

1.3 Project Location

1.3.1 The WFF Project 07 is located in Accomack County and is depicted on a historical aerial photograph from 1963 (Figure 2-1). The North American Datum (NAD) 1983 Universal Transverse Mercator (UTM) Zone 18N, easting (X) and northing (Y) coordinates of the approximate center of the WFF Project 07 are 459895.52 meters (m) and 4199090.92 m, respectively.

1.4 Munitions Response Site Prioritization Protocol

1.4.1 This SI Report includes a draft MRSPP for MRS 7 in Appendix K. The MRSPP scoring will be updated on an annual basis, or when necessary, to incorporate new information, as appropriate.

2. SITE DESCRIPTION

2.1 Property and Project Description and History

2.1.1 There were three major phases of property acquisition, consisting of many individual transactions that resulted in the facility known today as the National Aeronautics and Space Administration (NASA) WFF, which is larger than the WFF FUDS. The first phase of property acquisition was in early 1942 for the construction of the Chincoteague Naval Auxiliary Air Station (CNAAS). The second phase involved the acquisition of land on Wallops Island for testing naval aviation ordnance in 1945. The third phase occurred in the 1950s and was for expanding and improving CNAAS and its facilities (USACE 2011).

2.1.2 The NASA WFF currently consists of three sectors: Main Base, Wallops Island, and Mainland; however, no military operations were conducted on Mainland, so this portion of the current NASA WFF is not included as part of the WFF FUDS (Figure 2-2). The Main Base was commissioned in 1943 and was originally known as CNAAS. In 1946, the Bureau of Ordnance established the Naval Aviation Ordnance Test Station (NAOTS) at the CNAAS to conduct secret aviation ordnance tests and munitions experiments. The Wallops Island sector was used both by NAOTS and National Advisory Committee for Aeronautics (NACA) (USACE 2011).

2.1.3 MRS 7 is located in the Main Base Sector as shown on Figure 2-3. The four areas that are included in this project are as follows.

- Pyrotechnics Burn Area. This was an approximately 20 ft by 25 ft fenced in area used by the Navy to dispose of parachute flares and practice bomb signals using either gasoline or trinitrotoluene (TNT). The date of construction or first use of the Pyrotechnics Burn Area is not known.
- Gun Butt No. 1. This area was constructed in 1952 and used to test and perfect the use of medium caliber (20mm – 37mm) aviation guns and ammunition. The test range included a firing point and a concrete impact berm filled with sand or soil. Aircraft guns fired medium caliber ammunition from Building J-8 (firing point) into the impact berm (J-130) located approximately 350 ft to the southeast of the firing point.
- Gun Butt No. 2. This area was constructed in 1952 and, similar to Gun Butt No. 1, was used to test and perfect the use of medium caliber (20mm – 37mm) aviation guns and ammunition. The test range included a firing point and a concrete impact berm filled with sand or soil. Aircraft guns fired medium caliber ammunition from Building J-17 (firing point) into the impact bunker (J-18) which was located approximately 150 ft to the south of the firing point.

- South Bank of Boat Basin. Dredging of the Boat Basin and channel was completed on 26 April 1949 by the Navy in order to establish a boat dock and basin to transport rocket testing materials from the Wallops Main Base to the Wallops Island test facilities. The South Bank of Boat Basin had no known munitions use; however, numerous munitions items have been observed in this area.

2.1.4 In June 1959, the U.S. Navy ceased training and flight operations. The CNAAS was declared excess and leased to the newly formed NASA, the successor to NACA. The Main Base was formally transferred to NASA on 1 December 1961. In 1981, the facility became part of the Goddard Space Flight Center and was renamed WFF (Alion 2010 and USACE 2011).

2.2 Munitions Response Site Identification and Munitions Information

2.2.1 The Preliminary Assessment (PA) identified the four areas associated with the WFF Project 07 as shown in Table 2-1. The list of munitions associated with MRS 7 and their constituents were derived from the PA and other USACE data sources and are summarized in Table 2-2 (USACE 2011).

2.2.2 The USACE-provided geographic information system (GIS) data determined that MRS 7 is approximately 1.53 acres of land (USACE 2011). Figure 2-2 shows the USACE-provided MRS and FUDS boundaries on recent aerial imagery. However, during the 2011 SI field activities, it was determined that the Pyrotechnics Burn Area portion of the MRS 7 boundary provided by USACE was in an incorrect location. The correct location of the Pyrotechnics Burn Area is noted on the figures in this SI with the GPS coordinates collected at the four corners of the approximately 20 ft by 25 ft fenced area. Per USACE request, sampling and reconnaissance were performed in areas outside the MRS 7 boundaries (TPMC 2011).

2.3 Physical Setting

2.3.0.1 The following sections provide a physical description of MRS 7 with respect to relief, vegetation, and climate as well as the local demographic and land use.

2.3.1 Topography and Vegetation

2.3.1.1 The topography of MRS 7 is generally low and flat with elevation ranging from zero to five feet (ft) above mean sea level (msl). The former target butts of the Gun Butts No. 1 and 2 portion of MRS 7 are no longer present, and these areas are currently developed with manicured grass and display rockets associated with the nearby NASA WFF visitor information center. A shallow drainage swale separates the two former gun butt areas, and they are bordered by wetlands to the south and east. The South Bank of Boat Basin and Pyrotechnics Burn Area are forested with deciduous or evergreen trees and also contain wetland vegetation (USACE 2011 and USGS 2010).

2.3.2 Climate

2.3.2.1 MRS 7 is located adjacent to Mosquito Creek and Jenny's Gut. Further east of MRS 7 are several back bays, channels and inlets and the Atlantic Ocean. The climate of the VA coast is moderated by the nearby ocean. The coldest month is January with a mean normal temperature of 36.3 degrees Fahrenheit (˚F) and the warmest month is July with a mean normal temperature of 76.3 ˚F. The annual precipitation normal is 40.4 inches with precipitation occurring approximately equally per month throughout the year (NOAA 2002).

2.3.3 Local Demographics

2.3.3.1 MRS 7 is located near Wattsville in Accomack County, VA. The 2010 Census estimate indicates that the population density of Accomack County is 73.8 people per square mile (mi^2), and there were 33,164 people in 21,002 households. The Wattsville Census Designated Place (CDP) consists of 1,128 people in 497 households (U.S. Census Bureau 2010). There are no inhabited structures within the MRS boundary; however, the Visitor Information Center borders MRS 7. Within approximately two miles from the MRS boundary, there are more than 26 inhabited structures at NASA WFF (Google Earth 2011).

2.3.4 Current and Future Land Use

2.3.4.1 The WFF Project 07 currently is owned by NASA. A structure adjacent to the Gun Butts No. 1 and 2 is operated by NASA as a visitor information center. The visitor center is open to the general public and several rockets are on display on the surrounding grounds. There are no access restrictions to prevent visitors from accessing Gun Butts No. 1 and 2. The South Bank of the Boat Basin and the Pyrotechnics Burn Area are surrounded by fences and not easily accessible to the general public. However, the boat basin is still in use occasionally by NASA and the Marine Science Consortium. The potential receptors include employees, visitors, construction workers, trespassers and biota (TPMC 2011). Although future land use plans do not include residential reuse, stakeholders have requested that residents be included as potential future receptors. The future residential use of MRS 7 is not expected due to the unlikely closure of NASA WFF.

2.3.5 Geologic Setting

2.3.5.1 The WFF Project 07 is located within the embayed section of the Coastal Plain physiographic province. The geological features of the area are the result of the recent submergence of the Atlantic Coastal Plain due to weighting down under ice load during the last ice age, as well as the postglacial rise of sea level after large volumes of glacial melt waters returned to the ocean (USACE 2011).

2.3.5.2 The Coastal Plain province is characterized by low relief and surface streams emptying to marshy inlets. The elevation of the Coastal Plain province is commonly less than 100 ft above msl but can exceed 200 ft above msl (USACE 2011). Beach and marsh deposits of the Quaternary Period shape the landscape underlying the WFF. Beneath the Quaternary deposits lies the 400 ft thick Miocene age Calvert formation which is a bluish gray sandy silt. Below that lies the green, fine to coarse, glauconitic (20 to 40% glauconite), quartz sand of the Piney Point formation and the greenish to dark gray silts and clays of the Pamunkey formation. Bedrock is located approximately 4,500 ft beneath the surface (USACE 2011).

2.3.5.3 The soil series at MRS 7 include the Molena loamy sand (Gun Butt No. 1 and 2), ,Magotha fine sandy loam (Pyrotechnics Burn Area), and Udorthent and Udipsamment soils (Boat Basin) (TPMC 2011). The Molena soil series is very deep, rarely flooded, and well drained. The Magotha soil series is very deep, frequently flooded, poorly drained, and typically found in salt marshes ranging from 0- 2 percent slope. The Udorthent and Udipsamment soils are rarely flooded and well drained (USDA 2009).

2.3.6 Hydrogeologic Setting

2.3.6.1 There are four major aquifers at the Eastern Shore of Virginia, including where the WFF Project 07 is located: the Pleistocene aquifer (Columbia Group) and the three separate units (upper, middle, and lower) of Miocene aquifers in the Yorktown Formation (USGS 2009). Wind-deposited beach sands, silts, and gravel typically overlie the unconfined Columbia aquifer, also known as the water table aquifer. The Columbia aquifer is located between 5 and 60 ft below the ground surface (bgs). The Pleistocene aquifer is separated by the Miocene aquifer by a 20 to 30 ft confining layer (aquitard) of clay silt. The shallowest confined Miocene aquifer of the Yorktown Formation at WFF occurs at depths of approximately 100 ft bgs. The Miocene aquifers are classified as the upper, the middle, and the lower Miocene aquifers and each Miocene aquifer is overlain by the upper, middle, and lower Miocene confining units (USACE 2011).

2.3.6.2 The groundwater at MRS 7 generally flows to the southeast toward the nearby Mosquito Creek and wetland areas. The water table at the Main Base ranges from depths of 0 to 30 ft bgs and is generally recharged by surface waters or infiltration of precipitation (USACE 2011). During 2011 field activities, the depth to groundwater at MRS 7 was found to be less than ten ft bgs (Appendix D). The confined aquifers are recharged by the same process at locations further away from WFF where these units outcrop near the land surface. Aquifer tests of the unconfined (Pleistocene) aquifer have confirmed the ease of recharge from surface water and/or precipitation and that there is no significant vertical leakage through the aquitard below the unconfined aquifer (USACE 2011).

2.3.7 Area Water Supply/Groundwater Use

2.3.7.1 According to the Accomack-Northampton Planning District Commission, residents in Accomack County receive their potable water entirely from groundwater. Groundwater supply relies on precipitation recharging local aquifers. The confined upper, middle, and lower Yorktown-Eastover aquifers predominately provide the drinking water for Accomack County. The USEPA designated the groundwater as the Columbia and Yorktown-Eastover Multiaquifer System Sole Source Aquifer to protect the drinking water supplies in the area (ANPDC 2011). Town of Chincoteague (ToC) water is sourced from three shallow and four deep wells located in an area close to NASA WFF, next to Route 175. The shallow well depths range from 55 to 60 ft deep and draw from the Columbia Aquifer. The deep wells are in the Yorktown Aquifer with a depth range from 225 to 262 ft based on metadata provided by USACE (Appendix L). The water from these wells is chlorinated, filtered to remove iron, treated to reduce the corrosivity, and then disinfected again before being distributed to ToC's water system (ToC 2009).

2.3.7.2 According to the U.S. Geological Survey (USGS) National Water Information System (NWIS) Mapper, there are two wells within 1,000 ft of the MRS 7 boundary; however, there are no wells within the MRS 7 boundary. The well located less than 1,000 ft from the Boat Basin was completed at a depth of 256 ft bgs and the well located less than 1,000 ft from the Gun Butts was completed at 280 ft bgs. There are seven wells less than 2,000 ft and seven wells on Chincoteague Island less than five miles from MRS 7 (USGS 2011b). The ToC and NASA water supply well locations within a four mile radius of MRS 7 are shown on Figure 2-5. Information regarding the location of groundwater supply wells for private residences is not available to the general public, thus these wells are not included on Figure 2-5.

2.3.8 Sensitive Environments

2.3.8.0.1 The following subsections discuss the sensitive environments associated with MRS 7 and the process used to determine the necessity for completing an ecological risk assessment.

2.3.8.1 Army Checklist for Important Ecological Places

2.3.8.1.1 In accordance with USACE Environmental and Munitions Center of Expertise guidance, the Army Checklist for Important Ecological Places (Table 2-3) is completed to determine if the MRS requires an ecological risk assessment (USACE 2006 and USACE 2007). As shown on Table 2-3, MRS 7 contains wetlands (USFWS 1998) (Section 2.3.8.2) and is located within the VA Coastal Zone (VDEQ 2010) (Section 2.3.8.3). Consequently, a screening level ecological risk assessment is required. The screening level ecological risk assessment is shown in Section 5 of this SI Report.

2.3.8.2 Wetlands

2.3.8.2.1 There are several types of wetlands present within MRS 7 (Figure 2-4). The Pyrotechnics Burn Area is located within an Estuarine and Marine Wetland and South Bank of Boat Basin is located in Freshwater Forested/Shrub Wetland. Gun Butt No. 1 and 2 have been largely redeveloped but border the Estuarine and Marine Wetlands (USFWS 1998).

2.3.8.3 Coastal Zones

2.3.8.3.1 The WFF Project 07 is located along the Virginia coast less than two miles southwest of the Chincoteague Bay. According to the VDEQ, the lead agency for the Virginia Coastal Zone Management Program, the WFF Project 07 is located is within the Virginia Coastal Zone established as directed by the Federal Coastal Zone Management Act (VDEQ 2010).

2.4 Previous Investigations for Munitions Constituents and Munitions and Explosives of Concern

2.4.0.1 A summary of previous historical investigations and related discoveries of MC and MEC is provided in the following subsections.

2.4.1 Archives Search Report for NASA

2.4.1.1 The USACE St. Louis District prepared the Archives Search Report (ASR) Findings for NASA. This ASR was intended for use only by NASA to plan future environmental investigations. The ASR included previous investigations at the MRS, property description, physical characteristics of the property, real estate, and evaluation of historical munitions use by

Navy/NAOTS. It also included identification and evaluation of operations related to HTRW, chemical warfare materiel (CWM), and petroleum, oil, and lubricants, as well as historical operations by NACA/NASA, which are outside the scope of this SI (USACE 2005).

2.4.1.2 The ASR identified WFF Project 07 as an area where munitions may have been used, tested, fired, and/or disposed. The WFF Project 07 is comprised of four areas: Pyrotechnics Burn Area, Gun Butt No. 1, Gun Butt No. 2, and South Bank of Boat Basin. These four areas were identified by historical documents and maps as having the potential to contain MEC/MD or MC from military munitions. During the ASR visit the field team observed a small pile of burnt, presumably demilitarized pyrotechnic devices within the footprint of the Pyrotechnics Burn Area. The team also identified numerous 20mm expended rounds on the surface in the vicinity of Gun Butt No. 1 and 2. Several 20mm and 37mm expended artillery rounds were also observed on the shoreline in the southern portion of South Bank of Boat Basin. There is no evidence that chemical warfare materiel (CWM) was used, stored, manufactured, or disposed of at WFF Project 07. The WFF Project 07 was scored with a Risk Assessment Code (RAC) of 2 in the ASR (USACE 2005).

2.4.2 Inventory Project Report

2.4.2.1 USACE issued the Inventory Project Report (INPR) for the WFF FUDS, including WFF Project 07, in 2009. The INPR determined that the project was eligible for further inspection as a result of prior DoD ownership, utilization, or activity. In addition, the INPR determined that an environmental restoration project was an appropriate undertaking within the purview of the DERP for FUDS for WFF Project 07 (USACE 2009).

2.4.3 Preliminary Assessment

2.4.3.1 The PA was prepared for the WFF FUDS in 2010. This report documented the munitions used at the property and other information related to the property. The PA stated that there was no indication that CWM was used at WFF (USACE 2011).

2.4.3.2 The PA identified the four areas within WFF Project 07/MRS 7. The USACE field team identified a small pile of what appeared to be demilitarized (burned) pyrotechnic devices including various parachute flares within the fenced area of the Pyrotechnics Burn Area. Numerous expended 20mm rounds were observed at Gun Butts No. 1 and 2 during the visit in 2009. The field team observed several 20mm and suspected 37mm expended practice rounds on the shoreline of the South Bank of Boat Basin. An MRSPP score of 4 was provided for the entire MRS (four areas included) based on the types of munitions used (i.e., completion of the

Explosive Hazard Evaluation [EHE] module). CWM was not known to be used, so the Chemical Warfare Materiel Hazard Evaluation (CHE) module was completed as no known or suspected hazard. The Health Hazard Evaluation (HHE) module of the MRSPP was rated as evaluation pending since no samples were collected for the PA (USACE 2011).

2.5 Citizen Reports of Munitions and Explosives of Concern

2.5.1 Citizen reports are the result of a citizen calling the local authorities to remove a munitions item. Records of these reports can be filed with local EOD units, police, and/or fire and rescue who would maintain these records. Since military use of the MRS ceased, there are no known citizen reports of MEC or MD found at MRS 7 (USACE 2011). It would be expected that NASA would have knowledge of such records since their ownership of the property began; however, NASA is unaware of a citizen report occurring within WFF Project 07 (TPMC 2012). Refer to Paragraph 3.1.1 for munitions finds mentioned by NASA during the TPP #1 meeting.

2.6 Non-Department of Defense Contamination/Regulatory Status

2.6.1 There is no evidence, based on historical review and stakeholder comments, that activities occurring prior to or after DoD use of the area contributed to potential MEC, MD, or MC presence (USACE 2009 and 2010, TPMC 2011).

Table 2-1. MRS Inventory (USACE 2011)

FUDS Name/ Project Name	MRS Name	Area Name	Land Acreage	Water Acreage	Total Acreage
WFF/ Project 07: Boat Basin/Visitors Information Center	MRS 7: Boat Basin/Visitors Information Center	Pyrotechnics Burn Area	0.09	0.00	0.09
		Gun Butt No. 1	0.66	0.00	0.66
		Gun Butt No. 2	0.53	0.00	0.53
		South Bank of Boat Basin	0.25	0.00	0.25

FUDS – Formerly Used Defense Site
MRS – Munitions Response Site
No. - Number
WFF – Wallops Flight Facility

Table 2-2. Military Munitions Type and Composition
MRS 7 - Boat Basin/Visitors Information Center

MRS Name	Area Name	Munitions ID	Munitions Type	Composition (explosive constituents and metallic components)	Associated MC Analysis [2]
MRS 7- Boat Basin/ Visitors Information Center	**Pyrotechnics Burn Area[9]**	Pyrotechnics	Parachute Flare (Mk6)	***Body:*** Aluminum ***Priming Charge[1]:*** Black powder [3] (potassium nitrate, charcoal, sulfur), dextrin ***Flare Charge/Illuminant*:** Magnesium, barium nitrate, iron, sodium oxalate, aluminum, castor and linseed oil, sulfur ***Miscellaneous:*** trinitrotoluene (TNT) and/or gasoline or other combustible material may have been used during demolition. PAHs may be present due to the potential use of gasoline as an accelerant. Although perchlorates were not in wide spread use prior to 1957 (approximate timeframe of FUDS use), this facility was a research and development facility and perchlorate may have been used in some of the pyrotechnic devices disposed of at this area.	Explosive constituents: • TNT [6] Metals: • Aluminum • Antimony • Barium • Iron • Lead • Magnesium • Zinc Other: • Perchlorate (groundwater only)[7] • PAHs (soil only)
			AN-Mk4 Signals, ANMk5/ Mk23/Mk43 practice bombs	***Signals:*** Shotgun shell, black powder[3] (potassium nitrate, charcoal, sulfur) and red phosphorous pyrotechnic mixture ***Body:*** AN-Mk 5: zinc alloy; AN-Mk 23: cast iron; AN-Mk 43: lead-antimony alloy	
	Gun Butt No. 1 and Gun Butt No. 2[8]	Large Caliber (37mm and larger), HE (CTT18)	37mm, HE, tracer and practice	***Projectile:*** soft or forged steel (carbon and iron); filler for HE projectile: TNT or in some cases Tetryl ***Propellant:*** Smokeless powder or FNH powder (Nitrocellulose[4], nitroglycerin (NG),	Explosive constituents: • NG • DNT[5] • TNT [6] • RDX • Tetryl Metals (not analyzed at firing point):

Table 2-2. Military Munitions Type and Composition
MRS 7 - Boat Basin/Visitors Information Center

MRS Name	Area Name	Munitions ID	Munitions Type	Composition (explosive constituents and metallic components)	Associated MC Analysis[2]
				dinitrotoluene (DNT), potassium sulfate, graphite), diphenylamine ***Primer[1]:*** Lead sulphocyanate, antimony sulfide, potassium chlorate, TNT, black powder (sodium nitrate or potassium nitrate plus charcoal and sulfur) ***Tracer[1]:*** Magnesium, magnesium-aluminum alloy, strontium nitrate, barium oxide, calcium resinate, polyvinyl chloride	• Antimony • Copper • Iron • Lead • Nickel Other (per stakeholder request): • Perchlorate (groundwater only)[7]
		Medium Caliber (20 mm), HE and practice (CTT18)	20mm HE, tracer and practice	***Projectile:*** 20 mm ball (steel), 20mm HE (TNT or RDX). ***Propellant:*** Single- or Double-base smokeless powder (nitrocellulose[4], NG, DNT, potassium sulfate, graphite) ***Tracer[1]:*** Magnesium, magnesium-aluminum alloy, strontium nitrate, barium oxide, calcium resinate, polyvinyl chloride	
		Small Arms (CTT01)	Small Arms .50 Machine Gun	***Projectile:*** .50 cal: Lead, antimony, cupro-nickel, and soft steel ***Propellant:*** Single or Double-base smokeless powder (nitrocellulose[4] NG, DNT, potassium sulfate, graphite ***Tracer[1]:*** Magnesium, magnesium-aluminum alloy, strontium nitrate, barium oxide, calcium resinate, polyvinyl chloride	
	South Bank of Boat Basin[9]	Large Caliber (CTT18), Medium Caliber	37mm, HE, tracer and practice, 20mm HE, tracer and	**Refer to the MEC/MC list for Gun Butts No. 1 and 2 since munitions ID**	Explosive constituents: • NG • DNT[5] • TNT[6] • RDX

Table 2-2. Military Munitions Type and Composition
MRS 7 - Boat Basin/Visitors Information Center

MRS Name	Area Name	Munitions ID	Munitions Type	Composition (explosive constituents and metallic components)	Associated MC Analysis [2]
		(CTT18),	practice, Small Arms .50 Machine Gun	**and Type are the same**	• Tetryl Metals (sediment, surface soil, and subsurface soil only): • Antimony • Copper • Iron • Lead • Nickel Other (per stakeholder request): • Perchlorate (surface water only)[7]

CERCLA = Comprehensive Environmental Response, Compensation, and Liability Act	MC = Munitions Constituent
CTT = Closed Transferring and Transferred	Mk = Mark
DNT = Dinitrotoluene	mm = millimeter
DoD = Department of Defense	MRS = Munitions Response Site
FUDS = Formerly Used Defense Site	NG = Nitroglycerine
g = grams	oz = ounce
HE = High Explosive	PWP = Programmatic Work Plan
ID = Identification	RDX = Hexahydro-1,3,5-trinitro-1,3,5-triazine
ITRC = Interstate Technology Regulatory Council	RI/FS = Remedial Investigation/Feasibility Study
Lb = Pound	Tetryl = N-Metryl-N,2,4,6-tetranitroaniline
	TNT = Trinitrotoluene

[1] Fuzes and other internal components (e.g. igniters, primers, tracers) of the munitions represent a very small percentage by weight of the MC of concern. Where munitions less than 90mm (3.54") were used, MC associated with the primer, booster, detonator, and fuze were not analyzed due to the small amount within these components. The primer and tracer are assumed to be expended at the firing point, and the booster, detonator, tracer, and fuze are assumed to be expended at the impact area.

[2] Chemicals that are not CERCLA hazardous substances (e.g., iron) can be reported in the SI; however, the SI risk evaluation and conclusions includes a discussion of the limitations of the FUDS program to respond to such chemicals. Non-CERCLA chemical concentrations do not provide the basis for a RI/FS recommendation for MCs in this SI report

[3] Black powder was not sampled within the FUDS because, a) the black powder is a rapidly burning material that, when fired, leaves little residue as either decomposition products or uncombusted compounds (ITRC 2003), and b) typically any residual amounts are insignificant in volume to present a MC hazard. Additionally, the original chemical constituents and the decomposition products are, in general, common soil compounds (organic carbon, CO2, nitrates, etc.), which would be difficult to specifically identify as originating from within the FUDS boundary.

[4] Simple single-based nitrocellulose readily breaks down in the environment and is not expected to persist (Duran et al. 1994). Nitrocellulose is not considered toxic, and consequently no risk-based screening values have been developed for the compound. Furthermore, there are no chemical analysis techniques that quantify nitrocellulose separately from the natural common essential nutrient nitrate. Based on this rationale, no sampling for nitrocellulose was conducted.

[5] DNT and DNT break-down products currently on the approved PWP (Alion 2005) explosive constituents analysis

Table 2-2. Military Munitions Type and Composition
MRS 7 - Boat Basin/Visitors Information Center

MRS Name	Area Name	Munitions ID	Munitions Type	Composition (explosive constituents and metallic components)	Associated MC Analysis [2]
using method 8330A list (2,4-Dinitrotoluene; 2,6-Dinitrotoluene; 2-Amino-4,6-dinitrotoluene; 2-Nitrotoluene; 3-Nitrotoluene; 4-Nitrotoluene; 4-Amino-2,6-dinitrotoluene) were analyzed.					
[6] TNT and breakdown products currently on the approved PWP (Alion 2005) explosive constituents analysis using method 8330A list (including 2-Amino-4,6-dinitrotoluene; 4-Amino-2,6-dinitrotoluene; Nitrobenzene; 2,6-dinitrotoluene; 1,3,5-trinitrobenzene) were analyzed.					
[7] Unlike some of the other explosive constituents, perchlorate does not adsorb to soil easily and is not persistent in soil (i.e., it typically migrates downward through the soil to groundwater). Furthermore, given the high solubility and mobility of perchlorate (i.e., perchlorate does not adsorb to soil easily and does not persist in soil [DoD 2007]), detection of this compound in soil more than 50 years after DoD use ended is unlikely. Perchlorate was analyzed in groundwater samples only.					
[8] Munitions were assumed to be expended at Gun Butts No. 1 and 2. Propellant constituents, which are expected to be expended when munitions are fired, were analyzed at the firing point. Projectile constituents, which are expected to be found at the terminal location of the munition, were analyzed at the impact area.					
[9] Complete munitions may have been transported or disposed at the Pyrotechnics Burn Area or the South Bank of the Boat Basin; therefore, constituents associated with the entire round were analyzed at these areas.					

Table 2-3. Army Checklist for Important Ecological Places

Number	Checklist Item	Response		Comments
1.	Locally important ecological place identified by the Integrated Natural Resource Management Plan, Base Realignment and Closure Act Cleanup Plan or Redevelopment Plan, or other official land management plans.		No	
2.	Critical habitat for Federally designated endangered or threatened species. See No. 12 below.		No	
3.	Marine Sanctuary		No	
4.	National Park		No	
5.	Designated Federal Wilderness Area		No	
6.	Areas identified under the Coastal Zone Management Act	Yes		MRS 7 is located with the Virginia Coastal Zone (VDEQ 2010)
7.	Sensitive Areas identified under the National Estuary Program or Near Coastal Waters Program		No	
8.	Critical areas identified under the Clean Lakes Program		No	
9.	National Monument		No	
10.	National Seashore Recreational Area		No	
11.	National Lakeshore Recreational Area		No	
12.	Habitat known to be used by Federally designated or proposed endangered or threatened species	Yes		Federally designated threatened (Loggerhead sea turtle, Northeastern Beach tiger beetle, Piping Plover, Seabeach amaranth) and endangered (Delmarva Peninsula Fox squirrel, Roseate tern) species are within WFF Project 07 (USFWS 2011a).
13.	National preserve		No	
14.	National or State Wildlife Refuge		No	The Wallops Island National Wildlife Refuge is approximately 500 ft from the boundary of the MRS (USFWS 2011b).
15.	Unit of Coastal Barrier Resources System		No	
16.	Coastal Barrier (undeveloped)		No	
17.	Federal land designated for protection of natural ecosystems		No	
18.	Administratively Proposed Federal Wilderness Area		No	
19.	Spawning areas critical for the maintenance of fish/shellfish species within river, lake, or coastal tidal waters		No	
20.	Migratory pathways and feeding areas critical for maintenance of anadromous fish species within river reaches or areas in lakes or coastal tidal waters in which fish spend extended periods of time		No	
21.	Terrestrial areas utilized for breeding by large or dense		No	

Table 2-3. Army Checklist for Important Ecological Places

Number	Checklist Item	Response		Comments
	aggregations of animals			
22.	National river reach designated as Recreational		No	
23.	Habitat known to be used by state designated endangered or threatened species	Yes		State designated threatened (Loggerhead sea turtle, Northeastern Beach tiger beetle, Piping Plover, Seabeach amaranth) and endangered (Delmarva Peninsula Fox squirrel, Roseate tern) species are within WFF Project 07 (VDGIF 2011b).
24.	Habitat known to be used by species under review as to its Federal endangered or threatened status		No	
25.	Coastal Barrier (partially developed)		No	
26.	Federally designated Scenic or Wild River		No	
27.	State land designated for wildlife or game management		No	
28.	State-designated Scenic or Wild River		No	
29.	State-designated Natural Areas		No	
30.	Particular areas, relatively small in size, important to maintenance of unique biotic communities		No	
31.	State-designated areas for protection or maintenance of aquatic life		No	
32.	Wetlands	Yes		Wetlands are present within MRS 7 (USFWS 1998) (Figure 2-4)
33.	Fragile landscapes, land sensitive to degradation if vegetative habitat or cover diminishes		No	


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Test Cell Target
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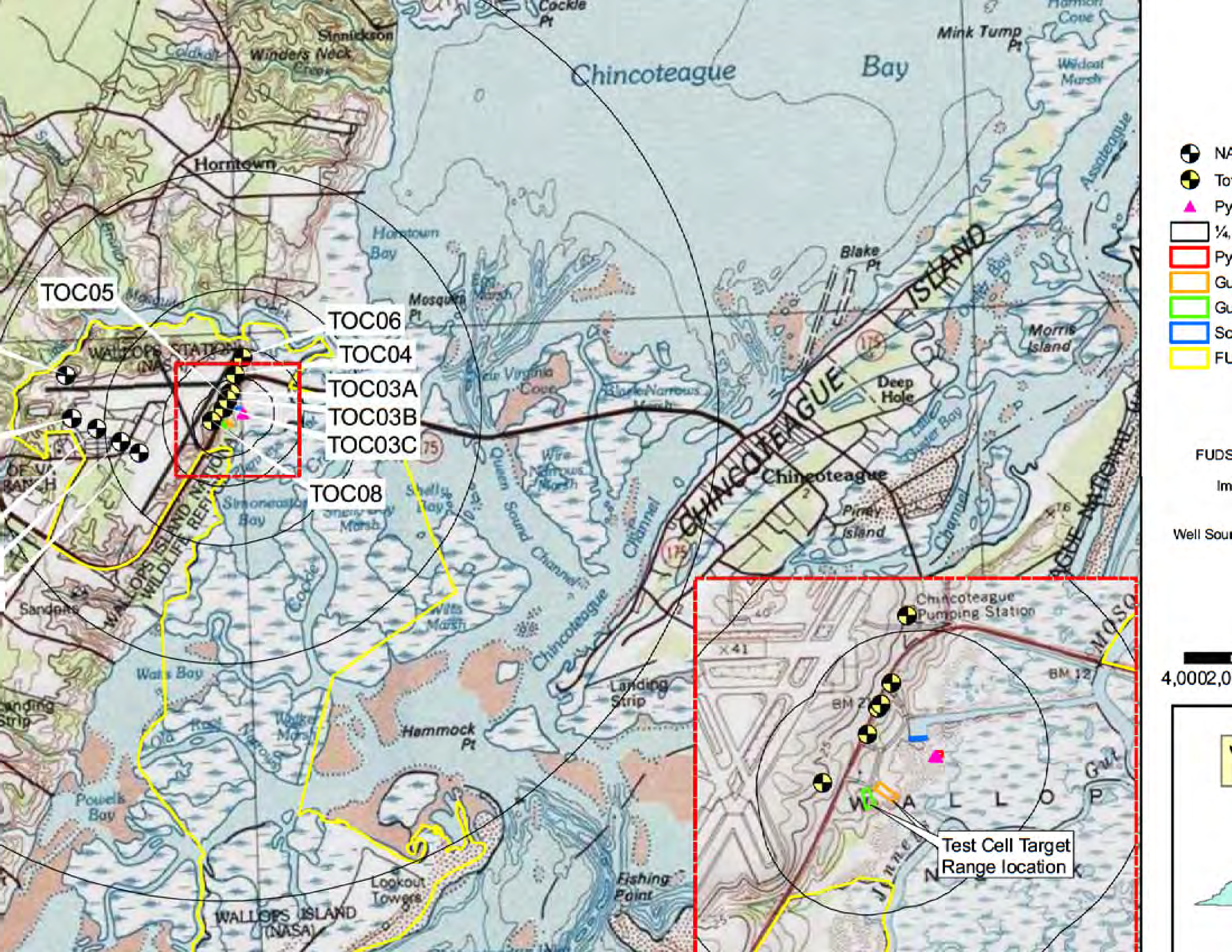

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3. SITE INSPECTION ACTIVITIES

3.1 Technical Project Planning

3.1.1 The first TPP meeting for WFF Project 07 was conducted on 6 May 2010 at the NASA WFF in Accomack County, VA. The Final TPP Memorandum documenting the meeting was issued in August 2010 (Alion 2010). NASA, VDEQ, CENAB, CENAO, USEPA Region 3, and HFA participated in this meeting. The participants in the meeting discussed the results of previous investigations, historical and current aerial photographs, the CSM, and Data Quality Objectives (DQOs) as documented in the TPP memorandum (Appendix B). During the TPP #1 meeting, NASA indicated that a removal action was conducted at the location of the former Gun Butts No. 1 and 2 in 2006 and hundreds of 20mm and 37mm projectiles and other MD were removed from the site (Alion 2010).

3.1.2 **DQO 1 – Determine if MRS 7 requires additional investigation through an RI/FS or if MRS 7 may be recommended for a No DoD Action Indicated (NDAI) designation based on the presence or absence of MEC and MC.** The basis of an RI/FS recommendation, detailed in the DQO of Appendix B, includes evaluation of evidence (e.g., historical data, field data, etc.), such as the data noted below, to make a final recommendation for an NDAI designation or RI/FS (e.g., presence of MD alone will not justify an RI/FS recommendation).

3.1.2.1 The basis for an RI/FS recommendation related to the presence of MEC includes:

- If there is historical data that indicates the presence of MEC or MD.
- If there is visual evidence of MEC/MD or surface anomalies which are classified as MEC or MD.
- If there are one or more anomalies in a target area near historical or current MEC/MD finds or within an impact crater.
- If there is physical evidence indicating the presence of MEC (e.g., distressed vegetation, stained soil, ground scarring, bomb craters, burial pits).

3.1.2.2 The basis for an RI/FS recommendation related to the presence of MC includes:

- If the maximum concentrations at MRS 7 exceed USEPA Regional Screening Values based on current and future land use.
- If the maximum concentrations at MRS 7 exceed USEPA interim ecological risk screening values.

- If the maximum concentrations at MRS 7 exceed site-specific background levels.
- Data indicating the presence or absence (less than the Reporting Limit [RL]) of analytes for which no screening criteria are available are to be used to support the weight-of-evidence (WOE) evaluation of MC at MRS 7.

3.1.2.2 In each of these instances, lines of evidence (e.g., historical data, field data) are used to make a final recommendation for an NDAI designation or RI/FS. If none of the above scenarios occur, then a recommendation for an NDAI designation for MEC/MC is a possible option.

3.1.3 **DQO 2 – Determine the potential need for a Time Critical Removal Action (TCRA) for MEC and MC by collecting data from previous investigations/reports, conducting an MRS visit, performing analog geophysical activities, and by collecting MC samples.** The basis for recommendations is specified below:

- A TCRA may be initiated if there is a complete pathway between source and receptor and if the MEC/MC and the situation are viewed as an imminent danger posed by the release or threat of a release. Cleanup or stabilization actions must be initiated within six months to reduce risk to public health or the environment.
- A non-TCRA (NTCRA) may be initiated if a release or threat of release that poses a risk where more than six months planning time is available.

3.1.3.1 In each of these instances, lines of evidence (e.g., historical data, field data) are to be used to make a final recommendation for a TCRA or NTCRA.

3.1.4 **DQO 3 – Collect or develop additional data, as appropriate, to support potential Hazard Ranking System scoring by USEPA.**

- This DQO is attained via verification in the SI Report that data were collected in accordance with the Final SS-WP. However, this SI was not intended to be the only source of data used to score WFF Project 07 in the HRS. While there is insufficient data in the SI for USEPA to perform an evaluation under the HRS Model, any data gaps will be discussed during the scoping process of the future RI.

3.1.5 **DQO 4 – Collect the additional data necessary to complete the MRSPP.**

- This DQO is attained via completion of the MRSPP for the MRS with available data and documentation of any data gaps for future annual updates.

3.1.6 The meeting participants concurred with the DQOs and the general technical approach for the planned SI activities discussed during the first TPP meeting and as revised and subsequently documented in the Final SS-WP (Alion 2010). In summary, these agreements were to inspect the MRS and conduct sampling in accordance with the Final SS-WP, and complete the assessment in accordance with the DQOs. As part of this SI Report, the DQOs were evaluated and a DQO attainment verification worksheet was completed to document completion of the DQOs (Appendix B). The four DQOs were attained during this SI.

3.2 Supplemental Records Review

3.2.0.1 State and federal agencies were contacted regarding threatened and endangered (T&E) species and cultural and archaeological resources at MRS 7.

3.2.1 Threatened and Endangered Species

3.2.1.1 According to the United States Fish and Wildlife Service (USFWS) and VA Fish and Wildlife Information Service, nineteen federal or state threatened or endangered bird, invertebrate, mammal, reptile and vascular plant species have been identified in Accomack County or within a five-mile radius of the WFF. The nineteen species and their respective statuses are listed in the PA (USACE 2011a) (Appendix L). In addition, the Wallops Island National Wildlife Refuge is approximately 500 ft from the boundary of the MRS (USFWS 2011b).

3.2.1.2 The USFWS, Virginia Department of Game and Inland Fisheries (VDGIF), VA Department of Conservation and Recreation (VDCR), and National Oceanic and Atmospheric Administration (NOAA) National Marine Fisheries Service (NMFS) were sent the proposed field activities for review to determine if any T&E species are present and were likely to be adversely affected by the field activities presented in this SS-WP. The responses from the DCR and USFWS indicated that no adverse impacts to T&E species are anticipated based on the limited field activities at WFF Project 07. However, USFWS identified several federally threatened (Loggerhead sea turtle, Northeastern Beach tiger beetle, Piping Plover, Seabeach amaranth) and endangered (Delmarva Peninsula Fox squirrel, Roseate tern) species within WFF Project 07 (USFWS 2011a). The VDGIF was unable to provide an assessment of the project at that time (VDGIF 2011a). The NMFS responded that several species of T&E sea turtle species may be found along the coast of Virginia, but due to the shallow depth of the Boat Basin it would be extremely unlikely that sea turtles would be present in that area and no further coordination was required (NOAA 2011). No changes were made to the field activities as a result of possible T&E species. The response letters from each agency are included in Appendix L.

3.2.2 Cultural and Archaeological Resources

3.2.2.1 Prior to the SI field activities at WFF Project 07, USACE sent a letter with supporting figures (proposed sampling and areas of archaeological sensitivity) to the Virginia Department of Historic Resources for consultation. The letter indicated that, based on the cultural resource assessment completed in 2003 and the limited intrusive sampling proposed during the SI field activities, significant impacts to cultural resources were not expected. Given the limited field activities, USACE concluded that no adjustments were necessary to the sampling design to avoid impact on cultural resources. The letter and supporting figures sent by USACE, dated 28 February 2011, to VA SHPO is included in Appendix L.

3.3 Site Inspection Fieldwork

3.3.0.1 SI field activities at MRS 7 were conducted on 12, 13, and 14 December 2011. A summary of the observations and MC samples collected at MRS 7 is provided in the following subsections. Additional information pertaining to the field activities for MRS 7, including field notes and forms, and chain of custody forms, are provided in Appendix D. As-collected sample locations, designations, rationale, and field observations for MRS 7 are summarized in Table 3-1. MRS 7 sample locations, QR paths, and anomalies are depicted on Figures 3-1a and 3-1b, respectively. A photo documentation log from the SI field activities is included in Appendix E, and photo locations are shown on Figure 3-2. Locations, designations, rationale, and field observations for background sediment samples collected during the 2011 SI field activities are summarized in Table 3-2. Locations of sediment background samples collected during the 2011 SI field activities are depicted on Figure 3-3. Background surface and subsurface soil and groundwater sample information was obtained from an existing background study (Appendix L) and is discussed in Paragraph 3.3.2.4 and in the context of the MRS 7 MC risk screening in Section 5 of this SI Report.

3.3.1 Site Inspection Munitions and Explosives of Concern Field Observations

3.3.1.1 An estimated 1.76 acres of land were assessed during the field work completed at MRS 7 using a Whites XLT metal detector (to detect ferrous and non-ferrous metals) and visual reconnaissance along a meandering path and around sample locations. The approximate land acreage of QR completed for each area within MRS 7 is 0.68 acres at and between Gun Butts No. 1 and 2; 0.22 acres at Pyrotechnics Burn Area; 0.86 acres at the South Bank and around the perimeter of the Boat Basin. Analog geophysics was used primarily to support anomaly avoidance activities for the field crew. Although no samples were collected within the Boat Basin (outside of MRS 7), approximately 0.31 acres of analog geophysics was completed in the water portion of the Boat Basin using a Bore Hole Gradiometer (BHG)-1 to detect ferrous metals.

3.3.1.2 **MRS 7 – Boat Basin/Visitors Information Center.** The former Pyrotechnics Burn Area, Gun Butts No. 1 and 2, and the South Bank of the Boat Basin were the primary focus of the 2011 SI field activities; however, additional QR and sampling were completed outside of the boundary of these four areas. The following observations were made during the SI field event.

- Portions of MRS 7 (Pyrotechnics Burn Area and Boat Basin) are fenced and not accessible to the public; however, the Marine Science Consortium and NASA employees have access to the Boat Basin. Other portions of MRS 7 (Gun Butt No. 1 and Gun Butt No. 2) are in an area outside of the Visitor Information Center that is open to the public.
- There is a gate at the entrance to the visitor center parking lot to regulate/control entering this area if necessary; however, the gate is open during daylight hours (10 am to 4 pm) on a schedule that is seasonal but a minimum of five days a week.
- Approximately 37 subsurface (single) and numerous surface anomalies were detected throughout the QR paths walked within and in close proximity to MRS 7. In addition, five areas of concentrated subsurface anomalies were documented. The surface anomalies were identified as military debris (e.g., Marston mat, MD). Two anomalies were detected while conducting analog geophysics within the water of the Boat Basin, and an undefined area along the South Bank of the Boat Basin was noted as having a large quantity (more than 50) of surface anomalies identified as rusty metal debris.
- No confirmed MEC was observed during the SI field event at MRS 7. However, three MD were observed. Also, seven Material Potentially Presenting an Explosive Hazard (MPPEH) items that could not be determined to not contain energetic material were observed and their locations recorded using a GPS unit. In accordance with the procedures outlined in the Final SS-WP, USACE and NASA were notified of the MPPEH items and the UXO technician recommended to NASA that the MPPEH items be removed as soon as possible. It was agreed that an emergency response action would not be initiated because the items were not viewed as an "immediate and unacceptable hazard" to the local populace or site personnel.

3.3.2 Site Inspection Munitions Constituents Samples Collected

3.3.2.1 **MRS 7 – Boat Basin/Visitors Information Center.** A total of 32 soil (21 surface and 11 subsurface), six sediment, four groundwater, and one surface water samples were collected at

MRS 7 (not including QA). Six co-located surface and subsurface soil samples, ten surface soil samples, and two groundwater samples were collected between and within the Gun Butts No. 1 and 2. Five sediment samples, one surface water sample, and one co-located surface and subsurface soil sample were collected from the South Bank of the Boat Basin. Four co-located surface and subsurface samples were collected (at each corner outside the fence), and two groundwater samples were collected at the Pyrotechnics Burn Area. The two groundwater samples were collected at the eastern and southern fence corner of the Pyrotechnic Burn Area. The list of analytes for the MRS 7 samples included a select list of explosive constituents and metals based on munitions used in these areas historically (Table 2-2). Two of the surface soil samples and one of the field duplicate surface soil samples collected at the Pyrotechnics Burn Area of MRS 7 also were analyzed for Polycyclic Aromatic Hydrocarbons (PAHs) due to the possible use of accelerants (Table 2-2). Additionally, perchlorate was analyzed in groundwater and surface water samples collected at MRS 7. The surface water sample and one field duplicate surface water samples were collected from the boat basin by placing the bottle within the water near the bottom of the water column. Refer to Section 3.4 for changes to proposed sample locations that occurred during field activities.

3.3.2.2 **Background Samples.** As agreed at the TPP meeting, samples collected at WFF Project 07 were compared to a previously established background data set for the WFF Main Base provided by NASA. Specifically, MRS 7 soil and groundwater samples were compared to the analytical results contained in the report, "Background Soil and Groundwater Investigation Report for the Main Base", which was completed in May 2004. The report does not include background data for perchlorate in groundwater or any analytes in sediment or surface water. NASA indicated that perchlorate has not been detected in groundwater samples collected to date at WFF; therefore, a background groundwater/surface water sample was not collected for background perchlorate comparison. Three sediment samples were collected outside the MRS boundary and analyzed for select metals (aluminum, antimony, barium, copper, iron, lead, magnesium, nickel, and zinc) for comparison to MRS 7 samples. Refer to Section 3.4 for changes to proposed background sample locations that occurred prior to or during field activities.

3.4 Work Plan Deviations and Field Determinations

3.4.1 Deviations from the WFF Project 07 Final SS-WP (TPMC 2011) occurred with respect to sample locations at MRS 7.

3.4.1.1 During the field event, the location proposed in the Final SS-WP for the groundwater sample WFF-MRS7-GW-00-04 was not conducive to transmitting water to sample. The field team received approval from USACE to collect a sample south of the proposed location.

Therefore, groundwater sample WFF-MRS7-GW-00-04 was moved slightly south of the former impact area Gun Butt No. 2.

3.4.1.2 The locations proposed in the SS-WP for the five sediment samples at the South Bank of the Boat Basin were located within the boat basin surface water feature. USACE provided concurrence to move the samples to the South Bank of the Boat Basin where MD was observed historically and during the field event.

3.4.1.3 The Pyrotechnics Burn Area was found to be incorrectly positioned in the USACE-provided GIS (USACE 2011). The correct location, as confirmed by visual evidence of burning contained within a deteriorated fence matching the description of the area cited in historical documents, was observed to be near the southwestern corner of the Pyrotechnic Burn Area shown in the Final SS-WP. GPS coordinates were collected at each corner of the fence, which was approximately 500 square ft (20 ft by 25 ft). The USACE-provided boundary for the Pyrotechnics Burn Area and the GPS coordinates for the four fence corners are shown on the figures in this SI Report. USACE approved moving the proposed samples for the Pyrotechnic Burn Area to be collected within the fenced area. However, due to a dense concentration of subsurface anomalies within the fenced area, the UXO Technician could not locate sample areas that were free of anomalies. USACE concurred with collecting the samples just outside the fenced Pyrotechnics Burn Area where an area could be cleared by the UXO technician.

3.5 Site Inspection Laboratory Data Quality Indicators

3.5.1 This section summarizes the data quality assessment for the WFF Project 07 SI analytical data. Data were generated by the TestAmerica, Inc. laboratory in Arvada, Colorado under the DoD Quality Systems Manual (QSM) Version 4.2 (DoD 2010) and validated by a third-party (EDS) using USEPA Region III Functional Guidelines. The detailed Test America, Inc. and EDS reports are contained in Appendixes F and G, respectively. The data were analyzed using the Automated Data Review Version 8.2 based on the DoD QSM 4.2 guidelines, and these results are included in the Environmental Data Management System (EDMS) database. Data Quality Indicators (DQIs) include precision, accuracy, representativeness, completeness, and comparability as well as sensitivity. At WFF Project 07, no quality assurance (QA) split samples were collected in accordance with USACE direction. Therefore, the USACE Memorandum for Record-Chemical Quality Assurance Report of Quality Assurance Split Samples is not applicable to this SI Report. However, CENAB will provide a Chemical Data Quality Assessment Report (CDQAR) for inclusion in Appendix G of the Final SI Report.

3.5.2 Precision is a measure of the reproducibility of repetitive measurements of the same process under similar conditions. Precision is determined by measuring the agreement among individual measurements of the same property, under similar conditions, and is calculated as an absolute value. The degree of agreement was expressed as the relative percent difference (RPD) between the separate measurements (usually matrix spike/matrix spike duplicate [MS/MSD] pairs) and the observed relative percent difference compared to acceptable values. Field precision is measured by the comparison of field duplicate samples to their associated parent samples.

3.5.2.1 For MRS 7, the MS/MSD samples pairs achieved acceptable RPD values. The field duplicate samples achieved acceptable values (Appendix G). The objectives for the precision DQI were met.

3.5.3 Accuracy is the degree of agreement of a measurement with an accepted reference or true value. Accuracy measures the bias or systematic error of the entire data collection process. To determine accuracy, a sample that has been spiked with a known concentration is analyzed by the laboratory as the MS, MSD, surrogate and blank spikes, or Laboratory Control Spike. EDS assessed accuracy according to Region III Functional Guidelines and assigned qualifiers as appropriate.

3.5.3.1 For MRS 7, the laboratory QA samples achieved acceptable values with the exception of the MS/MSD (antimony, iron, lead, 3-NB), Method Blank (iron, lead, copper, nickel, 2,4,6-TNT, 2-NT, Acenaphthylene, and Naphthalene), Field Blank (magnesium and zinc) and Surrogate Spike (1,2-dinitrobenzene), which required sample qualification. The affected samples were qualified appropriately as shown in Appendix G. The evaluation of the qualified analytical data and its validity for use in the risk assessment screening process presented in Paragraph 5.1.2.2. The objectives for the accuracy DQI were met (Appendix G).

3.5.4 Representativeness expresses the degree to which data accurately and precisely represents a characteristic of a population, parameter variations at a sampling point, or an environmental condition. Representativeness is achieved through proper development of the field sampling program during the TPP and work plan development. Some sample locations were moved during field work to areas where media was present or in the correct location (South Bank of Boat Basin, within the Pyrotechnics Burn Area) resulting in deviations from the Final SS-WP. The location movements were necessary to produce data that accurately represent the MC concentrations in the media present at the MRS. The samples collected were analyzed as proposed; therefore, the objectives for the representative DQI were achieved for the WFF Project 07.

3.5.5 Completeness is a measure of the amount of valid data obtained from a measurement system compared to the amount that was expected to be obtained under normal conditions. Data are complete and valid if the data achieve the acceptance criteria including accuracy, precision, and any other criteria specified by the particular analytical method being used. Each sample proposed in the Final SS-WP was collected, although some were relocated as discussed previously. The acreage of QR that was completed during the SI field event (approximately 1.76 acres of land and 0.31 acres within the Boat Basin) exceeded the QR proposed in the SS-WP (approximately 1.30 acres). All of the 847 analyte results associated with the MRS 7 SI sampling effort, with the exception of 17 antimony results, were accepted by EDS. Therefore, the WFF Project 07 data achieved 98.66% completeness and met the objectives for the completeness DQI.

3.5.6 Comparability expresses the confidence with which one data set can be compared to another. The comparability DQI was evaluated with respect to the comparability of sampling results within the data set based on analytical and data validation procedures prescribed in the DQOs. Standard methods for sampling and analyses were followed as described in the SS-WP. These methods were consistent with other samples collected under the MMRP. The MRS sample results for WFF Project 07 were compared to the background data set collected during the SI for sediment comparisons (metals) and the previous background study for soil comparisons (metals and PAHs). Since the background sediment samples were collected from similar sediment types using the same collection/analysis methods, the comparability of the data sets has a high degree of confidence. The background data set for soil was collected from a similar soil series. The background data set for groundwater was collected from a similar depth (shallow) and condition (unfiltered). The use of the background soil and groundwater comparisons was agreed to by stakeholders at the TPP #1 meeting as documented in the Final TPP Memorandum and SS-WP. Therefore, the objectives for the comparability DQI were achieved.

3.5.7 Sensitivity is a measure of the screening criteria as they compare to detection limits. If screening criteria are below the limit of quantitation (LOQ), the usability of the "non-detected" results to indicate that MCs are present at levels at which no unacceptable risks may occur is called into question. The laboratory reported to the LOQ, which represents the lowest concentration which can be reliably achieved at the specified limits of precision and accuracy. Consequently, if sensitivity Measurement Quality Objectives (MQOs) were achieved for MCs, the RLs are adequate to detect risks at levels of concern for the identified receptor. In this instance, non-detected data sufficiently indicates that no unacceptable risk to receptors is present from the sample or group of samples.

3.5.7.1 The sensitivity MQO was achieved for analyte/receptor/matrix combinations at MRS 7 with the exception of nitroglycerin (NG) in surface and subsurface soil, surface water, and groundwater (human receptors), antimony in groundwater (human receptors), and 1,3,5-trinitrobenzene (TNB) and nitrobenzene in sediment (ecological receptors). In addition, no human health screening values were available for magnesium, acenaphthylene, benzo[g,h,i]perylene, and phenanthrene in soil or magnesium in groundwater for human receptors. No ecological screening values were available for NG, 1,3,5-TNB, magnesium, and iron in soil; magnesium in sediment or groundwater; and perchlorate and tetryl in surface water. Uncertainties associated with the cases in which the MQOs for sensitivity were not met, and the absence of human and ecological screening values, are discussed within the context of analytical sample results in Section 5. This discussion indicates that for this particular MRS, the absence of screening values does not undermine the certainty with which the determinations of risk for human and ecological receptors can be made.

3.6 Second Technical Project Planning Meeting

3.6.1 Following the completion of the Draft Final SI Report, stakeholders had an opportunity to participate in a second TPP meeting to discuss the findings, conclusions, and recommendations of the SI Report; review the MRSPP (Appendix K); and confirm that the project objectives and DQOs were achieved. The second TPP meeting was held concurrent with the Remedial Project Manager (RPM) meeting at the NASA WFF on 14 June 2012. A memorandum summarizing the meeting minutes is included in Appendix B of the SI Report. Additionally, the responses to stakeholder comments, which are included at the end of this SI Report, were discussed with stakeholders in person during the TPP #2 meeting and via telephone calls that occurred on 7 and 20 June 2012.

Table 3-1. WFF Project 07 Sample Locations and Descriptions

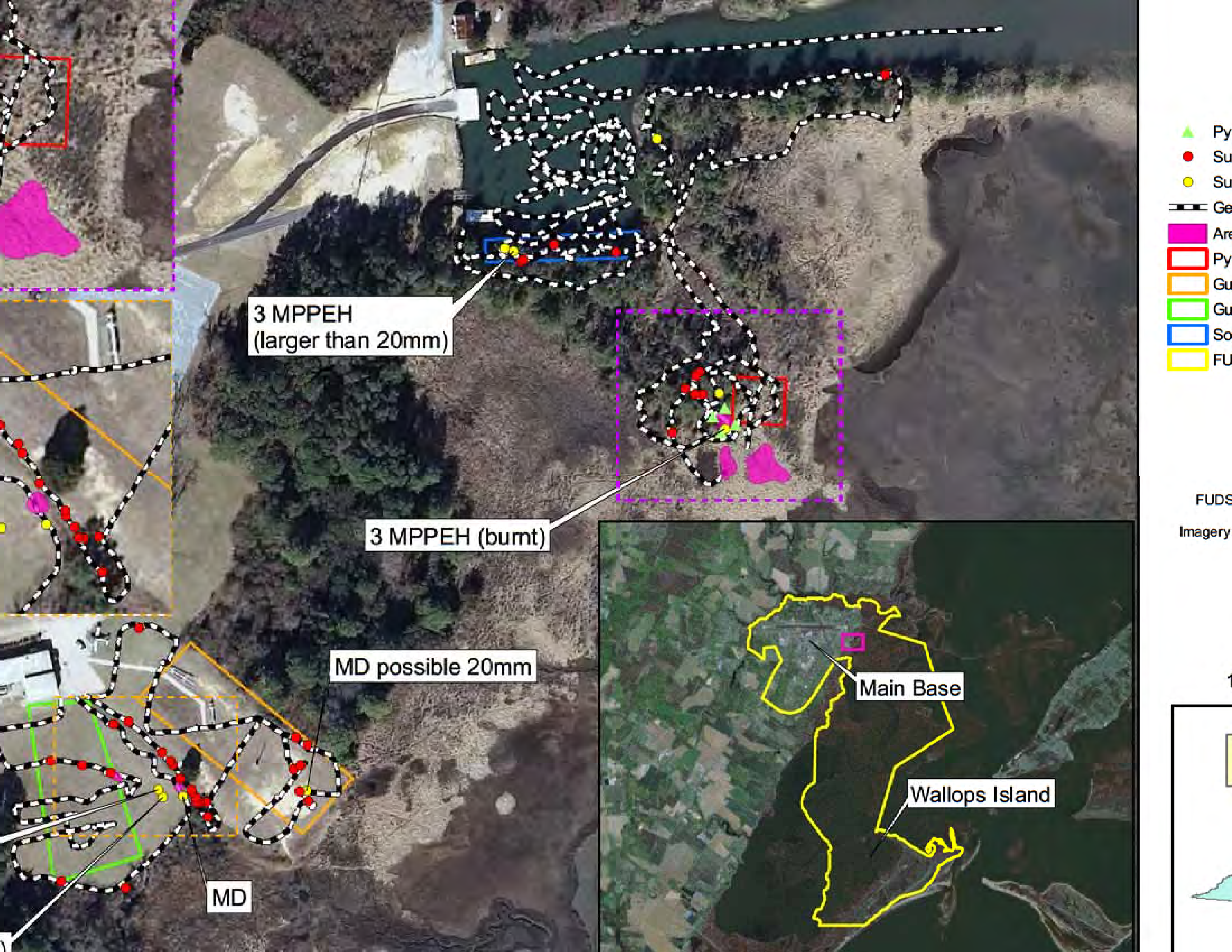
Location	Sampling ID	Coordinate System: UTM Zone: 18N Datum: NAD 1983 CONUS		Description of Sample Location
		Easting(m)	Northing(m)	
Pyrotechnics Burn Area	WFF-MRS7-SS-01-01/ WFF-MRS7-SB-02-01	460110.19	4199133.71	Eastern corner just outside the fenced-in Pyrotechnics Burn Area (Fence corner: 460109.98 m E, 4199134.07 m N)
	WFF-MRS7-SS-01-02/ WFF-MRS7-SB-02-02	460106.61	4199140.56	Northern corner just outside the fenced-in Pyrotechnics Burn Area (Fence corner: 460105.867 m E, 4199140.781 m N)
	WFF-MRS7-SS-01-03/ WFF-MRS7-SB-02-03	460104.36	4199130.81	Southern corner just outside the fenced-in Pyrotechnics Burn Area (Fence corner: 460104.376 m E, 4199131.216 m N)
	WFF-MRS7-SS-01-04/ WFF-MRS7-SB-02-04	460100.45	4199137.76	Western corner just outside the fenced-in Pyrotechnics Burn Area(Fence corner: 460100.867 m E, 4199137.465 m N)
	WFF-MRS7-GW-00-01	460107.11	4199131.82	Southern corner just outside the fenced-in area of the Pyrotechnics Burn Area
	WFF-MRS7-GW-00-02	460111.37	4199136.05	Eastern corner just outside the fenced-in area of the Pyrotechnics Burn Area
Gun Butt No. 1	WFF-MRS7-SS-01-05/ WFF-MRS7-SB-02-05	459937.84	4198978.81	Near the Gun Butt No. 1 former impact berm
	WFF-MRS7-SS-01-06/ WFF-MRS7-SB-02-06	459932.90	4198994.66	Near the Gun Butt No. 1 former impact berm
	WFF-MRS7-SS-01-07/ WFF-MRS7-SB-02-07	459922.83	4198981.41	Near the Gun Butt No. 1 former impact berm
	WFF-MRS7-SS-01-12	459917.34	4199014.42	Within Gun Butt No. 1 between the former firing point and impact berm
	WFF-MRS7-SS-01-13	459889.74	4199010.85	Within Gun Butt No. 1 between the former firing point and impact berm
	WFF-MRS7-SS-01-14	459876.43	4199036.85	At the Gun Butt No. 1 former firing point
	WFF-MRS7-GW-00-03	459932.41	4198984.70	Near the Gun Butt No. 1 former impact berm
Gun Butt No. 2	WFF-MRS7-SS-01-08/ WFF-MRS7-SB-02-08	459841.29	4198974.90	Near the Gun Butt No. 2 former impact berm
	WFF-MRS7-SS-01-09/ WFF-MRS7-SB-02-09	459841.15	4198962.38	Near the Gun Butt No. 2 former impact berm
	WFF-MRS7-SS-01-10/ WFF-MRS7-SB-02-10	459856.40	4198971.47	Near the Gun Butt No. 2 former impact berm
	WFF-MRS7-SS-01-15	459828.03	4198996.56	Within Gun Butt No. 2 between the former firing point and impact berm
	WFF-MRS7-SS-01-16	459852.86	4198992.26	Within Gun Butt No. 2 between the former firing point and impact berm
	WFF-MRS7-SS-01-17	459834.45	4199017.19	At the Gun Butt No. 2 former firing point

Table 3-1. WFF Project 07 Sample Locations and Descriptions

Location	Sampling ID	Coordinate System: UTM Zone: 18N Datum: NAD 1983 CONUS		Description of Sample Location
		Easting(m)	Northing(m)	
	WFF-MRS7-GW-00-04	459860.56	4198952.86	South of the Gun Butt No. 2 former impact berm
Outside MRS/ Drainage Area between Gun Butt No. 1 & 2	WFF-MRS7-SS-01-18	459870.99	4199005.88	Drainage area between Gun Butt No. 1 & 2
	WFF-MRS7-SS-01-19	459888.41	4198978.20	Drainage area between Gun Butt No. 1 & 2
	WFF-MRS7-SS-01-20	459929.91	4198956.99	Drainage area behind Gun Butt No. 1 former berm location
	WFF-MRS7-SS-01-21	459861.09	4198945.17	Drainage area behind Gun Butt No. 2 former berm location
South Bank of Boat Basin	WFF-MRS7-SD-01-01	460015.26	4199207.09	On the southern portion of the shoreline of the boat basin below the water line
	WFF-MRS7-SD-01-02	460043.45	4199208.05	On the southern portion of the shoreline of the boat basin below the water line
	WFF-MRS7-SD-01-03	460068.37	4199210.77	On the southern portion of the shoreline of the boat basin below the water line
	WFF-MRS7-SD-01-04	460028.76	4199205.13	On the southern portion of the shoreline of the boat basin on the shore
	WFF-MRS7-SD-01-05	460056.94	4199208.10	On the southern portion of the shoreline of the boat basin on the shore
	WFF-MRS7-SS-01-11/ WFF-MRS7-SB-02-11	460042.60	4199201.72	On the southern portion of the shoreline upland of the boat basin
	WFF-MRS7-SW-00-01	460041.29	4199207.81	Within the boat basin waters
Background	WFF-MBBG-SD-01-01	460251.35	4199592.52	Background sediment sample
	WFF-MBBG-SD-01-02	460254.87	4199648.07	Background sediment sample
	WFF-MBBG-SD-01-03	460253.55	4199559.59	Background sediment sample

CONUS= Continental United States
GW= Groundwater
ID= Identification
MBBG= Main Base Background
m= meter
MRS= Munitions Response Site
N= North
No.= Number
NAD= North American Datum
SB= Subsurface Soil
SD= Sediment
SS= Surface Soil
SW= Surface water
UTM= Universal Transverse Mercator
WFF= Wallops Flight Facility

WFF-MRS7-SS-01-02
WFF-MRS7-SB-02-02
WFF-MRS7-GW-00-02
WFF-MRS7-SD-01-02
WFF-MRS7-SD-01-01
WFF-MRS7-SD-01-05
WFF-MRS7-SD-01-03
WFF-MRS7-SS-01-01
WFF-MRS7-SB-02-01
WFF-MRS7-GW-00-01
WFF-MRS7-SD-01-04
WFF-MRS7-SS-01-11
WFF-MRS7-SB-02-11
WFF-MRS7-SS-01-18
WFF-MRS7-SS-01-13
WFF-MRS7-SS-01-12
WFF-MRS7-SS-01-06
WFF-MRS7-SB-02-06
WFF-MRS7-GW-00-03
WFF-MRS7-SS-01-05
WFF-MRS7-SB-02-05
WFF-MRS7-SS-01-07
WFF-MRS7-SB-02-07
WFF-MRS7-SS-01-20
Main Base
Wallops Island
FUDS
Imagery



3 MPPEH
(larger than 20mm)
3 MPPEH (burnt)
MD possible 20mm
MD
Main Base
Wallops Island
FUDS
Imagery

Photo E.7
Photo E.8
Photo E.6
Photo E.14
Photo E.9 & E.10
Photo E.5
Photo E.13
Photo E.14
Photo E.11
Photo E.12
Photo E.2
Photo E.4
Photo E.2
Photo E.3
Main Base
Wallops Island
FUDS
Imagery

WFF-MBBG-SD-01-02
WFF-MBBG-SD-01-01
WFF-MBBG-SD-01-03
Main Base
Wallops Island

4. MUNITIONS AND EXPLOSIVES OF CONCERN HAZARD ASSESSMENT

4.1 Munitions and Explosives of Concern Hazard Assessment Criteria

4.1.0.1 A qualitative MEC hazard assessment was conducted based on the SI QR, as well as historical data documented in the PA (USACE 2011). A qualitative hazard evaluation assesses the potential explosive safety hazard and communicates the hazard that may exist at the MRS along with the potential causes (USAESCH 2001).

4.1.0.2 An explosive safety hazard is the probability for an MEC item to detonate and potentially cause harm as a result of human activities. An explosive safety hazard exists if a person can come near or in contact with MEC and act on it to cause a detonation. The potential for an explosive safety hazard depends on the presence of three elements (USAESCH 2001).

- Ordnance and Explosive Factors - a source (presence of MEC)
- Site Characteristics Factors – accessibility and stability
- Human Factors – a receptor (person) and interaction (e.g., touching or picking up an item).

4.1.0.3 Each of these primary factors was used to evaluate the field and historical data to generate an overall hazard assessment rating of low, moderate, or high at MRS 7 (Section 4.2). The CSM for MRS 7 reflects this MEC assessment strategy (Appendix J).

4.1.0.4 The MEC source is based on the type, sensitivity, density and depth distribution. The type of MEC dictates the likelihood and severity of exposure, and thereby injury, if it should function when encountered. MEC sensitivity affects the likelihood of an item functioning as designed when encountered by a receptor (e.g., pressure from stepping on the item, fuze activation from moving the item, etc.). MEC quantity/density and depth, if present, are generally unknown during the SI and are evaluated during follow on studies (RI/FS).

4.1.0.5 Site characteristics refer to the physical conditions of the MRS and natural events that occur. Site accessibility affects the likelihood of a receptor coming in contact with MEC and include manmade (e.g., walls or fences) or natural barriers (e.g., terrain, topography, vegetation) that may prevent access to the MRS. A MEC item tends to remain in place unless disturbed through human or natural forces (e.g., frost heaving, erosion, tidal or wave action). If MEC movement occurs, the probability of direct human contact may increase, but not necessarily result in direct contact or exposure.

4.1.0.6 Human interaction includes the type of activities that exist at the MRS, the human population that may have access, and the frequency of that access. Activities are generally classified as recreational (hiking, camping, etc.) and occupational (farming, industrial, etc.). Activities at an MRS generate an exposure route for a MEC receptor. The MEC exposure route is typically direct contact with a MEC item on the surface or through subsurface activities (e.g., excavation during construction). The area population and frequency of use determines the likelihood of a receptor to encounter MEC. The hazard to the surrounding population is based on MRS characteristics and location, access restrictions, natural and/or manmade barriers, and the surrounding population.

4.1.0.7 Based on the hazard criteria delineated above, an MRS is qualitatively assigned a low, moderate, or high MEC hazard ranking. The MEC hazard assessment categories are summarized in Table 4-1.

4.2 Munitions and Explosives of Concern Hazard Assessment

4.2.1 MRS 7 – Boat Basin/Visitors Information Center

4.2.1.1 MRS 7 comprises four areas (Gun Butt No. 1, Gun Butt No. 2, the South Bank of the Boat Basin, and the Pyrotechnics Burn Area), which were the focus of this SI. However, the SI field activities included some areas outside the boundary of MRS 7. Numerous types of munitions were historically used at MRS 7, including HE. As discussed in Sections 2.4.1, 2.4.3, and 2.5, no MEC is known to have been historically found at MRS 7; however, numerous MD items have been observed historically. Three MD and seven MPPEH (20mm, larger than 20mm, burnt pyrotechnic items) were observed (one between the Gun Butts, three at the South Bank of the Boat Basin, three within the Pyrotechnics Burn Area) that could not be determined to not contain energetic material (Table 4-3 and Figure 3-1b). These items were identified as "MPPEH" but could not be confirmed as MD or MEC due to their rusty condition. In accordance with the procedures outlined in the Final SS-WP, the field team notified USACE and the property owner (NASA) of the presence of the MPPEH items. An emergency response action was not initiated because the MPPEH items were not viewed as an "immediate and unacceptable hazard" to the local populate or site personnel. However, NASA was notified that the MPPEH items should be removed as soon as possible. A removal report was not available from NASA for the Final SI Report. Also, 37 distinct subsurface anomalies were detected on land in or in close proximity to MRS 7. In addition, five areas of concentrated subsurface anomalies (i.e., the UXO technician was unable to count individual anomaly points) were identified, two at the Gun Butts and three at the Pyrotechnics Burn Area (including the entire area within the Pyrotechnics Burn Area fence).

Additionally, two underwater anomalies were noted (outside of MRS 7) during reconnaissance of the boat basin, and an undefined area along the South Bank of the Boat Basin was noted as having a large quantity (more than 50) of surface anomalies identified as rusty metal debris. The MEC type and sensitivity categories would be ranked as moderate.

4.2.1.2 The Gun Butt No. 1 and 2 portion of the MRS are open to NASA employees and visitors/trespassers; however, portions of MRS 7 (Boat Basin, Pyrotechnics Burn Area) are fenced (manmade barrier). The Marine Science Consortium staff and guests have access to the Boat Basin. Therefore, the access category was rated as moderate. The stability category was rated as moderate since erosion and frost-heave are possible.

4.2.1.3 Gun Butt No. 1 and 2 of MRS 7 is near the NASA Visitor Information Center which is open to the general public. Large rockets are on display and a tower was recently installed. Employees, visitors, construction workers, and trespassers have access to this portion MRS 7. The Boat Basin and Pyrotechnics Burn Area are fenced and not open to the public, but the Marine Science Consortium and NASA occasionally access boats in the Boat Basin. Therefore, the human interaction category was rated as moderate.

4.2.1.4 The overall MEC hazard is evaluated as moderate for MRS 7. Table 4-2 summarizes the qualitative MEC hazard at MRS 7. The MEC pathway is reflected as potentially complete at the surface and subsurface of MRS 7 in the CSM (Appendix J).

Table 4-1. MEC Hazard Assessment Categories

MEC Hazard	MEC Type	MEC Sensitivity	MRS Access	MRS Stability	Human Interactions
High	MEC that will cause an individual's death if detonated by an individual's activities	Very sensitive - Handling or movement may cause detonation	No Restriction - No manmade or natural barriers (e.g., no fence, gentle sloping terrain, no vegetation, no water) that restrict access	Site Unstable - MEC most likely will be exposed by natural events	High potential for and frequency of contact (e.g., general public has open and frequent access, high potential for surface/subsurface intrusive activity)
Moderate	MEC that will cause major injury to an individual if detonated by an individual's activities	Less sensitive - Fuzed but may be moved safely if identified as such by a UXO Technician	Limited Restriction - Manmade barriers and/or natural barrier (e.g., dense vegetation, water, snow or ice cover, and/or terrain) that restrict access	Moderately Stable - MEC may be exposed by natural events	Moderate potential for and frequency of contact (e.g., a limited number of the general public has open and somewhat frequent access, few MRS uses, surface/subsurface intrusive activity possible)
Low	MEC that will cause minor injury to an individual if detonated by an individual's activities	May have functioned correctly or is unfuzed but has a residual hazard	Restricted Access- All points of entry are controlled (manmade and/or natural barriers present)	Stable Site - MEC should not be exposed by natural events	Low potential for and frequency of contact (e.g., no general public access, infrequent MRS access primarily by personnel, no subsurface activity)
None	Inert MEC or scrap (MD), or only small arms used, will cause no injury	Inert MEC or scrap (MD), or only small arms used, will cause no injury	-	-	-

Table 4-2. MRS 7 – Boat Basin/Visitors Information Center Hazard Impact Assessment

	Historical Observations	SI Observations	Qualitative MRS Hazard
MEC Type and Sensitivity			
Munitions Type	Munitions types historically used include parachute flares, miniature practice bombs and signals, 37mm and 20 mm (including HE, tracer, and practice), and .50 caliber (Table 2-2) No MEC was observed at the MRS historically or during the 2005, 2007, and 2009 USACE visits. Numerous MD were observed and identified inert.	No confirmed MEC; however, MD and MPPEH items that could not be determined to not contain energetic material were observed during 2011 SI field event. 37 distinct subsurface anomalies and five areas of concentrated subsurface anomalies were identified during the field activities. Additionally, an undefined area along the South Bank of the Boat Basin was noted as having a large quantity (more than 50) of surface anomalies identified as rusty metal debris.	Moderate
MEC Sensitivity	Moderate	Same as above	Moderate
Access and Stability			
Accessibility	Gun Butts No. 1 and 2 not restricted, except for gate at entrance to visitor center. Boat Basin and Pyrotechnics Burn Area restricted by man made barrier (locked fence).	Limited restriction. Manmade barriers (gate and fence). Visitor center and consequently Gun Butts No. 1 and 2 are open during daylight hours. Boat Basin and Pyrotechnics Burn Area are behind fences, but Boat Basin accessible to NASA and Marine Science Consortium.	Moderate
Stability	Moderate	Moderately stable. Erosion and frost-heave possible.	Moderate
Human Interaction			
Population, Frequency of Use, Types of Activities	Low. No general public access. Wallops Island has been used for research and testing since military use ended.	Moderate. Boat Basin and Pyrotechnics Burn Area fenced, limited access. Gun Butts No. 1 and 2 are in landscaped lawn area with large rocket displays and recently installed tower.	Moderate
Overall MRS Hazard Ranking	Moderate		
MD – Munitions Debris MEC – Munitions of Explosive Concern MPPEH – Munitions Potentially Presenting an Explosive Hazard NASA – National Aeronautics and Space Administration	MRS – Munitions Response Site SI – Site Inspection USACE – U.S. Army Corps of Engineers WFF – Wallops Flight Facility		

Table 4-3. WFF Project 07 SI MD/MPPEH Items Locations and Descriptions

Location	Description	Coordinate System: UTM Zone: 18N Datum: NAD 1983 CONUS		Observations
		Easting(m)	Northing(m)	
Pyrotechnics Burn Area	Three MPPEH (burnt pyrotechnics)	460106.08	4199132.66	Inside the fence at southern fence line, items in small burn pile
Gun Butt No. 1	MD, possible 20mm	459935.18	4198984.82	In vicinity of the former berm location, very rusty condition
Gun Butt No. 2	None observed during 2011 SI field activities.	N/A	N/A	N/A
Outside MRS between Gun Butt No. 1 & 2	MD	459874.80	4198985.17	In drainage area, too deteriorated to identify
	MD	459884.71	4198982.47	In drainage area, too deteriorated to identify
	MPPEH (20mm intact)	459876.69	4198981.91	In drainage area, rusty condition
South Bank of Boat Basin	Three MPPEH (larger than 20mm)	460019.83	4199205.00	Located above water line at base of tree, items were deteriorated
CONUS= Continental United States m= meter MD= Munitions Debris MRS= Munitions Response Site N= North			N/A= Not Applicable No.= Number NAD= North American Datum UTM= Universal Transverse Mercator WFF= Wallops Flight Facility	

5. MUNITIONS CONSTITUENTS SAMPLING AND ANALYSIS

5.0.1 A screening level human health risk assessment (HHRA) and screening level ecological risk assessment (SLERA) were conducted to determine whether MCs in environmental media at WFF Project 07 may warrant a more detailed assessment of potential risk to current or future human and ecological receptors. The screening methodology, CSM, analytical results for the MC sampling, and results of the screening assessment are presented below.

5.1 Data Evaluation Methodology

5.1.0.1 The following sections present the process used to evaluate the MC data collected for the WFF Project 07. The methodology is designed to evaluate data for relevant MCs in the HHRA and SLERA using the appropriate risk-based screening criteria. The methodology also provides a means to evaluate uncertainty in the screening HHRA and SLERA processes and provides context for the risk conclusions. This process is consistent with the decision rules outlined in Section 3.1 (TPP) of this report, and is described in more detail in the following sections.

5.1.1 Refinement of Munitions Constituents

5.1.1.1 During the SI process, MCs potentially associated with WFF Project 07 were identified based on knowledge of munitions historically used. Information on historical use was obtained from munitions data sheets, historical documents, and other munitions reference documents.

5.1.1.2 WFF Project 07 is composed of the following four areas: Pyrotechnics Burn Area, Gun Butt No. 1, Gun Butt No. 2, and South Bank of Boat Basin. Gun Butts No. 1 and 2 were combined into one area for the purpose of the risk assessment based on similarity in the historical use and MC, resulting in a three distinct areas of interest for the MC risk assessment. The list of MCs analyzed at the three areas of interest for the WFF Project 07 is provided below.

Pyrotechnics Burn Area

- Explosive constituents (TNT and TNT breakdown products {1,3,5-TNB, 1,3-DNB, 2,4,6-TNT, 2-amino-4,6-DNT, 4-amino-2,6-DNT, NB, 2,6-DNT})
- Metals (aluminum, antimony, barium, iron, lead, magnesium, and zinc)[1]

[1]Aluminum, barium, magnesium, and iron are not classified as hazardous substances under CERCLA. As per USACE guidance regarding non-CERCLA hazardous substances, the screening results for these metals will not be used as the sole basis for determining an RI/FS recommendation for WFF Project 07.

- PAHs (acenaphthene, acenaphthylene, anthracene, benzo[a]anthracene, benzo[b]fluoranthene, benzo[k]fluoranthene, benzo[g,h,i]perylene, benzo[a]pyrene, chrysene, dibenzo[a,h]anthracene, fluoranthene, fluorene, indeno[1,2,3-cd]pyrene, naphthalene, phenanthrene, and pyrene)
- Perchlorate

Gun Butts No. 1 and 2[2]

- Explosive constituents (DNT and DNT breakdown products {2,4-DNT, 2,6-DNT, 2-amino-4,6-DNT, 2-nitrotoluene, 3-nitrotoluene, 4-amino-2,6-DNT, and 4-nitrotoluene}, TNT and TNT breakdown products {1,3,5-TNB, 1,3-DNB, 2,4,6-TNT, 2-amino-4,6-DNT, 4-amino-2,6-DNT, NB}, NG, RDX, and tetryl)
- Metals (antimony, copper, iron, lead, and nickel)[1]
- Perchlorate

South Bank of Boat Basin

- Explosive constituents (DNT and DNT breakdown products {2,4-DNT, 2,6-DNT, 2-amino-4,6-DNT, 2-nitrotoluene, 3-nitrotoluene, 4-amino-2,6-DNT, and 4-nitrotoluene}, TNT and TNT breakdown products {1,3,5-TNB, 1,3-DNB, 2,4,6-TNT, 2-amino-4,6-DNT, 4-amino-2,6-DNT, NB}, NG, RDX, and tetryl)
- Metals (antimony, copper, iron, lead, and nickel)[1]
- Perchlorate

5.1.2 Data Quality

5.1.2.1 All of the sampling data collected as part of this current SI effort were validated. The following summary provides details on media sampling conducted for this SI.

1. Twenty-one surface soil samples (collected 2-6 inches bgs)
2. Two duplicate[3] surface soil samples
3. Eleven subsurface soil samples (collected 12-24 inches bgs)
4. One duplicate subsurface soil sample
5. Five sediment samples (collected 0-6 inches bgs)
6. One duplicate sediment sample
7. Three background sediment samples

[2] For the purpose of this risk screening, Gun Butt No.1, Gun Butt No. 2 and the drainage area between Gun Butt No.1 and 2 were considered as a single area for Project 07.

[3] Duplicate samples were treated as discrete samples; duplicates were not averaged for the purpose of this risk screening.

8. One surface water sample
9. One duplicate surface water sample
10. Four groundwater samples
11. Two duplicate groundwater samples

5.1.2.2 The first step in the risk assessment screening process was the evaluation of the analytical data. Inclusion or exclusion of data in the risk-screening process on the basis of analytical qualifiers assigned during data validation was performed in accordance with USEPA risk assessment guidance (USEPA 1989). Accordingly, data with a J, K or L qualifier, which indicates an uncertainty in the reported concentration for the chemical, but not the assigned identity, were included in the risk screening at the reported concentrations. Data qualified with a U, UJ, or UL, indicating the chemical was not detected in the sample, were also retained in the risk-screening process. Analytes that were not detected in any of the samples for a particular medium within a subarea were eliminated from risk screening for that particular medium and subarea, as per the USEPA (1989) risk assessment guidance. However, an analysis of the adequacy of the reporting limits for these analytes not detected in any sample from a risk assessment perspective is presented in Section 5.1.4. The following provides a listing of the qualifiers in the validated analytical dataset and their treatment in the risk assessment process:

- Analytical results bearing the J qualifier (indicating that the reported value was estimated) were retained in the dataset. The estimated concentration provided by the laboratory was used for these samples.
- Analytical results bearing the K qualifier (indicating that the analyte is present and that the reported value may be biased high) were retained in the dataset. The reported concentration provided by the laboratory was used for these samples.
- Analytical results bearing the L qualifier (indicating that the analyte is present and that the reported value may be biased low) were retained in the dataset. The reported concentration provided by the laboratory was used for these samples.
- Analytical results bearing the B qualifier (indicating that the analyte was detected in the associated method blank at a level that is similar to the sample result) were retained in the dataset. These samples were treated as non-detected samples.
- Analytical results bearing the U qualifier (indicating that the analyte was not detected at the given detection limit) were retained in the dataset. The reporting limit (RL) was used for non-detected samples.
- Analytical results bearing the UJ qualifier (indicating that the analyte was not detected and the quantitation limit may be inaccurate or imprecise) were retained in the dataset. The RL was used for non-detected samples.

- Analytical results bearing the UL qualifier (indicating that the analyte was not detected and the quantitation limit may actually be higher) were retained in the dataset. The RL was used for non-detected samples.
- Analytical results bearing the R qualifier (indicating that the result was not usable) were excluded from the dataset.

5.1.3 Screening Values

5.1.3.1 Screening concentrations were used in the HHRA and SLERA to support risk-based conclusions and recommendations regarding MRS 7. Maximum MRS 7 concentrations for relevant MCs were compared to the risk-based concentrations as part of the selection process for chemicals of potential concern (COPCs) for the HHRA and chemicals of potential ecological concern (COPECs) for the SLERA.

5.1.3.2 For the HHRA, with the exception of perchlorate, USEPA regional screening levels (SLs) for residential soil, industrial soil, and tap water were selected as the basis for the screening criteria to select COPCs (USEPA 2012). The SLs are referred to as "regional SLs" throughout the remainder of this section. The regional SLs are developed from toxicity values and standard exposure factors to estimate contaminant concentrations that are protective of humans, including sensitive subgroups, over a lifetime. The USEPA interim drinking water health advisory for perchlorate, which was adopted as the DoD level of concern, was selected as the basis for the screening criterion to determine if perchlorate was a COPC in surface water and groundwater, and is discussed in further detail in Section 5.1.3.7. Although future land use plans do not include residential reuse, stakeholders have requested that residents be included as potential future receptors and that COPCs be compared against USEPA regional SLs for residential soil to evaluate the upper bound for potential site risks. However, future residential use of MRS 7 is not expected due to the unlikely closure of NASA WFF.

5.1.3.3 The regional SLs for residential and industrial soils consider exposures through direct contact (e.g., ingestion, dermal contact, and inhalation of particulates and vapors). Incidental ingestion, inhalation, and dermal contact are identified as pathways of exposure in the SS-WP Addendum (TPMC 2011) for surface and subsurface soils that could occur at the FUDS (i.e., potentially complete pathways). For surface soil, indirect exposures, including ingestion of plants and animals exposed to MCs, were also identified as potentially complete pathways for human receptors. These indirect pathways are anticipated to result in significantly lower exposures compared to those described above, in which humans come into direct contact with soil. Therefore, the regional SLs for residential and industrial soils are determined to be appropriate screening tools for surface and subsurface soils for the HHRA.

5.1.3.4 For sediment, potentially complete pathways identified in the SS-WP Addendum for human receptors included incidental ingestion of, and dermal contact with MCs present in sediment, as well as ingestion of benthos exposed to MCs in sediment. Regional SLs or similar values are not available for screening risks from human exposure to sediments, and soil SLs are not directly applicable for screening sediment for human receptors, given the likelihood of reduced exposure to sediment relative to soil. Therefore, for use in screening sediment concentrations of MCs in the HHRA, soil SLs were adjusted to account for the relatively lower exposure levels for human receptors to sediment. The adjustment is described in Section 5.1.3.10.

5.1.3.5 Potentially complete pathways identified for human receptors to surface water include dermal contact and incidental ingestion of MCs in surface water, and ingestion of fish exposed to MCs via surface water (TPMC 2011). The availability of screening values that specifically account for these exposures is limited. Regional tap water SLs available for screening groundwater reflect potential exposures via ingestion of drinking water and inhalation of volatile organic chemicals released during use of contaminated groundwater. The intake of MCs in surface water by human receptors via the potentially complete pathways for this FUDS are likely to be significantly less than the intake received from drinking two liters assumed in the derivation of the regional SLs for tap water. Therefore, the tap water SLs were adjusted to account for the anticipated differences in intake of surface water compared to tap water. The adjustment is described in Section 5.1.3.10.

5.1.3.6 As described above, regional tap water SLs available for screening groundwater reflect potential exposures via ingestion of drinking water and inhalation of volatile organic chemicals released during use of contaminated groundwater. Potentially complete transfer mechanisms identified for MCs in groundwater to humans included ingestion, incidental ingestion, and dermal contact (TPMC 2011). Because the regional tap water SLs do not consider dermal contact, they do not reflect every potentially complete exposure identified for human receptors at MRS 7. Nevertheless, the tap water SLs are considered health protective for use at MRS 7 because the drinking water rate assumed in their derivation (i.e., two liters per day, based on an upper end estimate for residential use) is significantly greater than the potential intake for the current human receptors at MRS 7 (i.e., visitor/trespassers, construction workers, and employees) and therefore offsets the omission of the dermal contact exposure pathway. For future residents, the use of these tap water SLs are appropriate because they reflect the drinking water ingestion pathway, which is the most risk significant exposure pathway.

5.1.3.7 For perchlorate, the USEPA interim drinking water health advisory of 15 μg/L, adopted as the DoD level of concern for managing perchlorate in drinking water (USEPA 2008, DoD 2009), provided the basis for the surface water and groundwater screening criteria used in the HHRA. The health advisory level represents a safe level of perchlorate in drinking water and was derived using conservative exposure assumptions regarding residential groundwater ingestion appropriate for protecting the most sensitive population. It also incorporates an assumption that individuals will be exposed to perchlorate through ingestion of food; therefore, exposure to the allowable levels in water alone would not result in adverse health effects. Similar to the regional SLs for tap water discussed above, the perchlorate standard considers exposure via drinking water but not dermal contact, which was identified as a potentially complete pathway in the SS-WP Addendum. However, the DoD level of concern for managing perchlorate includes a groundwater ingestion rate of two liters per day, which is significantly higher than the potential ingestion rate for human receptors defined for MRS 7, with respect to surface water exposures. Therefore, the perchlorate screening level was increased by a factor of ten to account for the significantly greater exposure assumed for the drinking water level of concern versus the incidental contact anticipated at MRS 7 for surface water exposures. A factor of ten reduction was applied to this modified perchorate surface water SL to account for cumulative risks. Similarly, for groundwater exposures to human receptors, the DoD level of concern was reduced by a factor of ten to reflect cumulative risks from simultaneous exposure to multiple MC in drinking water. Overall, the use of the perchlorate drinking water health advisory as a basis for the screening criteria in this HHRA is considered a conservative approach for evaluating potential surface water and groundwater exposures at WFF Project 07.

5.1.3.8 In some cases, SLs are based on the toxicity, or relative toxicity, of related compounds. The regional SLs for 2-amino-4,6-DNT and 4-amino-2,6-DNT are based on toxicity information for 2,4-DNT. Because the amino-DNT isomers may behave differently from 2,4-DNT, the use of the regional SLs for these MCs may result in some uncertainty in the risk assessment. The SLs for the PAHs benzo(a)anthracene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, dibenzo(a,h)anthracene, and indeno(1,2,3-cd)pyrene are derived using a toxicity equivalency factor (TEF) that scales the relative potency of each PAH against the toxicity of benzo(a)pyrene. Because the toxicity of each individual PAH has not been comprehensively characterized, the use of these SLs may also result in some uncertainty in the risk assessment.

5.1.3.9 The regional SLs for direct contact with soil and tap water correspond to typical risk thresholds of a one-in-one million (1E-06) cancer risk or a non-carcinogenic hazard quotient (HQ) of 1.0. The HHRA screening levels for the explosive constituents 2,4,6-TNT, 2,4-DNT, 2-nitrotoluene, 4-nitrotoluene, NB, and RDX; and for the PAHs benzo(a)anthracene, benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(a)pyrene, chrysene, dibenzo(a,h)anthracene, indeno(1,2,3-cd)pyrene, and naphthalene are based on carcinogenic endpoints. The HHRA screening levels for perchlorate, and the explosive constituents 1,3,5-TNB, 2,6-DNT, 2-amino-4,6-DNT, 3-nitrotoluene, 4-amino-2,6-DNT, NG, and tetryl; as well as for the metals aluminum, antimony, barium, copper, iron, lead, nickel, and zinc; and for the PAHs acenaphthene, anthracene, fluoranthene, fluorene, and pyrene are based on non-carcinogenic endpoints. The toxicological endpoint for all of these non-carcinogenic MCs is not the same. Rather these MCs act at various different target organs, including the spleen, kidney, GI, and liver (USEPA 2011a, USEPA 1997).

5.1.3.10 As discussed in the SS-WP Addendum (TPMC 2011), the regional SLs derived from non-carcinogenic endpoints were divided by ten to provide a means to account for potential occurrence of adverse non-carcinogenic health effects due to exposure to multiple non-carcinogens. Following this adjustment, the soil screening values used for the HHRA were multiplied by a factor of ten for application as sediment screening values to account for lower incidence of exposure to sediments relative to soils. Similarly, tap water screening values were multiplied by a factor of ten for application as surface water screening values to account for lower incidence of incidental exposure to surface water relative to tap water. These adjustments to the residential screening values used in the HHRA account for the potential cumulative effect of simultaneous exposures to multiple non-carcinogens. The exception to the adjustments described is for lead. In the case of lead, regional SLs are based on a blood lead level rather than a chronic daily intake, as is used for other non-carcinogens. Therefore, no adjustments were made to the lead regional SLs for use in evaluating soils, sediments, surface water, or groundwater.

5.1.3.11 The majority of the MCs had screening values available for application in the HHRA. The application of HHRA screening values is described in Sections 5.1.3.20 and 5.1.3.21. Results of the HHRA are discussed in Section 5.4, and are presented in Tables 5-1 through 5-4.

5.1.3.12 Screening for ecological-based COPECs was conducted by calculating an HQ, which represents the ratio of the maximum detected chemical concentration in an environmental medium to a medium-specific ecological screening level. SLs derived from studies in specific media and environmentally similar conditions to those at MRS 7 are the most relevant and appropriate for screening. In cases where screening values derived from environmentally-specific testing environments are not available, alternative screening values may offer a sufficient screening tool.

5.1.3.13 Ecological soil screening levels (eco-SSLs) were used to screen for COPECs in soil. Eco-SSLs are screening level benchmark concentrations for contaminants in soil that have been determined to be protective of terrestrial-based ecological receptors that commonly come into contact with soil, or ingest biota that live in, or on, the soil. These benchmark concentrations are generally used for screening level purposes to identify COPECs in upland soils that may require further evaluation. Eco-SSLs are derived using information on toxicity and estimated ingestion exposure doses for terrestrial-based ecological receptors. As described in the SS-WP Addendum CSM diagram for the WFF Project 07, potentially complete transfer pathways for ecological receptors to surface soils at MRS 7 include incidental ingestion of, and dermal contact with MCs in surface soil, inhalation of particulates from surface soil, and ingestion of vegetation and game exposed to MCs in surface soil. USEPA guidance (USEPA 2005a) states that the dermal pathway is generally less significant compared to ingestion, and does not warrant inclusion in the derivation of eco-SSLs. Therefore, the eco-SSLs derived using exposure assumptions for ingestion only are determined to be adequate for the purposes of the SLERA.

5.1.3.14 USEPA sanctioned sediment screening values were adopted for the SLERA where available. In cases where no USEPA supported value was available, screening values were obtained from peer-reviewed literature and other regulatory and advisory programs. The WFF Project 07 is characterized as a freshwater environment; therefore, freshwater sediment screening values were adopted where available. In the case that no freshwater sediment benchmark was available, a sediment screening value derived in marine/estuarine environments was adopted for use in the SLERA. In the instance where no sediment screening values were available, eco-SSLs were used to screen for COPECs in sediment. USEPA states that eco-SSLs may provide utility for screening wetland soils, like those found at MRS 7 (USEPA 2005a). The appropriateness of their use generally is determined by comparing the soil properties evaluated to the sediment properties at the site of interest, and the degree of flooding estimated to occur at the marsh. In general, USEPA considers the eco-SSLs to be conservative with respect to their use for wetlands, given that wetland sediments generally have conditions which limit bioavailability relative to upland soils (e.g., relatively higher total organic carbon present in sediments). Potentially complete pathways identified for ecological receptors to sediment at the WFF Project 07 include incidental ingestion of, and dermal contact with MCs in sediment, as well as ingestion of benthos exposed to MCs in sediment. The sediment screening values and eco-SSLs described above were derived using assumptions of exposure via ingestion pathways. As described in Section 5.1.3.13, exposures via the dermal pathway are generally less significant when compared to the ingestion pathway. Therefore, the sediment screening values and eco-SSLs derived using exposure assumptions for ingestion only are determined to be adequate for the purposes of sediment screening in the SLERA.

5.1.3.15 National Ambient Water Quality Criteria (AWQC) were used for screening COPECs in surface water. AWQC are derived from the results of laboratory tests completed under controlled conditions. Guidelines require that toxicity tests be complete on plants, invertebrates, and fish species. Species are normally submerged in freshwater or marine media, and, therefore, are exposed to the test chemical via multiple pathways (USEPA 1994). Second tier AWQC are derived using methods identical to those in the federal guidelines; however, they are rated as second tier because they have not been tested on the full suite of taxonomic groups specified under federal guidelines. Given that toxicity results for fewer taxonomic groups are available, uncertainty factors[4] are applied in determining the final screening value. The WFF Project 07 is characterized as a freshwater environment. Therefore, freshwater AWQCs were selected for screening criteria when available. In the case that no freshwater value was available, a value derived for marine/estuarine organisms was adopted. As discussed in the SS-WP Addendum, potentially complete transfer mechanisms for ecological receptors to MCs in surface water include incidental ingestion, and dermal contact with MCs in surface water, and ingestion of fish exposed to MCs in surface water. Given that test organisms are submerged in media and exposed to chemicals via multiple routes of exposure, the use of AWQC is determined to be appropriate for screening surface water in the SLERA.

5.1.3.16 For the ecological soil screening, eco-SSLs developed by USEPA were adopted for screening the PAHs and the metals aluminum, antimony, barium, copper, lead, nickel, and zinc. For PAHs, USEPA derives generic eco-SSLs to be applied for categories of low and high molecular weight (MW) PAHs (USEPA 2007d). Data from chemicals which fall within each of these categories is considered in their derivation. While grouping the data together increases the number of studies that are considered in deriving the eco-SSLs, it may limit the preciseness of the screening value for screening individual analytes. No eco-SSL was available from USEPA for the metals iron or magnesium, or for any of the explosive constituents being evaluated. Consistent with previous SLERAs completed under this program, screening values were obtained from Talmage et al. (1999) for 2,4,6-TNT, 2,4-DNT, 2,6-DNT, 2-amino-4,6-DNT, 2-nitrotoulene, 3-nitrotoluene, 4-amino-2,6-DNT, 4-nitrotoluene, RDX, and tetryl. The eco-SSL for NB was obtained from Efroymson et al. (1997). No eco-SSLs, or appropriate alternative screening values, were available for the explosive constituents 1,3,5-TNB, or NG; or for the metals iron and magnesium.

[4] Uncertainty factors are commonly applied in risk assessment practice to account for gaps in the data, and assure that uncertainties are dealt with in a conservative manner and that health protective measures are derived.

5.1.3.17 In some cases, eco-SSLs are based on the toxicity or relative toxicity of related compounds. The eco-SSL of 30 mg/kg for 2,4-DNT, 2,6-DNT, 2-nitrotoluene, 3-nitrotoluene, and 4-nitrotoluene is based on toxicity data for 2,4,6-TNT. There is no conclusive evidence regarding the dominant process by which 2,4,6-TNT is reduced in soil. One study indicated that bacterial degradation of 2,4,6-TNT to breakdown products of TNT (specifically, 2-amino-4,6-DNT and 4-amino-2,6-DNT) occurs under aerobic and anaerobic conditions (Vorbeck et al. 1998). An *in vitro* study completed in a *Pseudomonas bacterium* species suggests that 2,4,6-TNT breaks down to 2,4-DNT (Haïdour and Ramos 1996). Laboratory studies support the observations of Haïdour and Ramos (1996) that bacteria strains can generate 2,4-DNT from TNT (Martin et al. 1997). These findings provide some support for the use of 2,4,6-TNT as a surrogate for TNT breakdown products. In addition, the eco-SSL of 80 mg/kg for 4-amino-2,6-DNT is based on data for the chemical isomer 2-amino-4,6-DNT. There is some uncertainty associated with adopting surrogate screening values for MCs based on 2,4,6-TNT and 2-amino-4,6-DNT. In addition, some screening values are based on limited data. A limited amount of data were available for the derivation of the eco-SSLs for 2-amino-4,6-DNT, RDX, and tetryl. Each of these eco-SSLs was derived using data from a single study in plants.

5.1.3.18 For the sediment screening, sediment-specific screening values derived for freshwater organisms were available for the explosive constituent 1,3,5-TNB, and the metals aluminum, copper, iron, lead, nickel, and zinc. In the absence of freshwater values, marine-based screening levels were adopted for nitrobenzene and antimony. With the exception of the explosive constituent 1,3,5-TNB mentioned above, no sediment screening values were available for any of the explosive constituents being evaluated, or for the metal barium. Interim eco-SSLs were used for these MCs in the absence of sediment-specific screening values. For barium, an interim eco-SSL derived by USEPA (2005c) was used. Interim eco-SSLs derived by Talmage et al. (1999) were used for 2,4,6-TNT, 2,4-DNT, 2,6-DNT, 2-amino-4,6-DNT, 2-nitrotoluene, 3-nitrotoluene, 4-amino-2,6-DNT, 4-nitrotoluene, RDX, and tetryl. Although the use of eco-SSLs for screening sediments introduces some uncertainty into the SLERA, as discussed in Section 5.1.3.14, the use of soil screening values for wetland soils is likely to result in a conservative evaluation and; therefore, is considered an adequate screening tool for the SLERA. No sediment SLs, or appropriate alternative screening values, were available for the explosive constituent NG, or for the metals iron or magnesium.

5.1.3.19 The application of the ecological screening values is described in Sections 5.1.3.20 and 5.1.3.22. Results of the SLERA are discussed in Section 5.4, and are presented in Tables 5-1 through 5-3.

5.1.3.20 Consistent with USEPA Guidance (1989), the following screening process was utilized.

1. The maximum concentration of each chemical detected in each medium was identified.

2. If a chemical was detected in at least one sample in a specific medium, it was retained for consideration in the screening of COPCs/COPECs.

3. If the maximum concentration of a specific chemical exceeded its screening value, and its mean or maximum concentration was above the respective mean or maximum background concentration, the chemical was retained as a COPC/COPEC.

4. If a screening concentration was not available for a specific chemical in a particular medium, the screening concentration for a structurally similar compound was used, if warranted. The screening tables list any surrogates that were used.

5. An analyte was eliminated from the list of COPCs/COPECs if it was an essential nutrient of low toxicity, and its reported maximum concentration was unlikely to be associated with adverse health impacts.

5.1.3.21 For the HHRA, the maximum detected concentrations for each detected MC were compared to the screening criteria determined for use in the HHRA. If the maximum concentration was less than the screening value(s), the target analyte was eliminated from consideration. If the maximum concentration exceeded the screening value, the analyte was retained as a COPC.

5.1.3.22 Under the SLERA, an HQ analysis was completed for each detected analyte. An HQ is defined as the measured concentration divided by the screening criteria. If the maximum concentration was less than the screening value (HQ < 1.0), the analyte was eliminated from consideration as a COPEC. If the maximum concentration exceeded the screening value (HQ > 1.0), the analyte was retained as a COPEC.

5.1.3.23 For both the HHRA and SLERA, in cases in which no screening criteria are available, any available information regarding the potential for the MCs to present a risk to receptors is presented.

5.1.4 Comparison of Screening Levels with Detection Limits for Non-Detected Analytes

5.1.4.1 The usability of the analytical data for making conclusions regarding risk was evaluated by comparing the RLs for samples that were not detected in any sample to their respective screening values used for human health (Table 5-5) and ecological (Table 5-6) risk screening. If a chemical was not detected in any of the samples collected, but the RL was higher than the screening value, then the MQO for sensitivity was not met. Such non-detects are not usable for determining whether chemical is greater or less than the screening value. Where no screening values are available, no conclusions can be drawn regarding the adequacy of the RLs for screening risk, and as a result, uncertainty is introduced into the risk assessment. In these instances, a weight-of-evidence (WOE) approach is used in making risk-based decisions. The WOE approach used in the absence of screening values includes an assessment of the fate and transport of the chemical and the frequency of detection of MCs that are likely to have been co-derived from a munitions source.

5.1.4.2 Table 5-5 shows a comparison of the RLs and human health screening values for analytes not detected in surface soil, subsurface soil, sediment, surface water, and groundwater at WFF Project 07 by media.

5.1.4.3 In surface soil, none of the explosive constituents or the PAHs acenaphthene, acenaphthylene, dibenzo(a,h)anthracene, fluorene, indeno(1,2,3-cd)pyrene, or naphthalene were detected above their respective RLs at WFF Project 07. Acenaphthylene was detected in one out of three site samples, and naphthalene was detected in three out of three site samples, but these two analytes were also detected in the associated method blank. The concentrations in the site samples were less than five times the maximum amount detected in any blank. Therefore, following USEPA guidance (USEPA 1989), these two site samples were treated as non-detects and the values reported by the laboratory were used as the reported concentrations. In surface soil, with the exception of NG, the RLs for the non-detected explosive constituents, and the above named PAHs, were lower than the respective soil screening criteria adopted for the HHRA. The maximum RL of 2 mg/kg for NG exceeds the residential soil screening value of 0.61 mg/kg. The MQO for sensitivity for NG was not met and any reported non-detects (<RL) do not demonstrate that NG contamination is less than the selected screening criterion. However, as described in Section 5.1.3.10, the residential screening value used in the HHRA is adjusted to account for the potential cumulative effect of simultaneous exposures to multiple non-carcinogens. Under the methodology employed in the HHRA for cumulative non-carcinogenic risk, ten chemicals are assumed to elicit toxic effects on the same target organ. At the WFF Project 07, a total of 38 MCs were identified for surface soil, and the vast majority of these were non-detects with RL that were well below their respective SLs. Additionally, most of the MCs

are not anticipated to act by the same non-carcinogenic mode of action or at the same target organ as NG. Thus, the adjusted screening value used in this HHRA for NG, which was developed by reducing the USEPA regional SL by a factor of ten, is likely to be overly conservative. Moreover, the difference between the adjusted screening value of 0.61 mg/kg and the maximum RL of 2 mg/kg is relatively small. Considering these factors, the RL for NG is determined to be adequate for the HHRA screening at the WFF Project 07. No soil screening value was available for acenaphthylene. Therefore, no conclusions regarding the adequacy of the RL obtained for these MCs can be made.

5.1.4.4 In subsurface soil, the explosive constituents analyzed and antimony were not detected above their respective RLs at WFF Project 07. For this medium, with the exception of NG, the RLs for non-detected explosive constituents were lower than their respective soil screening criteria adopted for the HHRA. As described in Section 5.1.4.3, the maximum RL of 2 mg/kg for NG exceeds the residential soil screening value of 0.61 mg/kg and the MQO for sensitivity for NG was not met. Any reported non-detects (<RL) do not demonstrate that NG contamination is less than the selected screening criterion. However, as described in Section 5.1.4.3, the RL for NG is determined to be adequate for the HHRA screening at the WFF Project 07.

5.1.4.5 As described in Section 5.1.3.8, the regional SLs for 2-amino-4,6-DNT and 4-amino-2,6-DNT are based on toxicity data for 2,4-DNT. The maximum RL of 0.1 mg/kg in soil (surface and subsurface) for the two amino-DNT isomers is well below the residential and industrial screening criteria developed from regional SLs for use in the HHRA (15 and 200 mg/kg for 2-amino-4,6-DNT, respectively; and 15 and 190 mg/kg for 4-amino-2,6-DNT, respectively). Any uncertainties in the application of these screening levels to the risk assessment are, therefore, determined not to be significant for the HHRA.

5.1.4.6 In sediment, the explosive constituents analyzed and antimony were not detected above their respective RLs at WFF Project 07. RLs for non-detected MCs were lower than the respective sediment screening criteria adopted for the HHRA.

5.1.4.7 As described in Section 5.1.3.8, the regional SLs for 2-amino-4,6-DNT and 4-amino-2,6-DNT are based on toxicity data for 2,4-DNT. The maximum RL of 0.1 mg/kg in sediment for the amino-DNT isomers is well below the residential and industrial screening criteria developed from regional SLs for use in the HHRA (150 and 2,000 mg/kg for 2-amino-4,6-DNT, respectively; and 150 and 1,900 mg/kg for 4-amino-2,6-DNT, respectively). Therefore, any uncertainties in the application of these screening levels to the risk assessment are determined not to be significant for the HHRA.

5.1.4.8 In surface water, none of the explosive constituents analyzed or perchlorate were detected above their respective RLs at WFF Project 07. With the exception of NG, the RLs for non-detected MCs were below the respective surface water screening criteria adopted for the HHRA. The RL of 3 µg/L for NG exceeds the surface water screening value of 1.5 µg/L adopted for the HHRA and the MQO for sensitivity for NG was not met. Any reported non-detects (<RL) do not demonstrate that NG contamination is less than the selected screening criterion. However, as described in Section 5.1.3.10, the regional tap water SL for NG was adjusted to account for potential cumulative effects of simultaneous exposure to multiple non-carcinogens. At the WFF Project 07, a maximum of 14 MCs were identified in surface water. As described in Section 5.1.3.10, each of these MCs is not anticipated to act by the same non-carcinogenic mode of action or at the same target organ. Further, the difference between the RL and screening criterion for NG is relatively small. Based on these considerations, the RL for NG is considered adequate for the HHRA.

5.1.4.9 As described in Section 5.1.3.8, the regional SLs for 2-amino-4,6-DNT and 4-amino-2,6-DNT are based on the toxicity of 2,4-DNT. The maximum RL of 0.2 µg/L for these MCs is well below the screening criteria of 30 µg/L developed from regional tap water SLs for use in the HHRA. Any uncertainties regarding the application of these screening levels to the HHRA are determined not to be significant.

5.1.4.10 In groundwater, perchlorate, the explosive constituents, and the metals antimony and copper were not detected above their respective RLs. With the exception of NG and antimony, the RLs for non-detected MCs were below the respective groundwater screening criteria adopted for the HHRA. The RL of 3 µg/L for NG exceeds the groundwater screening value of 0.15 µg/L, and the RL of 6 µg/L for antimony exceeds the groundwater screening value of 0.6 µg/L adopted for the HHRA. Therefore, the MQO for sensitivity was not met for NG or antimony. Any reported non-detects (<RL) do not demonstrate that contamination from these MCs is less than the selected screening criteria. However, as described in Section 5.1.3.10, the regional tap water SLs for antimony and NG were adjusted to account for the potential cumulative effect of simultaneous exposure to multiple non-carcinogens. At the WFF Project 07, 23 MCs were identified in groundwater. As described in Section 5.1.3.10, each of these MCs is not anticipated to act by the same non-carcinogenic mode of action or at the same target organ. Therefore, the RLs for antimony and NG are considered adequate for the HHRA screening at the WFF Project 07.

5.1.4.11 As described in Section 5.1.3.8, the regional SLs for 2-amino-4,6-DNT and 4-amino-2,6-DNT are based on the toxicity of 2,4-DNT. The maximum RL of 0.2 µg/L for these MCs is below the screening criteria of 3 µg/L developed from regional tap water SLs for use in the HHRA. Any uncertainties regarding the application of these screening levels to the HHRA are determined not to be significant.

5.1.4.12 Table 5-6 shows a comparison of the RLs and ecological screening values for analytes not detected in surface soil, sediment, and surface water at WFF Project 07 by media.

5.1.4.13 In surface soil, none of the explosive constituents or the PAHs acenaphthene, acenaphthylene, dibenzo(a,h)anthracene, fluorene, indeno(1,2,3-cd)pyrene, or naphthalene were detected above their respective RLs at WFF Project 07. Acenaphthylene was detected in one out of three site samples, and naphthalene was detected in three out of three site samples, but these two analytes were also detected in the associated method blank. The concentrations in the site samples were less than five times the maximum amount detected in any blank. Therefore, following USEPA guidance (USEPA 1989), these two site samples were treated as non-detects and the values reported by the laboratory were used as the reported concentrations. In surface soil, the RLs for the non-detected MCs for which eco-SSLs were available were lower than the respective screening criteria adopted for the SLERA.

5.1.4.14 As described in Section 5.1.3.17, the adoption of screening values from surrogates introduces some uncertainty into the SLERA. The eco-SSL for 2,4,6-TNT was adopted for 2,4-DNT, 2,6-DNT, 2-nitrotoluene, 3-nitrotoluene, and 4-nitrotoluene. The maximum RLs of 0.1 mg/kg for 2,4-DNT and 2,6-DNT, and 0.2 mg/kg for the nitrotoluene isomers are well below the eco-SSL of 30 mg/kg adopted for these MCs in the SLERA. In addition, the eco-SSL for 2-amino-4,6-DNT was adopted for 4-amino-2,6-DNT. The maximum RL of 0.1 mg/kg for 4-amino-2,6-DNT is well below the ecological soil screening value of 80 mg/kg adopted for this MC in the SLERA. Therefore, any uncertainties associated with the use of 2,4,6-TNT and 2-amino-4,6-DNT as surrogates for the explosive MCs are determined not to be significant for the SLERA. No eco-SSL was available for 1,3,5-TNB or NG. Therefore, no conclusions regarding the adequacy of the RLs obtained for these MCs can be made.

5.1.4.15 In sediment, none of the explosive constituents analyzed or antimony were detected above their respective RLs. With the exception of 1,3,5-TNB and NB, the RLs for all non-detected MCs for which eco-SSLs were available were lower than the respective screening criteria adopted for the SLERA. The maximum RLs for 1,3,5-TNB and NB were above the respective screening values selected for the SLERA (1,3,5-TNB: maximum is 0.1 mg/kg, SL is

0.0024 mg/kg; NB: maximum RL is 0.3 mg/kg, SL is 0.021 mg/kg). Therefore, the MQO for sensitivity was not met for these analytes, and any reported non-detects do not demonstrate that contamination is less than the selected screening criteria. No ecological sediment screening value was available for NG. Therefore, no conclusions regarding the adequacy of the RL obtained for this MC can be made.

5.1.4.16 As described in Section 5.1.3.17, the use of surrogates for ecological screening values introduces some uncertainty into the SLERA. The sediment screening criteria for 2,4-DNT, 2,6-DNT, 2-nitrotoluene, 3-nitrotoluene, and 4-nitrotoluene are based on toxicity data for 2,4,6-TNT. The RLs of 0.1 mg/kg for 2,4-DNT and 2,6-DNT, and 0.2 mg/kg for the 2-nitrotoluene, 3-nitrotoluene, and 4-nitrotoluene are well below the ecological sediment screening value of 30 mg/kg adopted for these MCs in the SLERA. In addition, the screening value for 4-amino-2,6-DNT is based on information for 2-amino-2,4-DNT. The RL of 0.1 mg/kg for 4-amino-2,6-DNT is well below the ecological sediment screening value of 80 mg/kg adopted for this MC in the SLERA. Therefore, any uncertainties associated with the use of 2,4,6-TNT and 2-amino-4,6-DNT as surrogates for the explosive MCs are determined not to be significant for the SLERA.

5.1.4.17 In surface water, none of the explosive constituents analyzed or perchlorate were detected above their respective RLs. The RLs for all non-detected MCs f or which eco-SSLs were available were lower than the respective screening criteria adopted for the SLERA. No ecological sediment screening values were available for tetryl or perchlorate. Therefore, no conclusions regarding the adequacy of the RLs obtained for these MCs can be made.

5.2 Conceptual Site Model

5.2.0.1 The CSM diagram for the WFF Project 07 is provided in Appendix J. The CSM defines the source(s) (e.g., the secondary source/media), interaction (e.g., secondary release mechanism, tertiary source, exposure route), and receptors at MRS 7 and provides an overview of complete, potentially complete, and incomplete pathways. The CSM is limited to those areas potentially impacted by MECs and/or MCs based on the site use and history. These areas are shown in Figure 2-2. In this SI Report, the CSM has been revised from the version presented in the SS-WP Addendum to reflect the results of the analytical samples collected and the human and ecological risk screening.

5.2.0.2 Current and future potential human receptors for the WFF Project 07 are expected to be visitors/trespassers, construction workers, employees, and residents (future only) as depicted in the CSM diagram in Appendix J. Potentially complete pathways for human receptors exist for surface and subsurface soil, groundwater, surface water, and sediment. In the HHRA, the soil and sediment screening values used for visitors/trespassers and residents were based on regional SLs for direct contact with residential soil, while the screening values used for construction workers and employees were based on the regional SLs for direct contact with industrial soil. The groundwater and surface water screening values were based on the tap water SLs.

5.2.0.3 The ecological receptors of concern for the WFF Project 07 are plants, soil and benthic invertebrates, terrestrial- and aquatic-feeding mammals, and terrestrial- and aquatic-feeding birds. Potentially complete pathways were identified for surface soil, sediment, and surface water. Screening values selected for the SLERA were applied uniformly to every ecological receptor.

5.2.0.4 Potentially complete pathways for human and ecological receptors are based on the presence of MECs/MCs and interactions, including transport and release mechanisms, and receptor use patterns.

5.2.0.5 Under the MMRP program, a pathway is complete for this SI if all of the following conditions are present:

1. Source and mechanism of chemical release (e.g., a munitions-related organic chemical is detected or a munitions-related inorganic chemical is detected and the levels exceed maximum and/or mean site background sample concentrations)[5].
2. Transfer mechanisms (e.g., overland flow of contaminants into an adjacent stream, advection of contaminants with groundwater flow).
3. Point of contact (exposure point, e.g., drinking water, soil).
4. Exposure route to receptor (e.g., ingestion, inhalation, etc.).

5.2.0.6 Comparisons of maximum detected site concentrations to risk-based screening values are used to determine if an MC is a COPC or COPEC, depending on the risk screening being conducted (human health or ecological, respectively). In the case that complete pathways exist between media and receptors, and a COPC and/or COPEC is identified, a WOE approach may be used to further evaluate the potential risk. The WOE approach considers multiple aspects of the MCs present, including the frequency of detection, magnitude, and comparison to background, as well as the applicability of the screening criteria selected to the specific receptor groups and exposures that are likely to occur at MRS 7. The WOE evaluation is shown after select COPCs and COPECs in Section 5.4. An RI/FS may be recommended for MCs where COPCs and/or

[5] In the case that an MC is not detected in any of the samples collected for a given medium and the MQO for sensitivity is not met (i.e., the RL is greater than the respective screening level for human or ecological receptors), the pathway remains potentially complete.

COPECs are determined to represent the potential for risks to an exposed receptor population. An NDAI designation may be recommended for MCs if no COPCs or COPECs are identified through the risk screening process, or if the WOE evaluation indicates that COPCs/COPECs do not pose an unacceptable risk to the exposed receptors.

5.2.0.7 In conclusion, pathway completeness will result in a RI/FS recommendation for MCs only in the instance where risk screening criteria exceedances occur. A pathway can be complete but a RI/FS is not recommended if there are no exceedances of risk screening criteria, or if identified risks are determined to be at acceptable risk levels. When a pathway is incomplete, a RI/FS recommendation is not made.

5.3 Background Data Evaluation

5.3.0.1 Background comparisons were conducted for MC that were identified as COPCs/COPECs in Tables 5-1 through 5-4. Two background data sets were available for this evaluation. One was a background soil and groundwater investigation conducted for the Main Base Area of WFF by NASA (2004). The NASA background data were derived from samples that were collected from areas upgradient or outside the influence of areas with known or suspected NASA or DoD activities. The samples were primarily used to represent native background conditions; however, some locations were considered to be potentially influenced by anthropogenic activities. Summary tables of descriptive statistics from the NASA report were used to develop the background data shown in Tables 5-7 through 5-9. Separate surface and subsurface background datasets were developed to conform to the report conclusions that concentration distributions in these two soil horizons were different. Only samples collected from the Molena soil type were included in the summary as they are most representative of the soils within the areas of interest for the WFF Project 07. The other background data set was a collection of three sediment samples collected during the recent WFF Project 07 SI sampling effort. These sediment samples were collected from areas from within the FUDS boundary, but outside MRS 7. The analytical results for these three background sediment samples are presented in Table 5-2 under sample names WFF-MBBG-SD-01 through WFF-MBBG-SD-03.

5.3.0.2 Background comparisons for COPCs/COPECS in the soil and groundwater of the Pyrotechnics Burn Area are shown in Table 5-7. For surface soil, copper, lead, and zinc, site concentrations were elevated relative to background surface soil concentrations, but iron was not. No comparison could be made for antimony in surface soil due to the absence of valid detections in the NASA background study. In subsurface soil, the site aluminum detections were elevated relative to background concentrations, but iron was not. Iron in groundwater was also not elevated relative to background concentrations.

5.3.0.3 The background comparison for COPCs/COPECs in the soil and groundwater of the Gun Butt No. 1 and 2 Area are shown in Table 5-8. For surface soil, site concentrations of copper were elevated relative to background surface soil, but iron and lead were not. Similarly, the site concentrations of iron in subsurface soil were not elevated relative to background. However, in groundwater, the site iron concentrations were elevated relative to background.

5.3.0.4 The background comparison for COPCs/COPECs in the South Bank of Boat Basin are shown in Table 5-9. The surface soil comparison is of limited utility because only a single site sample was collected from the area. For copper, the site concentration in surface soils was greater than the maximum observed in the background data. Conversely, the iron concentration from this site area was below the maximum observed in the background data. The background comparison for copper in sediment was also of limited utility because only three background samples were collected. The sediment copper concentrations in the site area were elevated relative to background.

5.4 Human and Ecological Risk Screening Results

5.4.0.1 As discussed in Section 5.1.1.2, the WFF Project 07 was separated into the following three distinct areas of interest for the purpose of the risk assessment: Pyrotechnics Burn Area; Gun Butt No. 1 and 2 Area; and South Bank of Boat Basin. For each sampled media, the selection of COPCs/COPECs was based on a comparison of the maximum MC concentration identified within the WFF Project 07 to the relevant risk-based screening level values. The MC concentration distribution specific within each of the three areas of interest was then reviewed to determine the COPC/COPEC risk significance on an area-specific basis. The risk assessment discussion is grouped by media and begins by identifying COPCs/COPECs for the WFF Project 07, followed by an analysis of the risk conclusions for each of the three areas of interest.

5.4.0.2 MCs analyzed at the WFF Project 07 varied between the three areas but included explosive constituents (DNT and DNT breakdown products, TNT and TNT breakdown products, NG, RDX, and tetryl), metals (aluminum, antimony, barium, copper, iron, lead, magnesium, nickel, and zinc), PAHs (acenaphthene, acenaphthylene, anthracene, benzo[a]anthracene, benzo[b]fluoranthene, benzo[k]fluoranthene, benzo[g,h,i]perylene, benzo[a]pyrene, chrysene, dibenzo[a,h]anthracene, fluoranthene, fluorene, indeno[1,2,3-cd]pyrene, naphthalene, phenanthrene, and pyrene), and perchlorate. Surface soil, subsurface soil, groundwater, sediment and surface water were identified as media of concern for MRS 7.

5.4.1 Surface Soil Pathway and Screening Results

5.4.1.1 In the SS-WP, surface soil was identified as a medium with potentially complete pathways for human and ecological receptors at the WFF Project 07. A total of 23 surface soil samples were collected from within the WFF Project 07 during this SI effort. Table 5-1 presents the analytical results for these surface soil samples, along with the human health and ecological screening values described previously in Section 5.1.3. Potentially complete pathways were identified for incidental ingestion and dermal contact with surface soil, inhalation of particulates from surface soil, and ingestion of vegetation and game exposed to MCs in surface soil for human and ecological receptors at this site. The only COPC identified for surface soil was iron. COPECs in surface soil included antimony, copper, lead and zinc.

5.4.1.2 Pyrotechnics Burn Area. Within the Pyrotechnics Burn Area, iron was identified as a COPC, and antimony, copper, lead and zinc were identified as COPECs. The risk significance of these designations within the Pyrotechnics Burn Area is discussed below.

- Iron as a COPC

  One of five surface soil samples exceeded the HHRA SL for iron. The iron SL reflects an added margin of safety to account for simultaneous exposure to multiple non-carcinogenic compounds through contact with surface soils. This is an overly conservative assumption given the lack of other COPCs in the surface soil of this area. None of the site iron surface soil concentrations exceed the USEPA regional SL for iron in residential soil. Furthermore, site iron concentrations were not elevated relative to background, so there is no indication of human health risk impacts from FUDS related activities. No adverse human health impacts are expected for iron in surface soil based on the WOE evaluation.

- Antimony as a COPEC

  Antimony concentrations in four of the five surface soil samples exceeded the eco-SSL. The maximum concentration exceeded the eco-SSL by a factor of 7. No background comparison could be made for antimony due to the absence of detections in the background dataset. Antimony is assumed to represent a potential risk to ecological receptors in this area.

- Copper as a COPEC

  Copper concentrations in two of the five surface soil samples exceeded the eco-SSL. The maximum concentration exceeded the eco-SSL by a factor of 1.4. The copper concentrations in this area were elevated relative to background concentrations. Copper is not assumed to represent a potential risk to ecological receptors because of the site concentrations exceed the eco-SSL infrequently and by a negligible amount.

- Lead as a COPEC

  All five lead concentrations in the surface soil exceeded the eco-SSL. The maximum concentration exceeded the eco-SSL by a factor of 26. The lead concentrations from this area were also elevated relative to the background samples. Lead is assumed to represent a potential risk to ecological receptors in this area.

- Zinc as a COPEC

  All five zinc concentrations in the surface soil exceed the eco-SSL. The maximum concentration exceeded the eco-SSL by a factor of 41; however, the maximum concentration is an estimated value, which introduces a degree of uncertainty in the SLERA. The next two highest zinc concentrations from this area had no such qualifier and still exceeded the eco-SSL by a factor of ten. The zinc concentrations from this area were also elevated relative to the background samples. Zinc is assumed to represent a potential risk to ecological receptors in this area.

5.4.1.3 Gun Butt No. 1 and 2 Area. Within the Gun Butt No. 1 and 2 Area, iron was identified as a COPC, while copper and lead were identified as COPECs. The risk significance of these designations within the Gun Butt No. 1 and 2 Area is discussed below. Antimony was not above human or ecological SLs, however, antimony results were rejected and therefore not included in the HHRA/SLERA for ten of the fifteen surface soil samples from this area. At the five sampling locations with valid antimony results other analytes were above their respective human or ecological SLs but antimony was not. None of the MC analytes were above their SLs at three of the sampling locations with rejected antimony results. The only risk issue at five of the other locations with rejected antimony results was iron as a COPC, which was not considered risk significant because of the conservatism in the iron HHRA SL. Ultimately, the uncertainty introduced by this antimony data gap is not considered significant enough to change the risk conclusions for antimony.

- Iron as a COPC

  Nine of the fifteen concentrations of iron in surface soil samples for this area exceeded the HHRA SL. As discussed previously, the iron SL reflects an added margin of safety applied to the USEPA regional SL to account for simultaneous exposure to multiple non-carcinogenic compounds through contact with surface soils. This is an overly conservative assumption given the lack of other COPCs in the surface soil of this area. None of the site iron surface soil concentrations exceed the unadjusted USEPA regional SL for iron in residential soil. Furthermore, site iron detections were not elevated relative to background concentrations, so there is no indication of human health risk impacts from FUDS related activities. No adverse human health impacts are expected for iron in surface soil based on the WOE evaluation.

- Copper as a COPEC

  Copper concentrations in three of the fifteen surface soil samples exceeded the eco-SSL. The maximum concentration exceeded the eco-SSL by a factor of 3.3. Copper detections were elevated relative to background concentrations. Copper is not expected to present a potential risk to ecological receptors because the site concentrations exceeded the eco-SSL infrequently and by a negligible amount.

- Lead as a COPEC

  Five of the fifteen lead concentrations in the surface soil exceeded the eco-SSL. The maximum concentration exceeded the eco-SSL by a factor of 4. The lead concentrations in the surface soil are not expected to represent an unacceptable risk to ecological receptors since the exceedance were infrequent and by a negligible amount. Furthermore, the lead detections from this area did not exceed relative to the background concentrations. Therefore, there is no additional risk to ecological receptors from FUDS related activities. Lead is not assumed to represent a risk to ecological receptors for this area based on the WOE evaluation.

5.4.1.4 South Bank of Boat Basin Area. Within the South Bank of Boat Basin Area, iron was identified as a COPC, and copper was identified as a COPEC. The risk significance of these designations within the South Bank of Boat Basin Area is discussed below.

- Iron as a COPC

  The iron concentration in the single surface soil sample collected from this area exceeded the HHRA SL. As discussed previously, the iron SL reflects an added margin of safety applied to the USEPA regional SL to account for simultaneous exposure to multiple non-carcinogenic compounds through contact with surface soils. This is an overly conservative assumption given the lack of other COPCs in this surface soil sample. The iron surface soil concentration in this area does not exceed the unadjusted USEPA regional SL for iron in residential soil. No meaningful background comparison could be made because only a single sample was collected in this area. However, no adverse human health impacts are expected for iron in surface soil based on the WOE evaluation.

- Copper as a COPEC

  The copper concentration in the single surface soil sample exceeded the eco-SSL. The maximum concentration exceeded the eco-SSL by a factor of 2.7. No meaningful background comparison could be made because only a single sample was collected in this area. Copper is assumed to represent a potential risk to ecological receptors because the only sample for the area exceeds the eco-SSL.

5.4.2 Subsurface Soil Pathway and Screening Results

5.4.2.1 Subsurface soil was identified as a medium with potentially complete pathways for human receptors at the WFF Project 07. A total of twelve subsurface soil samples were collected from within the WFF Project 07 during this SI effort. Table 5-1 presents the analytical results for these subsurface soil samples, along with the human health screening values described previously in Section 5.1.3. Potentially complete pathways were identified for incidental ingestion, dermal contact, and inhalation of particulates from subsurface soil for human and ecological receptors at this site. Aluminum and iron were the only COPCs identified for subsurface soil at the WFF Project 07.

5.4.2.2 Pyrotechnics Burn Area. Within the Pyrotechnics Burn Area, aluminum and iron were identified as COPCs. The risk significance of these designations within the Pyrotechnics Burn Area is discussed below.

- Aluminum as a COPC

  Two of the four subsurface soil samples exceeded the HHRA SL for aluminum. The aluminum SL reflects an added margin of safety applied to the USEPA regional SL to account for simultaneous exposure to multiple non-carcinogenic compounds through contact with subsurface soils. This is an overly conservative assumption given the limited number of COPCs in the subsurface soil of this area. None of the aluminum subsurface soil concentrations exceed the unadjusted USEPA regional SL for aluminum in residential soil. Site aluminum concentrations were elevated relative to background. However, no adverse human health impacts are expected for aluminum in subsurface soil based on the conservatism in the HHRA SL used to identify aluminum as a COPC.

- Iron as a COPC

  Two of the four subsurface soil samples exceeded the HHRA SL for iron. The iron SL reflects an added margin of safety applied to the USEPA regional SL to account for simultaneous exposure to multiple non-carcinogenic compounds through contact with subsurface soils. This is an overly conservative assumption given the limited number of COPCs in the subsurface soil of this area. None of the iron subsurface soil concentrations exceed the unadjusted USEPA regional SL in residential soil. Furthermore, site iron concentrations were not elevated relative to background, so there is no indication of human health risk impacts from FUDS related activities.

5.4.2.3 Gun Butt No. 1 and 2 Area. Within the Gun Butt No. 1 and 2 Area, iron was identified as a COPC. The risk significance of this designation within the Gun Butt No. 1 and 2 Area is discussed below.

- Iron as a COPC

  Two of the seven subsurface soil samples exceeded the HHRA SL for iron. The iron SL reflects an added margin of safety applied to the USEPA regional SL to account for simultaneous exposure to multiple non-carcinogenic compounds through contact with subsurface soils. This is an overly conservative assumption given the lack of other COPCs in the subsurface soil of this area. None of the iron subsurface soil concentrations exceeded the unadjusted USEPA regional SL in residential soil. Furthermore, site iron concentrations were not elevated relative to background, so there is no indication of human health risk impacts from FUDS related activities.

5.4.2.4 South Bank of Boat Basin Area. No COPCs were identified within the South Bank of Boat Basin Area.

5.4.3 Sediment Pathway and Screening Results

5.4.3.1 Sediment was identified as a medium with potentially complete pathways for human and ecological receptors at the WFF Project 07. A total of six sediment samples were collected from within the WFF Project 07 during this SI effort. Table 5-2 presents the analytical results for these sediment samples, along with the human health and ecological screening values described previously in Section 5.1.3. Potentially complete pathways were identified for incidental ingestion, dermal contact, and inhalation of particulates from sediment for human and ecological receptors at this site. However, sediment was not present within the Pyrotechnics Burn Area or Gun Butt No. 1 or 2 (including the area between the Gun Butts); therefore, sediment samples were not collected from these areas. However, sediment was present and collected from the South Bank of the Boat Basin. No COPCs were identified for sediment and copper was the only COPEC identified for sediment at the WFF Project 07. One of the six antimony samples collected at WFF Project 07 was rejected. This data gap is considered to be insignificant because antimony was not detected in the other five samples and the RLs were well below risk-based screening levels.

5.4.3.2 South Bank of Boat Basin Area. Within the South Bank of Boat Basin Area, only copper was identified as a COPEC. The risk significance of this designation within the South Bank of Boat Basin is discussed below.

- Copper as a COPEC

  Only one of the six sediment samples exceeded the ecological SL for copper. The maximum concentration exceeds the ecological SL by a factor of 2.6. The site sediment concentrations for copper are elevated with respect to the background concentrations. However, adverse impacts to ecological receptors are not expected from exposure to copper in sediments based on the very low frequency and magnitude with which site concentrations exceeded the ecological SL.

5.4.4 Surface Water Pathway and Screening Results

5.4.4.1 Surface water was identified as a medium with potentially complete pathways for human and ecological receptors at the WFF Project 07. A total of two surface water samples were collected from within the WFF Project 07 during this SI effort. Table 5-3 presents the analytical results for these surface water samples, along with the human health and ecological screening values described previously in Section 5.1.3. Potentially complete pathways were identified for incidental ingestion of and dermal contact with MC in surface water, in addition to ingestion of fish exposed to MC in surface water, for human and ecological receptors at this site. No COPCs or COPECs were identified for surface water collected from within the Boat Basin

5.4.5 Groundwater Pathway and Screening Results

5.4.5.1 Groundwater was identified as a medium with potentially complete pathways for human receptors at the WFF Project 07. A total of six groundwater samples were collected from within the WFF Project 07 during this SI effort. Table 5-4 presents the analytical results for these groundwater samples, along with the human health screening values described previously in Section 5.1.3. Potentially complete pathways were identified for ingestion of, dermal contact with MC in groundwater for human receptors at this site. Antimony and iron were the only COPCs identified for groundwater at the site.

5.4.5.2 Pyrotechnics Burn Area. Within the Pyrotechnics Burn Area, antimony and iron were identified as COPCs. The risk significance of these designations within the Pyrotechnics Burn Area is discussed below.

- Antimony as a COPC

  All three of the groundwater samples exceeded the HHRA SL for antimony. The antimony HHRA SL reflects an added margin of safety to the USEPA regional SL tap water concentration to account for simultaneous exposure to multiple non-carcinogenic compounds through groundwater exposure. This is an overly conservative assumption given the limited number of COPCs in the groundwater of this area. None of the antimony groundwater concentrations exceed the unadjusted USEPA regional SL for antimony in tap water. No adverse human health impacts are expected for antimony in groundwater based on the conservatism in the HHRA SL used to identify antimony as a COPC.
- Iron as a COPC

  One of the three groundwater samples exceeded the HHRA SL for iron. The iron HHRA SL reflects an added margin of safety to the USEPA regional SL tap water concentration to account for simultaneous exposure to multiple non-carcinogenic compounds through groundwater exposure. This is an overly conservative assumption given the limited number of COPCs in the groundwater of this area. None of the iron groundwater concentrations exceed the unadjusted USEPA regional SL for iron in tap water. Furthermore, site iron concentrations were not elevated relative to background, so there is no indication of human health risk impacts from FUDS related activities.

5.4.2.3 Gun Butt No. 1 and 2 Area. Within the Gun Butt No. 1 and 2 Area, iron was identified as a COPC. The risk significance of this designation within the Gun Butt No. 1 and 2 Area is discussed below.

- Iron as a COPC

  All three groundwater samples exceeded the HHRA SL for iron. The iron SL reflects an added margin of safety to the USEPA regional SL tap water concentration to account for simultaneous exposure to multiple non-carcinogenic compounds through contact with subsurface soils. This is an overly conservative assumption given the limited number of COPCs in the groundwater of this area. However, two of the three groundwater concentrations exceed the unadjusted USEPA regional SL for iron in tap water. Furthermore, site iron concentrations were elevated relative to background. There is a potential for adverse human health impacts from iron in groundwater based on the WOE evaluation.

		Screening Values for Visitor/Trespasser [a,b]	Screening Values for Construction Worker, Employee [a,b]	Screening Values for Biota								
	Sample Name:				WFF-MRS7-SS-01-01	WFF-MRS7-SS-DUP3	WFF-MRS7-SS-01-02	WFF-MRS7-SS-01-03	WFF-MRS7-SS-01-04	WFF-MRS7-SB-02-01	WFF-MRS7-SB-02-02	WFF-MRS7-SB-02-
	Sample Date:				12/14/2011	12/14/2011	12/14/2011	12/14/2011	12/14/2011	12/14/2011	12/14/2011	12/14/2011
	Parent Name:					WFF-MRS7-SS-01-01						
	Area:				Pyrotechnics Burn Area	Pyrotechnics Burn Area	Pyrotechnics Burn Area	Pyrotechnics Burn Area	Pyrotechnics Burn Area	Pyrotechnics Burn Area	Pyrotechnics Burn Area	Pyrotechnics Burn A
AS	Unit											
-35-4	mg/kg	220	2,700	NSL	0.10 U	0.09 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.1
-96-7	mg/kg	19	79	30 [c]	0.10 U	0.09 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.1
-14-2	mg/kg	1.6	5.5	30 [c,d]	—	—	--	—	—	--	—	-
-20-2	mg/kg	6.1	62	30 [c,d]	0.10 U	0.09 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.1
72-78-2	mg/kg	15 [e]	200 [f]	80 [c]	0.10 U	0.09 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.1
-72-2	mg/kg	2.9	13	30 [c,d]	—	—	--	—	—	--	—	-
-08-1	mg/kg	0.61	6.2	30 [c,d]	—	—	--	—	—	--	—	-
06-51-0	mg/kg	15 [e]	190 [f]	80 [c,f]	0.10 U	0.09 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.1
-99-0	mg/kg	30	110	30 [c,d]	—	—	--	—	—	--	—	-
-95-3	mg/kg	4.8	24	40 [g]	0.29 U	0.28 U	0.29 U	0.29 U	0.29 U	0.28 U	0.29 U	0.3
-63-0	mg/kg	0.61	6.2	NSL	—	—	--	—	—	--	—	-
-82-4	mg/kg	5.6	24	100 [c]	—	—	--	—	—	--	—	-
-45-8	mg/kg	24	250	25 [c]	—	—	--	—	—	--	—	-
9-90-5	mg/kg	7,700	99,000	pH < 5.5 [h]	2,200.00	1,700.00	7,000.00	5,200.00 J	7,400.00	30,000.00	1,100.00	29,000.0
0-36-0	mg/kg	3.1	41	0.27 [i]	1.90	1.50 L	0.11 J	0.51 L	0.31 L	0.03 J	0.06 J	0.0
0-39-3	mg/kg	1,500	19,000	330 [j]	3.80	4.80 K	14.00	6.60 K	25.00 K	34.00	3.40	46.0
0-50-8	mg/kg	310	4,100	28 [k]	32.00	15.00	19.00	16.00	39.00	20.00	3.10	32.0
9-89-6	mg/kg	5,500	72,000	NSL	1,900.00	1,100.00	5,000.00	3,500.00 J	7,800.00	11,000.00	460.00	15,000.0
9-92-1	mg/kg	400	800	11 [l]	81.00	57.00 L	70.00	31.00 L	290.00 L	15.00	10.00	21.0
9-95-4	mg/kg	NSL	NSL	NSL	1,800.00	880.00	810.00	3,400.00	910.00	4,300.00	170.00	5,400.0
0-02-0	mg/kg	150	2,000	38 [m]	2.10	1.50	3.70	2.10	5.30	13.00	0.78	16.0
0-66-6	mg/kg	2,300	31,000	46 [n]	460.00	500.00	83.00	1,900.00 J	130.00	260.00	18.00	66.0
-32-9	µg/kg	340,000	3,300,000	29,000 [o]	10.00 U	8.80 U	--	7.70 U	—	--	—	-
-96-8	µg/kg	NSL	NSL	29,000 [o]	0.77 B	8.80 U	--	7.70 U	—	--	—	-
-12-7	µg/kg	1,700,000	17,000,000	29,000 [o]	3.30 J	8.80 U	--	7.70 U	—	--	—	-
-55-3	µg/kg	150	2,100	1,100 [p]	2.50 J	1.60 J	--	7.70 U	—	--	—	-
-32-8	µg/kg	15	210	1,100 [p]	2.50 J	2.60 J	--	1.20 J	—	--	—	-
-99-2	µg/kg	150	2,100	1,100 [p]	6.50 J	6.60 J	--	2.20 J	—	--	—	-
-24-2	µg/kg	NSL	NSL	1,100 [p]	2.40 J	2.20 J	--	7.70 U	—	--	—	-
7-00-9	µg/kg	1,500	21,000	1,100 [p]	2.40 J	8.80 U	--	7.70 U	—	—	—	-
-01-9	µg/kg	15,000	210,000	1,100 [p]	7.20 J	4.50 J	--	1.50 J	—	—	—	-
-70-3	µg/kg	15	210	1,100 [p]	10.00 U	8.80 U	--	7.70 U	—	—	—	-
-44-0	µg/kg	230,000	2,200,000	29,000 [o]	5.70 J	2.30 J	--	7.70 U	—	—	—	-
-73-7	µg/kg	230,000	2,200,000	29,000 [o]	10.00 U	8.80 U	--	7.70 U	—	—	—	-
-39-5	µg/kg	150	2,100	1,100 [p]	10.00 U	8.80 U	--	7.70 U	—	—	—	-
-20-3	µg/kg	3,600	18,000	29,000 [o]	1.60 B	0.87 B	--	0.67 B	—	—	—	-
-01-8	µg/kg	NSL	NSL	29,000 [o]	3.00 J	8.80 U	--	7.70 U	—	—	—	-
-00-0	µg/kg	170,000	1,700,000	1,100 [p]	5.00 J	2.20 J	--	7.70 U	—	—	—	-

		Screening Values for Visitor/Trespasser [a,b]	Screening Values for Construction Worker, Employee [a,b]	Screening Values for Biota								
	Sample Name:				WFF-MRS7-SS-01-06	WFF-MRS7-SS-01-07	WFF-MRS7-SS-01-08	WFF-MRS7-SS-01-09	WFF-MRS7-SS-01-10	WFF-MRS7-SS-01-12	WFF-MRS7-SS-01-13	WFF-MRS7-SS-01-14
	Sample Date:				12/12/2011	12/12/2011	12/12/2011	12/12/2011	12/12/2011	12/12/2011	12/12/2011	12/12/2011
	Parent Name:											
	Area:				Gun Butt No. 1 and 2	Gun Butt No. 1 and 2	Gun Butt No. 1 and 2	Gun Butt No. 1 and 2	Gun Butt No. 1 and 2	Gun Butt No. 1 and 2	Gun Butt No. 1 and 2	Gun Butt No. 1 and 2
AS	Unit											
35-4	mg/kg	220	2,700	NSL	0.09 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U
-96-7	mg/kg	19	79	30 [c]	0.09 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U
-14-2	mg/kg	1.6	5.5	30 [c,d]	–	–	–	–	–	0.10 U	0.10 U	0.10 U
-20-2	mg/kg	6.1	62	30 [c,d]	0.09 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U
2-78-2	mg/kg	15 [e]	200 [e]	80 [c]	0.09 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U
72-2	mg/kg	2.9	13	30 [c,d]	–	–	–	–	–	0.20 U	0.19 U	0.20 U
08-1	mg/kg	0.61	6.2	30 [c,d]	–	–	–	–	–	0.20 U	0.19 U	0.20 U
6-51-0	mg/kg	15 [e]	190 [e]	80 [c]	0.09 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U
99-0	mg/kg	30	110	30 [c,d]	–	–	–	–	–	0.20 U	0.19 U	0.20 U
95-3	mg/kg	4.8	24	40 [g]	0.27 U	0.30 U	0.30 U	0.29 U	0.30 U	0.29 U	0.29 U	0.30 U
63-0	mg/kg	0.61	6.2	NSL	–	–	–	–	–	2.00 U	1.90 U	2.00 U
-82-4	mg/kg	5.6	24	100 [c]	0.18 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.19 U	0.20 U
-45-6	mg/kg	24	250	25 [c]	0.18 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.19 U	0.20 U
9-90-5	mg/kg	7,700	99,000	pH < 5.5 [h]	–	–	–	–	–	–	–	–
0-36-0	mg/kg	3.1	41	0.27 [i]	0.05 L	– R	– R	– R	0.04 L	– R	– R	–
0-39-3	mg/kg	1,500	19,000	330 [i]	–	–	–	–	–	–	–	–
0-50-8	mg/kg	310	4,100	28 [k]	21.00	25.00	43.00	21.00	24.00	10.00	5.00	–
9-89-6	mg/kg	5,500	72,000	NSL	2,100.00	3,300.00	10,000.00	5,800.00	5,300.00 J	4,600.00	8,500.00	–
9-92-1	mg/kg	400	800	11 [l]	23.00 L	5.60 L	5.60 L	7.00 L	25.00 L	5.10 L	6.20 L	–
9-95-4	mg/kg	NSL	NSL	NSL	–	–	–	–	–	–	–	–
0-02-0	mg/kg	150	2,000	38 [m]	3.00	3.10	4.30	4.30	4.10	4.50	5.30	–
0-66-6	mg/kg	2,300	31,000	46 [n]	–	–	–	–	–	–	–	–
-32-9	µg/kg	340,000	3,300,000	29,000 [o]	–	–	–	–	–	–	–	–
-96-8	µg/kg	NSL	NSL	29,000 [o]	–	–	–	–	–	–	–	–
-12-7	µg/kg	1,700,000	17,000,000	29,000 [o]	–	–	–	–	–	–	–	–
-55-3	µg/kg	150	2,100	1,100 [o]	–	–	–	–	–	–	–	–
-32-8	µg/kg	15	210	1,100 [o]	–	–	–	–	–	–	–	–
-99-2	µg/kg	150	2,100	1,100 [o]	–	–	–	–	–	–	–	–
-24-2	µg/kg	NSL	NSL	1,100 [o]	–	–	–	–	–	–	–	–
-08-9	µg/kg	1,500	21,000	1,100 [o]	–	–	–	–	–	–	–	–
-01-9	µg/kg	15,000	210,000	1,100 [o]	–	–	–	–	–	–	–	–
70-3	µg/kg	15	210	1,100 [o]	–	–	–	–	–	–	–	–
-44-0	µg/kg	230,000	2,200,000	29,000 [o]	–	–	–	–	–	–	–	–
73-7	µg/kg	230,000	2,200,000	29,000 [o]	–	–	–	–	–	–	–	–
-39-5	µg/kg	150	2,100	1,100 [o]	–	–	–	–	–	–	–	–
20-3	µg/kg	3,600	18,000	29,000 [o]	–	–	–	–	–	–	–	–
01-8	µg/kg	NSL	NSL	29,000 [o]	–	–	–	–	–	–	–	–
-00-0	µg/kg	170,000	1,700,000	1,100 [o]	–	–	–	–	–	–	–	–

CAS	Unit	Screening Values for Visitor/Trespasser [a,b]	Screening Values for Construction Worker, Employee [a,b]	Screening Values for Biota								
	Sample Name:				WFF-MRS7-SS-01-17	WFF-MRS7-SS-01-18	WFF-MRS7-SS-01-19	WFF-MRS7-SS-01-20	WFF-MRS7-SS-DUP2	WFF-MRS7-SS-01-21	WFF-MRS7-SB-02-05	WFF-MRS7-SB-02-06
	Sample Date:				12/12/2011	12/12/2011	12/12/2011	12/12/2011	12/12/2011	12/12/2011	12/12/2011	12/12/2011
	Parent Name:								WFF-MRS7-SS-01-20			
	Area:				Gun Butt No. 1 and 2	Gun Butt No. 1 and 2	Gun Butt No. 1 and 2	Gun Butt No. 1 and 2	Gun Butt No. 1 and 2	Gun Butt No. 1 and 2	Gun Butt No. 1 and 2	Gun Butt No. 1 and 2
99-35-4	mg/kg	220	2,700	NSL	0.10 U	0.10 U	0.09 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U
18-96-7	mg/kg	19	79	30 [c]	0.10 U	0.10 U	0.09 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U
21-14-2	mg/kg	1.6	5.5	30 [c,d]	0.10 U	–	–	0.10 U	0.10 U	0.10 U	–	–
06-20-2	mg/kg	6.1	62	30 [c,d]	0.10 U	0.10 U	0.09 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U
572-78-2	mg/kg	15 [e]	200 [e]	80 [c]	0.10 U	0.10 U	0.09 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U
98-72-2	mg/kg	2.9	13	30 [c,d]	0.20 U	–	–	0.20 U	0.20 U	0.19 U	–	–
99-08-1	mg/kg	0.61	6.2	30 [c,d]	0.20 U	–	–	0.20 U	0.20 U	0.19 U	–	–
406-51-0	mg/kg	15 [e]	190 [e]	80 [c,f]	0.10 U	0.10 U	0.09 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U
99-99-0	mg/kg	30	110	30 [c,d]	0.20 U	–	–	0.20 U	0.20 U	0.19 U	–	–
98-95-3	mg/kg	4.8	24	40 [g]	0.30 U	0.29 U	0.28 U	0.29 U	0.30 U	0.29 U	0.29 U	0.29 U
55-63-0	mg/kg	0.61	6.2	NSL	2.00 U	–	–	2.00 U	2.00 U	1.90 U	–	–
21-82-4	mg/kg	5.6	24	100 [c]	0.20 U	0.19 U	0.19 U	0.20 U	0.20 U	0.19 U	0.19 U	0.20 U
79-45-8	mg/kg	24	250	25 [c]	0.20 U	0.19 U	0.19 U	0.20 U	0.20 U	0.19 U	0.19 U	0.20 U
429-90-5	mg/kg	7,700	99,000	pH < 5.5 [h]	–	–	–	–	–	–	–	–
440-36-0	mg/kg	3.1	41	0.27 [i]	–	– R	0.05 L	– R	– R	– R	– R	– R
440-39-3	mg/kg	1,500	19,000	330 [i]	–	–	–	–	–	–	–	–
440-50-8	mg/kg	310	4,100	28 [i]	–	92.00	20.00	5.20	5.60	6.50	4.30	1.30 J
439-89-6	mg/kg	5,500	72,000	NSL	–	6,800.00	4,400.00	6,100.00	6,400.00	6,100.00 J	3,700.00	1,100.00
439-92-1	mg/kg	400	800	11 [i]	–	6.00 L	26.00 L	4.90	5.30	6.40	2.40 L	1.10 L
439-95-4	mg/kg	NSL	NSL	NSL	–	–	–	–	–	–	–	–
440-02-0	mg/kg	150	2,000	38 [m]	–	4.40	4.60	4.80	5.10	4.40	3.90	2.30
440-66-6	mg/kg	2,300	31,000	46 [n]	–	–	–	–	–	–	–	–
83-32-9	µg/kg	340,000	3,300,000	29,000 [o]	–	–	–	–	–	–	–	–
08-96-8	µg/kg	NSL	NSL	29,000 [o]	–	–	–	–	–	–	–	–
20-12-7	µg/kg	1,700,000	17,000,000	29,000 [o]	–	–	–	–	–	–	–	–
56-55-3	µg/kg	150	2,100	1,100 [o]	–	–	–	–	–	–	–	–
50-32-8	µg/kg	15	210	1,100 [o]	–	–	–	–	–	–	–	–
05-99-2	µg/kg	150	2,100	1,100 [o]	–	–	–	–	–	–	–	–
91-24-2	µg/kg	NSL	NSL	1,100 [o]	–	–	–	–	–	–	–	–
07-08-9	µg/kg	1,500	21,000	1,100 [o]	–	–	–	–	–	–	–	–
18-01-9	µg/kg	15,000	210,000	1,100 [o]	–	–	–	–	–	–	–	–
53-70-3	µg/kg	15	210	1,100 [o]	–	–	–	–	–	–	–	–
06-44-0	µg/kg	230,000	2,200,000	29,000 [o]	–	–	–	–	–	–	–	–
86-73-7	µg/kg	230,000	2,200,000	29,000 [o]	–	–	–	–	–	–	–	–
93-39-5	µg/kg	150	2,100	1,100 [o]	–	–	–	–	–	–	–	–
91-20-3	µg/kg	3,600	18,000	29,000 [o]	–	–	–	–	–	–	–	–
85-01-8	µg/kg	NSL	NSL	29,000 [o]	–	–	–	–	–	–	–	–
29-00-0	µg/kg	170,000	1,700,000	1,100 [o]	–	–	–	–	–	–	–	–

Analyte	CAS	Unit	Screening Values for Visitor/Trespasser [a,b]	Screening Values for Construction Worker, Employee [a,b]	Screening Values for Biota	WFF-MRS7-SB-02-08	WFF-MRS7-SB-02-09	WFF-MRS7-SB-02-10	WFF-MRS7-SS-01-11	WFF-MRS7-SS-02-11
Sample Name:						WFF-MRS7-SB-02-08	WFF-MRS7-SB-02-09	WFF-MRS7-SB-02-10	WFF-MRS7-SS-01-11	WFF-MRS7-SS-02-11
Sample Date:						12/12/2011	12/12/2011	12/12/2011	12/13/2011	12/13/2011
Parent Name:										
Area:						Gun Butt No. 1 and 2	Gun Butt No. 1 and 2	Gun Butt No. 1 and 2	South Bank of Boat Basin	South Bank of Boat Basin
Explosives										
1,3,5-TRINITROBENZENE	99-35-4	mg/kg	220	2,700	NSL	0.10 U	0.09 U	0.10 U	0.09 U	0.09 U
2,4,6-TRINITROTOLUENE	118-96-7	mg/kg	19	79	30 [c]	0.10 U	0.09 U	0.10 U	0.09 U	0.09 U
2,4-DINITROTOLUENE	121-14-2	mg/kg	1.6	5.5	30 [c,d]	--	--	--	0.09 U	0.09 U
2,6-DINITROTOLUENE	606-20-2	mg/kg	6.1	62	30 [c,d]	0.10 U	0.09 U	0.10 U	0.09 U	0.09 U
2-AMINO-4,6-DINITROTOLUENE	35572-78-2	mg/kg	15 [b]	200 [b]	80 [c]	0.10 U	0.09 U	0.10 U	0.04 J	0.09 U
2-NITROTOLUENE	88-72-2	mg/kg	2.9	13	30 [c,d]	--	--	--	0.19 U	0.19 U
3-NITROTOLUENE	99-08-1	mg/kg	0.61	6.2	30 [c,d]	--	--	--	0.19 U	0.19 U
4-AMINO-2,6-DINITROTOLUENE	19406-51-0	mg/kg	15 [b]	190 [b]	80 [c,f]	0.10 U	0.09 U	0.10 U	0.09 U	0.09 U
4-NITROTOLUENE	99-99-0	mg/kg	30	110	30 [c,d]	--	--	--	0.19 U	0.19 U
NITROBENZENE	98-95-3	mg/kg	4.8	24	40 [g]	0.29 U	0.28 U	0.29 U	0.16 J	0.28 U
NITROGLYCERINE	55-63-0	mg/kg	0.61	6.2	NSL	--	--	--	1.90 U	1.90 U
RDX	121-82-4	mg/kg	5.6	24	100 [g]	0.20 U	0.19 U	0.20 U	0.19 U	0.19 U
TETRYL	479-45-8	mg/kg	24	250	25 [c]	0.20 U	0.19 U	0.20 U	0.35 J	0.19 U
Metals										
ALUMINUM	7429-90-5	mg/kg	7,700	99,000	pH < 5.5 [h]	--	--	--	--	--
ANTIMONY	7440-36-0	mg/kg	3.1	41	0.27 [i]	-- R	-- R	-- R	0.02 J	0.21 U
BARIUM	7440-39-3	mg/kg	1,500	19,000	330 [j]	--	--	--	--	--
COPPER	7440-50-8	mg/kg	310	4,100	28 [k]	2.30 J	7.30	5.00	75.00	43.00
IRON	7439-89-6	mg/kg	5,500	72,000	NSL	5,200.00	8,200.00	7,900.00	8,290.00	5,000.00
LEAD	7439-92-1	mg/kg	400	800	11 [l]	3.20 L	6.90 L	6.60 L	7.20	12.00
MAGNESIUM	7439-95-4	mg/kg	NSL	NSL	NSL	--	--	--	--	--
NICKEL	7440-02-0	mg/kg	150	2,000	38 [m]	3.90	6.70	7.90	1.60	6.00
ZINC	7440-66-6	mg/kg	2,300	31,000	46 [n]	--	--	--	--	--
Polycyclic Aromatic Hydrocarbons (PAHs)										
ACENAPHTHENE	83-32-9	μg/kg	340,000	3,300,000	29,000 [o]	--	--	--	--	--
ACENAPHTHYLENE	208-96-8	μg/kg	NSL	NSL	29,000 [o]	--	--	--	--	--
ANTHRACENE	120-12-7	μg/kg	1,700,000	17,000,000	29,000 [o]	--	--	--	--	--
BENZO[a]ANTHRACENE	56-55-3	μg/kg	150	2,100	1,100 [o]	--	--	--	--	--
BENZO[a]PYRENE	50-32-8	μg/kg	15	210	1,100 [o]	--	--	--	--	--
BENZO[b]FLUORANTHENE	205-99-2	μg/kg	150	2,100	1,100 [o]	--	--	--	--	--
BENZO[g,h,i]PERYLENE	191-24-2	μg/kg	NSL	NSL	1,100 [o]	--	--	--	--	--
BENZO[k]FLUORANTHENE	207-08-9	μg/kg	1,500	21,000	1,100 [o]	--	--	--	--	--
CHRYSENE	218-01-9	μg/kg	15,000	210,000	1,100 [o]	--	--	--	--	--
DIBENZO[a,h]ANTHRACENE	53-70-3	μg/kg	15	210	1,100 [o]	--	--	--	--	--
FLUORANTHENE	206-44-0	μg/kg	230,000	2,200,000	29,000 [o]	--	--	--	--	--
FLUORENE	86-73-7	μg/kg	230,000	2,200,000	29,000 [o]	--	--	--	--	--
INDENO(1,2,3-cd)PYRENE	193-39-5	μg/kg	150	2,100	1,100 [o]	--	--	--	--	--
NAPHTHALENE	91-20-3	μg/kg	3,600	18,000	29,000 [o]	--	--	--	--	--
PHENANTHRENE	85-01-8	μg/kg	NSL	NSL	29,000 [o]	--	--	--	--	--
PYRENE	129-00-0	μg/kg	170,000	1,700,000	1,100 [o]	--	--	--	--	--

[a] Soil screening values used for visitors/trespassers were based on USEPA (2011) regional screening levels for direct contact with residential soils, while the soil screening values used for construction workers and employees were based on regional screening levels for direct contact with industrial soils. Regional screening levels are available from http://www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/Generic_Tables/index.htm.

[b] For non-carcinogens, with the exception of lead, screening levels were divided by 10 to account for potential exposure to multiple non-carcinogens. No adjustment was made for carcinogens or lead.

[c] Talmage et al. 1999. Talmage, S.S., D.M. Opresko, C.J. Maxwell, C.J.E. Welsh, M. Cretella, P.H. Reno, and F.B. Daniel. Nitroaromatic munition compounds: environmental effects and screening values. Rev. Environ. Contam. Toxicol. 161: 1-156.

[d] Screening level based on 2,4,6-trinitrotoluene.

[e] Screening level based on 2,4-dinitrotoluene.

[f] Screening level based on 2-amino-4,6-dinitrotoluene.

[g] Efroymson, R.A., M.E. Will, and G.W. Suter II. 1997. Toxicological benchmarks for contaminants of potential concern for effects on soil and litter invertebrates and heterotrophic processes: 1997 revision. ES/ER/TM-126/R2. U.S. Department of Energy, Oak Ridge National Laboratory, Oak Ridge.

[h] USEPA. 2003. Ecological Soil Screening Level for Aluminum. Available at: www.epa.gov/ecotox/ecossl/pdf/eco-ssl_aluminum.pdf.

[i] USEPA. 2005b. Ecological Soil Screening Level for Antimony. Available at: www.epa.gov/ecotox/ecossl/pdf/eco-ssl_antimony.pdf.

[j] USEPA. 2005c. Ecological Soil Screening Level for Barium. Available at: www.epa.gov/ecotox/ecossl/pdf/eco-ssl_barium.pdf.

[k] USEPA. 2007a. Ecological Soil Screening Level for Copper. Available at: www.epa.gov/ecotox/ecossl/pdf/eco-ssl_copper.pdf.

[l] USEPA. 2005d. Ecological Soil Screening Level for Lead. Available at: www.epa.gov/ecotox/ecossl/pdf/eco-ssl_lead.pdf.

[m] USEPA. 2007b. Ecological Soil Screening Level for Nickel. Available at: www.epa.gov/ecotox/ecossl/pdf/eco-ssl_nickel.pdf.

[n] USEPA. 2007c. Ecological Soil Screening Level for Zinc. Available at: www.epa.gov/ecotox/ecossl/pdf/eco-ssl_zinc.pdf.

[o] USEPA. 2007d. Ecological Soil Screening Level for Polycyclic Aromatic Hydrocarbons (PAHs). Available at: www.epa.gov/ecotox/ecossl/pdf/eco-ssl_pah.pdf.

B = The analyte was found in the associated method blank at a level that is similar to the sample result.
CAS = Chemical Abstract Service.
J = The associated value is an estimated quantity.
K = Analyte present. Reported value may be biased high. Actual value is expected to be lower.
L = Analyte present. Reported value may be biased low. Actual value is expected to be higher.
μg/kg = Microgram per kilogram.
mg/kg = Milligram per kilogram.
NSL = No screening level.
R = Rejected data. Unreliable result. Analyte may or may not be present in the sample.
U = Not detected. Values listed are reporting limits (RLs).
USEPA = United States Environmental Protection Agency.
-- = Not analyzed if no qualifier is shown. If an R qualifier is shown, the analyte was analyzed but the value was rejected during data validation.

		Screening Values for Visitor/Trespasser [a,b]	Screening Values for Construction Worker, Employee [a,b]	Screening Values for Biota [c]							
	Sample Name:				WFF-MRS7-SD-01-01	WFF-MRS7-SD-DUP1	WFF-MRS7-SD-01-02	WFF-MRS7-SD-01-03	WFF-MRS7-SD-01-04	WFF-MRS7-SD-01-05	WFF-MBBG-SD-01
	Sample Date:				12/13/2010	12/12/2010	12/13/2010	12/13/2010	12/13/2010	12/13/2010	12/14/2011
	Parent Name:					WFF-MRS7-SD-01-01					
	Area:				South Bank of Boat Basin	South Bank of Boat Basin	South Bank of Boat Basin	South Bank of Boat Basin	South Bank of Boat Basin	South Bank of Boat Basin	
CAS	Unit										
99-35-4	mg/kg	2,200	27,000	0.0024 [c]	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.09 U	--
118-96-7	mg/kg	190	790	30 [d]	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.09 U	--
121-14-2	mg/kg	16	55	30 [d]	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.09 U	--
606-20-2	mg/kg	61	620	30 [d]	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.09 U	--
35572-78-2	mg/kg	150 [e]	2,000 [e]	80 [d]	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.09 U	--
88-72-2	mg/kg	29	130	30 [d]	0.19 U	0.20 U	0.20 U	0.19 U	0.19 U	0.19 U	--
99-08-1	mg/kg	6.1	62	30 [d]	0.19 U	0.20 U	0.20 U	0.19 U	0.19 U	0.19 U	--
19406-51-0	mg/kg	150 [e]	1,900 [e]	80 [d]	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.09 U	--
99-99-0	mg/kg	300	1,100	30 [d]	0.19 U	0.20 U	0.20 U	0.19 U	0.19 U	0.19 U	--
98-95-3	mg/kg	48	240	0.021 [f]	0.29 U	0.29 U	0.29 U	0.29 U	0.29 U	0.28 U	--
55-63-0	mg/kg	6.1	62	NSL	1.90 U	2.00 U	2.00 U	1.90 U	1.90 U	1.90 U	--
121-82-4	mg/kg	56	240	100 [c]	0.19 U	0.20 U	0.20 U	0.19 U	0.19 U	0.19 U	--
479-45-8	mg/kg	240	2,500	25 [d]	0.19 U	0.20 U	0.20 U	0.19 U	0.19 U	0.19 U	--
7429-90-5	mg/kg	77,000	990,000	58,000 [g]	--	--	--	--	--	--	20,000.00
7440-36-0	mg/kg	31	410	2.0 [h]	0.21 U	-- R	0.29 U	0.23 U	0.63 U	0.22 U	0.07 L
7440-39-3	mg/kg	15,000	190,000	330 [i]	--	--	--	--	--	--	27.00 K
7440-50-8	mg/kg	3,100	41,000	16 [j]	1.80 J	4.50	6.70	4.40	42.00	4.80	8.00 J
7439-89-6	mg/kg	55,000	720,000	20,000 [j]	2,400.00	2,200.00	2,400.00	5,500.00	5,600.00	3,500.00	22,000.00
7439-92-1	mg/kg	400	800	36 [k]	5.20	5.50	9.40	10.00	10.00	8.00	20.00 L
7439-95-4	mg/kg	NSL	NSL	NSL	--	--	--	--	--	--	7,500.00
7440-02-0	mg/kg	1,500	20,000	16 [j]	3.80	2.80	3.90	4.10	7.90	5.30	9.20
7440-66-6	mg/kg	23,000	310,000	120 [k]	--	--	--	--	--	--	36.00

ed from USEPA (2011) Regional Screening Levels. Available from http://www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/Generic_Tables/index.htm.

were divided by 10 to account for potential exposure to multiple non-carcinogens. No initial adjustment was made for carcinogens. The resulting values were multiplied by 10 to account for reduced exposures to sediment

nvironments, except for nitrobenzene and antimony. Freshwater screening levels for nitrobenzene and antimony were not available; therefore, marine screening levels were applied for these analytes.

sko, C.J. Maxwell, C.J.E. Welsh, M. Cretella, P.H. Reno, and F.B. Daniel. Nitroaromatic munition compounds: environmental effects and screening values. Rev. Environ. Contam. Toxicol. 161: 1-156.

ce Tables (SQuiRTs), NOAA OR&R Report 08-1, Seattle, WA, Office of Response and Restoration Division, National Oceanographic and Atmospheric Administration. 34p.

diment effect concentrations for the amphipod Hyalella azteca and the midge Chironomus riparius. EPA 905/R96/008. U.S. Environmental Protection Agency, Great Lakes National Program Office, Chicago, IL.

al for biological effects of sediment-sorbed contaminants tested in the national status and trends program. NOAA Technical Memorandum NOS OMA 52.

for Barium. Available at: www.epa.gov/ecotox/ecossl/pdf/eco-ssl_barium.pdf.
93. Guidelines for the protection and management of aquatic sediment quality in Ontario. Ontario Ministry of the Environment and Energy. August. ISBN 0-7729-9248-7.

er. 2000. Development and evaluation of consensus-based sediment quality guidelines for freshwater ecosystems. Arch. Environ. Contam. Toxicol. 39: 20-31.

d blank at a level that is similar to the sample result.

d high. Actual value is expected to be lower.
d low. Actual value is expected to be higher.

or may not be present in the sample.
(RLs).
r.
Agency.
ualifier is shown, the analyte was analyzed but the value was rejected during data validation.

r receptors for which the medium had a potentially completed pathway identified in the SS-WP Addendum.

lues that exceed ecological screening criteria.

Table 5-3 Summary of Surface Water Analytical Results

		Sample Name:	Screening Value Human Receptors [a,b]	Screening Value Biota [c]	WFF-MRS7-SW-00-01	WFF-MRS7-SW-DUP1
		Sample Date:			12/13/2011	12/13/2011
		Parent Name:				WFF-MRS7-SW-00-01
		Area:			South Bank of Boat Basin	South Bank of Boat Basin
Analyte	CAS	Unit				
Explosives						
1,3,5-TRINITROBENZENE	99-35-4	µg/L	460	11 [d]	0.98 U	1.00 U
2,4,6-TRINITROTOLUENE	118-96-7	µg/L	22	90 [d]	0.39 U	0.40 U
2,4-DINITROTOLUENE	121-14-2	µg/L	2.0	310 [e]	0.39 U	0.40 U
2,6-DINITROTOLUENE	606-20-2	µg/L	15	310 [e,f]	0.20 U	0.20 U
2-AMINO-4,6-DINITROTOLUENE	35572-78-2	µg/L	30 [f]	20 [d]	0.20 U	0.20 U
2-NITROTOLUENE	88-72-2	µg/L	2.7	440 [g]	0.39 U	0.40 U
3-NITROTOLUENE	99-08-1	µg/L	1.3	380 [g]	0.39 U	0.40 U
4-AMINO-2,6-DINITROTOLUENE	19406-51-0	µg/L	30 [f]	20 [d,h]	0.20 U	0.20 U
4-NITROTOLUENE	99-99-0	µg/L	37	950 [g]	0.98 U	1.00 U
NITROBENZENE	98-95-3	µg/L	1.2	270 [e]	0.39 U	0.40 U
NITROGLYCERINE	55-63-0	µg/L	1.5	69 [g]	2.90 U	3.00 U
RDX	121-82-4	µg/L	6.1	190 [d]	0.20 U	0.20 U
TETRYL	479-45-8	µg/L	63	NSL	0.24 U	0.24 U
PERCHLORATE	14797-73-0	µg/L	15	NSL	0.50 U	0.50 U

[a] With the exception of perchlorate, screening values for human receptors are derived from USEPA (2011) Regional Screening Levels. Available from http://www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/Generic_Tables/index.htm. The screening value for perchlorate was derived from Department of Defense (DoD). 2009. Perchlorate Release Management Policy. Memorandum from W. Arny to Assistant Secretaries of the Army, Navy, and Air Force, and Director of DLA Enterprise Support. Dated April 22, 2009. Department of Defense, Washington, DC.

[b] For non-carcinogens, screening levels for tap water were divided by 10 to account for potential exposure to multiple non-carcinogens. All values were multiplied by 10 to account for reduced exposures to surface water compared to tap water.

[c] Ecological screening values are for fresh water environments.

[d] Talmage, S.S., D.M. Opresko, C.J. Maxwell, C.J.E. Welsh, M. Cretella, P.H. Reno, and F.B. Daniel. Nitroaromatic munition compounds: environmental effects and screening values. Rev. Environ. Contam. Toxicol. 161: 1-156.

[e] USEPA. 2001. Supplemental Guidance to RAGS: Region 4 Bulletins, Ecological Risk Assessment. Originally published November 1995. Website version last updated November 30, 2001: http://www.epa.gov/region4/waste/ots/ecolbul.htm

[f] Screening value based on 2,4-dinitrotoluene.

[g] TNRCC (Texas Natural Resources Conservation Commission). 2006. Guidance for conducting ecological risk assessments at remediation sites in Texas. RG-263. January 2006 version. 83 pp.

[h] Screening value based on 2-amino-4,6-dinitrotoluene.

CAS = Chemical Abstract Service.
µg/L = Microgram per liter.
U = Not detected. Values listed are reporting limits (RLs).
USEPA = United States Environmental Protection Agency.

Table 5-4 Summary of Groundwater Analytical Results

Analyte	CAS	Unit	Screening Value Human Receptors [a,b]	WFF-MRS7-GW-00-01	WFF-MRS7-GW-00-02	WFF-MRS7-GW-DUP2	WFF-MRS7-GW-00-03	WFF-MRS7-GW-DUP1	WFF-MRS7-GW-00-04
		Sample Date:		12/14/2011	12/14/2011	12/14/2011	12/13/2011	12/13/2011	12/13/2011
		Parent Name:				WFF-MRS7-GW-00-02		WFF-MRS7-GW-00-03	
		Area:		Pyrotechnics Burn Area	Pyrotechnics Burn Area	Pyrotechnics Burn Area	Gun Butt No. 1 and 2	Gun Butt No. 1 and 2	Gun Butt No. 1 and 2
Explosives									
1,3,5-TRINITROBENZENE	99-35-4	µg/L	46	1.00 UJ	1.00 UJ	1.00 UJ	1.10 U	1.10 U	1.10 U
2,4,6-TRINITROTOLUENE	118-96-7	µg/L	2.2	0.42 UJ	0.40 UJ	0.41 UJ	0.44 U	0.44 U	0.44 U
2,4-DINITROTOLUENE	121-14-2	µg/L	0.2	--	--	--	0.44 U	0.44 U	0.44 U
2,6-DINITROTOLUENE	606-20-2	µg/L	1.5	0.21 UJ	0.20 UJ	0.21 UJ	0.22 U	0.22 U	0.22 U
2-AMINO-4,6-DINITROTOLUENE	35572-78-2	µg/L	3.0 [c]	0.21 UJ	0.20 UJ	0.21 UJ	0.22 U	0.22 U	0.22 U
2-NITROTOLUENE	88-72-2	µg/L	0.27	--	--	--	0.44 U	0.44 U	0.44 U
3-NITROTOLUENE	99-08-1	µg/L	0.13	--	--	--	0.44 U	0.44 U	0.44 U
4-AMINO-2,6-DINITROTOLUENE	19406-51-0	µg/L	3.0 [c]	0.21 UJ	0.20 UJ	0.21 UJ	0.22 U	0.22 U	0.22 U
4-NITROTOLUENE	99-99-0	µg/L	3.7	--	--	--	1.10 U	1.10 U	1.10 U
NITROBENZENE	98-95-3	µg/L	0.12	0.42 UJ	0.40 UJ	0.41 UJ	0.44 U	0.44 U	0.44 U
NITROGLYCERINE	55-63-0	µg/L	0.15	--	--	--	3.30 U	3.30 U	3.30 U
RDX	121-82-4	µg/L	0.61	--	--	--	0.22 U	0.22 U	0.22 U
TETRYL	479-45-8	µg/L	6.3	--	--	--	0.26 U	0.27 U	0.27 U
PERCHLORATE	14797-73-0	µg/L	1.5	0.50 U	0.50 U	0.50 U	0.05 U	0.05 U	0.05 U
Metals									
ALUMINUM	7429-90-5	µg/L	1,600	220.00 J	41.00 L	37.00 J	--	--	--
ANTIMONY	7440-36-0	µg/L	0.6	**1.30 J**	**5.70 L**	**4.70 J**	6.00 U	6.00 U	6.00 U
BARIUM	7440-39-3	µg/L	290	55.00	100.00 L	120.00 J	--	--	--
COPPER	7440-50-8	µg/L	62	10.00 U	2.00 UL	10.00 U	0.77 J	3.70 J	1.30 J
IRON	7439-89-6	µg/L	1,100	**2,500.00 J**	39.00 J	40.00 J	**35,000.00 J**	**65,000.00**	**2,000.00**
LEAD	7439-92-1	µg/L	15	2.00 J	1.20 L	1.20 J	1.50 J	4.70 J	1.80 J
MAGNESIUM	7439-95-4	µg/L	NSL	1,200,000.00	1,200,000.00 J	1,300,000.00	--	--	--
NICKEL	7440-02-0	µg/L	30	1.50 J	0.50 B	1.70 J	1.10 J	4.80 J	2.60 J
ZINC	7440-66-6	µg/L	470	43.00 J	4.20 L	15.00 J	--	--	--

[a] With the exception of perchlorate, screening values for human receptors are derived from USEPA (2011) Regional Screening Levels. Available from http://www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/Generic_Tables/index.htm. The screening value for perchlorate was derived from Department of Defense (DoD). 2009. Perchlorate Release Management Policy. Memorandum from W. Army to Assistant Secretaries of the Army, Navy, and Air Force, and Director of DLA Enterprise Support. Dated April 22, 2009. Department of Defense, Washington, DC.

[b] For non-carcinogens, screening levels for tap water were divided by 10 to account for potential exposure to multiple non-carcinogens. No adjustments were made for carcinogens.

[c] Screening value based on 2,4-dinitrotoluene.

B = The analyte was found in the associated method blank at a level that is similar to the sample result.
CAS = Chemical Abstract Service.
J = Analyte is present. Reported value may not be accurate or precise.
L = Analyte present. Reported value may be biased low. Actual value is expected to be higher.
NSL = No screening level.
U = Not detected. Values listed are reporting limits (RLs).
µg/L = Microgram per liter.
UJ = Not detected. The associated detection limit is an estimate and may be inaccurate or imprecise. Values listed are reporting limits (RLs).
UL = Not detected. Quantitation limit may be higher.
USEPA = United States Environmental Protection Agency.
-- = Not analyzed.

Screening level exceedances were only identified for receptors for which the medium had a potentially completed pathway identified in the SS-WP Addendum.
Shaded and bold values represent detected values that exceed human health screening criteria.

Table 5-5. Non-Detection Concentrations and Screening Values for Human Receptors for Never-Detected Analytes [a]

Analyte	CAS	Units	Minimum Non-Detect Concentration [b]	Maximum Non-Detect Concentration [b]	Screening Value - Visitor/Trespasser [c]	Screening Value - Employee, Construction Worker [c]
Surface Soil						
1,3,5-TRINITROBENZENE	99-35-4	mg/kg	0.09	0.1	220	2,700
2,4,6-TRINITROTOLUENE	118-96-7	mg/kg	0.09	0.1	19	79
2,4-DINITROTOLUENE	121-14-2	mg/kg	0.09	0.1	1.6	5.5
2,6-DINITROTOLUENE	606-20-2	mg/kg	0.09	0.1	6.1	62
2-AMINO-4,6-DINITROTOLUENE	35572-78-2	mg/kg	0.09	0.1	15	200
2-NITROTOLUENE	88-72-2	mg/kg	0.2	0.2	2.9	13
3-NITROTOLUENE	99-08-1	mg/kg	0.2	0.2	0.61	6.2
4-AMINO-2,6-DINITROTOLUENE	19406-51-0	mg/kg	0.09	0.1	15	190
4-NITROTOLUENE	99-99-0	mg/kg	0.2	0.2	30	110
NITROBENZENE	98-95-3	mg/kg	0.3	0.3	4.8	24
NITROGLYCERINE	55-63-0	mg/kg	2	2	0.61	6.2
RDX	121-82-4	mg/kg	0.2	0.2	5.6	24
TETRYL	479-45-8	mg/kg	0.2	0.2	24	250
ACENAPHTHENE	83-32-9	µg/kg	8	10	340,000	3,300,000
ACENAPHTHYLENE	208-96-8	µg/kg	0.8	9	NSL	NSL
DIBENZO[a,h]ANTHRACENE	53-70-3	µg/kg	8	10	15	210
FLUORENE	86-73-7	µg/kg	8	10	230,000	2,200,000
INDENO[1,2,3-cd]PYRENE	193-39-5	µg/kg	8	10	150	2,100
NAPHTHALENE	91-20-3	µg/kg	0.7	2	3,600	18,000
Subsurface Soil						
1,3,5-TRINITROBENZENE	99-35-4	mg/kg	0.09	0.1	220	2,700
2,4,6-TRINITROTOLUENE	118-96-7	mg/kg	0.09	0.1	19	79
2,4-DINITROTOLUENE	121-14-2	mg/kg	0.09	0.09	1.6	5.5
2,6-DINITROTOLUENE	606-20-2	mg/kg	0.09	0.1	6.1	62
2-AMINO-4,6-DINITROTOLUENE	35572-78-2	mg/kg	0.09	0.1	15	200
2-NITROTOLUENE	88-72-2	mg/kg	0.2	0.2	2.9	13
3-NITROTOLUENE	99-08-1	mg/kg	0.2	0.2	0.61	6.2
4-AMINO-2,6-DINITROTOLUENE	19406-51-0	mg/kg	0.09	0.1	15	190
4-NITROTOLUENE	99-99-0	mg/kg	0.2	0.2	30	110
NITROBENZENE	98-95-3	mg/kg	0.3	0.3	4.8	24
NITROGLYCERINE	55-63-0	mg/kg	2	2	0.61	6.2
RDX	121-82-4	mg/kg	0.2	0.2	5.6	24
TETRYL	479-45-8	mg/kg	0.2	0.2	24	250
ANTIMONY	7440-36-0	mg/kg	0.20	0.20	31	410

Table 5-5. Non-Detection Concentrations and Screening Values for Human Receptors for Never-Detected Analytes [a] (continued)

Analyte	CAS	Units	Minimum Non-Detect Concentration [b]	Maximum Non-Detect Concentration [b]	Screening Value - Visitor/Trespasser [c]	Screening Value - Employee, Construction Worker [c]
Sediment						
1,3,5-TRINITROBENZENE	99-35-4	mg/kg	0.09	0.1	2,200	27,000
2,4,6-TRINITROTOLUENE	118-96-7	mg/kg	0.09	0.1	190	790
2,4-DINITROTOLUENE	121-14-2	mg/kg	0.09	0.1	16	56
2,6-DINITROTOLUENE	606-20-2	mg/kg	0.09	0.1	61	620
2-AMINO-4,6-DINITROTOLUENE	35572-78-2	mg/kg	0.09	0.1	150	2,000
2-NITROTOLUENE	88-72-2	mg/kg	0.2	0.2	20	130
3-NITROTOLUENE	99-08-1	mg/kg	0.2	0.2	6.1	62
4-AMINO-2,6-DINITROTOLUENE	19406-51-0	mg/kg	0.09	0.1	150	1,900
4-NITROTOLUENE	99-99-0	mg/kg	0.2	0.2	300	1,100
NITROBENZENE	98-95-3	mg/kg	0.3	0.3	48	240
NITROGLYCERINE	55-63-0	mg/kg	2	2	6.1	62
RDX	121-82-4	mg/kg	0.2	0.2	56	240
TETRYL	479-45-8	mg/kg	0.2	0.2	240	2,500
ANTIMONY	7440-36-0	mg/kg	0.2	0.6	31	410
Surface Water						
1,3,5-TRINITROBENZENE	99-35-4	µg/L	1	1	460	460
2,4,6-TRINITROTOLUENE	118-96-7	µg/L	0.4	0.4	22	22
2,4-DINITROTOLUENE	121-14-2	µg/L	0.4	0.4	2.0	2.0
2,6-DINITROTOLUENE	606-20-2	µg/L	0.2	0.2	15	15
2-AMINO-4,6-DINITROTOLUENE	35572-78-2	µg/L	0.2	0.2	30	30
2-NITROTOLUENE	88-72-2	µg/L	0.4	0.4	2.7	2.7
3-NITROTOLUENE	99-08-1	µg/L	0.4	0.4	1.3	1.3
4-AMINO-2,6-DINITROTOLUENE	19406-51-0	µg/L	0.2	0.2	30	30
4-NITROTOLUENE	99-99-0	µg/L	1	1	37	37
NITROBENZENE	98-95-3	µg/L	0.4	0.4	1.2	1.2
NITROGLYCERINE	55-63-0	µg/L	3	3	1.5	1.5
RDX	121-82-4	µg/L	0.2	0.2	6.1	6.1
TETRYL	479-45-8	µg/L	0.2	0.2	63	63
PERCHLORATE	14797-73-0	µg/L	0.5	0.5	15.0	15.0
Groundwater						
1,3,5-TRINITROBENZENE	99-35-4	µg/L	1	1	46	46
2,4,6-TRINITROTOLUENE	118-96-7	µg/L	0.4	0.4	2.2	2.2
2,4-DINITROTOLUENE	121-14-2	µg/L	0.4	0.4	0.2	0.2
2,6-DINITROTOLUENE	606-20-2	µg/L	0.2	0.2	1.5	1.5
2-AMINO-4,6-DINITROTOLUENE	35572-78-2	µg/L	0.2	0.2	3.0	3.0
2-NITROTOLUENE	88-72-2	µg/L	0.4	0.4	0.27	0.27
3-NITROTOLUENE	99-08-1	µg/L	0.4	0.4	0.13	0.13
4-AMINO-2,6-DINITROTOLUENE	19406-51-0	µg/L	0.2	0.2	3.0	3.0
4-NITROTOLUENE	99-99-0	µg/L	1	1	3.7	3.7
NITROBENZENE	98-95-3	µg/L	0.4	0.4	0.12	0.12
NITROGLYCERINE	55-63-0	µg/L	3	3	0.15	0.15
RDX	121-82-4	µg/L	0.2	0.2	0.61	0.61
TETRYL	479-45-8	µg/L	0.3	0.3	6.3	6.3
PERCHLORATE	14797-73-0	µg/L	0.05	0.5	1.5	1.5
ANTIMONY	7440-36-0	µg/L	6	6	0.6	0.6
COPPER	7440-50-8	µg/L	2	10	62	62

[a] Analytes were not detected within any one or more subareas.

[b] Detection limits are reporting limits (RLs).

[c] Screening levels for human receptors are derived from USEPA (2011) Regional Screening Levels for residential and industrial soils. Available from http://www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/Generic_Tables/index.htm.

Perchlorate value derived from Department of Defense (DoD). 2009. Perchlorate Release Management Policy. Memorandum from W. Arny to Assistant Secretaries of the Army, Navy, and Air Force, and Director of DLA Enterprise Support. Dated April 22, 2009. Department of Defense, Washington, DC.

For non-carcinogens, screening levels were divided by 10 to account for potential exposure to multiple non-carcinogens. No adjustment was made for carcinogens.

The USEPA screening levels for 2-amino-4,6-DNT and 4-amino-2,6-DNT are based on toxicity information for 2,4-DNT.

Shading indicates instances where the RL was greater than the screening value.

CAS = Chemical Abstract Service.
µg/kg = Microgram per kilogram.
mg/L = Microgram per liter.
mg/kg = Milligram per kilogram.
USEPA = United States Environmental Protection Agency.

Table 5-6. Non-Detection Concentrations and Screening Values for Ecological Receptors for Never-Detected Analytes [a]

Analyte	CAS	Units	Minimum Non-Detect Concentration [b]	Maximum Non-Detect Concentration [b]	Screening Value - Biota [c]
Surface Soil					
1,3,5-TRINITROBENZENE	99-35-4	mg/kg	0.09	0.1	NSL
2,4,6-TRINITROTOLUENE	118-96-7	mg/kg	0.09	0.1	30
2,4-DINITROTOLUENE	121-14-2	mg/kg	0.09	0.1	30
2,6-DINITROTOLUENE	606-20-2	mg/kg	0.09	0.1	30
2-AMINO-4,6-DINITROTOLUENE	35572-78-2	mg/kg	0.09	0.1	80
2-NITROTOLUENE	88-72-2	mg/kg	0.2	0.2	30
3-NITROTOLUENE	99-08-1	mg/kg	0.2	0.2	30
4-AMINO-2,6-DINITROTOLUENE	19406-51-0	mg/kg	0.09	0.1	80
4-NITROTOLUENE	99-99-0	mg/kg	0.2	0.2	30
NITROBENZENE	98-95-3	mg/kg	0.3	0.3	40
NITROGLYCERINE	55-63-0	mg/kg	2.0	2.00	NSL
RDX	121-82-4	mg/kg	0.2	0.2	100
TETRYL	479-45-8	mg/kg	0.2	0.2	25
ACENAPHTHENE	83-32-9	µg/kg	8	10	29,000
ACENAPHTHYLENE	208-96-8	µg/kg	0.8	9	29,000
DIBENZO[a,h]ANTHRACENE	53-70-3	µg/kg	8	10	1,100
FLUORENE	86-73-7	µg/kg	8	10	29,000
INDENO[1,2,3-cd]PYRENE	193-39-5	µg/kg	8	10	1,100
NAPHTHALENE	91-20-3	µg/kg	0.7	2	29,000
Sediment					
1,3,5-TRINITROBENZENE	99-35-4	mg/kg	0.09	0.1	0.0024
2,4,6-TRINITROTOLUENE	118-96-7	mg/kg	0.09	0.1	30
2,4-DINITROTOLUENE	121-14-2	mg/kg	0.09	0.1	30
2,6-DINITROTOLUENE	606-20-2	mg/kg	0.09	0.1	30
2-AMINO-4,6-DINITROTOLUENE	35572-78-2	mg/kg	0.09	0.1	80
2-NITROTOLUENE	88-72-2	mg/kg	0.2	0.2	30
3-NITROTOLUENE	99-08-1	mg/kg	0.2	0.2	30
4-AMINO-2,6-DINITROTOLUENE	19406-51-0	mg/kg	0.09	0.1	80
4-NITROTOLUENE	99-99-0	mg/kg	0.2	0.2	30
NITROBENZENE	98-95-3	mg/kg	0.3	0.3	0.021
NITROGLYCERINE	55-63-0	mg/kg	2	2	NSL
RDX	121-82-4	mg/kg	0.2	0.2	100
TETRYL	479-45-8	mg/kg	0.2	0.2	25
ANTIMONY	7440-36-0	mg/kg	0.2	0.6	2

Table 5-6. Non-Detection Concentrations and Screening Values for Ecological Receptors for Never-Detected Analytes [a] (continued)

Analyte	CAS	Units	Minimum Non-Detect Concentration [b]	Maximum Non-Detect Concentration [b]	Screening Value - Biota [c]
Surface Water					
1,3,5-TRINITROBENZENE	99-35-4	µg/L	1	1	11
2,4,6-TRINITROTOLUENE	118-96-7	µg/L	0.4	0.4	90
2,4-DINITROTOLUENE	121-14-2	µg/L	0.4	0.4	310
2,6-DINITROTOLUENE	606-20-2	µg/L	0.2	0.2	310
2-AMINO-4,6-DINITROTOLUENE	35572-78-2	µg/L	0.2	0.2	20
2-NITROTOLUENE	88-72-2	µg/L	0.4	0.4	440
3-NITROTOLUENE	99-08-1	µg/L	0.4	0.4	380
4-AMINO-2,6-DINITROTOLUENE	19406-51-0	µg/L	0.2	0.2	20
4-NITROTOLUENE	99-99-0	µg/L	1	1	950
NITROBENZENE	98-95-3	µg/L	0.4	0.4	270
NITROGLYCERINE	55-63-0	µg/L	3	3	69
RDX	121-82-4	µg/L	0.2	0.2	190
TETRYL	479-45-8	µg/L	0.2	0.2	NSL
PERCHLORATE	14797-73-0	µg/L	0.5	0.5	NSL

[a] Analytes were not detected within any one or more subareas.

[b] Detection limits are reporting limits (RLs).

[c] Screening values for biota are from the following sources:

Talmage et al. 1999. Talmage, S.S., D.M. Opresko, C.J. Maxwell, C.J.E. Welsh, M. Cretella, P.H. Reno, and F.B. Daniel. Nitroaromatic munition compounds: environmental effects and screening values. Rev. Environ. Contam. Toxicol. 161: 1-156.

Buchman, M.F. 2008. Screening Quick Reference Tables (SQuiRTs), NOAA OR&R Report 08-1, Seattle, WA, Office of Response and Restoration Division, National Oceanographic and Atmospheric Administration. 34p.

Efroymson et al. 1997. Efroymson, R.A., M.E. Will, and G.W. Suter II. 1997. Toxicological benchmarks for contaminants of potential concern for effects on soil and litter invertebrates and heterotrophic processes: 1997 revision. ES/ER/TM-126/R2. U.S. Department of Energy, Oak Ridge National Laboratory, Oak Ridge, TN.

Long, E.R., and L.G. Morgan. 1990. The potential for biological effects of sediment-sorbed contaminants tested in the national status and trends program. NOAA Technical Memorandum NOS OMA 52.

TNRCC (Texas Natural Resources Conservation Commission). 2006. Guidance for conducting ecological risk assessments at remediation sites in Texas. RG-263. January 2006 version. 83 pp.

USEPA. 2001. Supplemental Guidance to RAGS: Region 4 Bulletins, Ecological Risk Assessment. Originally published November 1995. Website version last updated November 30, 2001: http://www.epa.gov/region4/waste/ots/ecolbul.htm.

USEPA. 2007d. Ecological Soil Screening Level for Polycyclic Aromatic Hydrocarbons (PAHs). Available at: www.epa.gov/ecotox/ecossl/pdf/eco-ssl_pah.pdf.

Soil screening values for 2,4-dinitrotoluene, 2,6-dinitrotoluene, 2-nitrotoluene, 3-nitrotoluene, and 4-nitrotoluene are based on 2,4,6-trinitrotoluene.

The screening values for 4-amino-2,6-dinitrotoluene are based on 2-amino-4,6-dinitrotoluene.

The surface water screening value for 2,6-dinitrotoluene is based on 2,4-dinitrotolene.

CAS = Chemical Abstract Service.
µg/kg = Microgram per kilogram.
mg/L = Microgram per liter.
mg/kg = Milligram per kilogram.
NSL = No screening level.
USEPA = United States Environmental Protection Agency.

Table 5-7. Comparison of Onsite and Background Concentrations for Metals at the Pyrotechnics Burn Area within MRS 7 [a]

		Onsite: Pyrotechnics Burn Area				Background				Comparisons	
Chemical	Units	Detection Frequency	Minimum Concentration/ Qualifier [b]	Maximum Concentration/ Qualifier [c]	Mean Concentration [d]	Detection Frequency	Minimum Concentration/ Qualifier [b]	Maximum Concentration/ Qualifier [c]	Mean Concentration [d]	Site Maximum > Background Maximum	Site Mean > Background Mean
Surface Soil											
ANTIMONY	mg/kg	5/5	0.11 J	1.90	0.87	--	--	--	--	--	--
COPPER	mg/kg	5/5	15.0	39.0	24.2	9/9	2.10	33.0	8.91	YES	YES
IRON	mg/kg	5/5	1,100	7,800	3,860	10/10	1,740	10,900	7,590	NO	NO
LEAD	mg/kg	5/5	31.0 L	290 L	106	10/10	4.90	124	30.6	YES	YES
ZINC	mg/kg	5/5	83.0	1900 J	615	10/10	4.50	104	29.4	YES	YES
Subsurface Soil											
ALUMINUM	mg/kg	4/4	1,100	30,000	16,000	11/11	5,380	22,400	14,100	YES	YES
IRON	mg/kg	4/4	460	15,000	6,830	11/11	3,040	17,900	10,800	NO	NO
Groundwater											
IRON	µg/L	3/3	39 J	2500 J	860	11/12	452	50,000 J	11,800	NO	NO

[a] Historical background data was used for comparison to site samples (Tables 4.6, 4.24, 4.25; NASA 2004).
[b] Minimum concentration of analyte detected.
[c] Maximum concentration of analyte detected.
[d] Non-detects are carried forth as one-half of the reporting limit (RL) in the calculation of the mean concentration.

-- = Not available, no detected values. Chemical not detected in background, therefore comparison to site is not meaningful.
J = The associated value is an estimated quantity.
L = Analyte present. Reported value may be biased low. Actual value is expected to be higher.
µg/L = Microgram per liter.
mg/kg = Milligram per kilogram.
NASA. 2004. Background Soil and Groundwater Investigation Report for the Main Base. NASA Wallops Flight Facility, Wallops Islands, Virginia. National Aeronautics and Space Administration, Goddard Space Flight Center.

Table 5-8. Comparison of Onsite and Background Concentrations for Metals at Gun Butt No. 1 and 2 within MRS 7 [a]

		Onsite: Gun Butt No. 1 and 2				Background				Comparisons	
Chemical	Units	Detection Frequency	Minimum Concentration/ Qualifier [b]	Maximum Concentration/ Qualifier [c]	Mean Concentration [d]	Detection Frequency	Minimum Concentration/ Qualifier [b]	Maximum Concentration/ Qualifier [c]	Mean Concentration [d]	Site Maximum > Background Maximum	Site Mean > Background Mean
Surface Soil											
COPPER	mg/kg	15/15	2.70	92.0	22.8	9/9	2.10	33.0	8.91	YES	YES
IRON	mg/kg	15/15	2,100	10,000	5,910	10/10	1,740	10,900	7,590	NO	NO
LEAD	mg/kg	15/15	2.60	46.0	13.1	10/10	4.90	124	30.6	NO	NO
Subsurface Soil											
IRON	mg/kg	7/7	1,100	8,200	5,043	11/11	3,040	17,900	10,800	NO	NO
Groundwater											
IRON	µg/L	3/3	9,000	65,000	36,300	11/12	452	50,000 J	11,800	YES	YES

[a] Historical background data was used for comparison to site samples (Tables 4.6, 4.24, 4.25; NASA 2004).
[b] Minimum concentration of analyte detected.
[c] Maximum concentration of analyte detected.
[d] Non-detects are carried forth as one-half of the reporting limit (RL) in the calculation of the mean concentration.

J = The associated value is an estimated quantity.
L = Analyte present. Reported value may be biased low. Actual value is expected to be higher.
µg/L = Microgram per liter.
mg/kg = Milligram per kilogram.
NASA. 2004. Background Soil and Groundwater Investigation Report for the Main Base. NASA Wallops Flight Facility, Wallops Islands, Virginia. National Aeronautics and Space Administration, Goddard Space Flight Center.

Table 5-9. Comparison of Onsite and Background Concentrations for Metals at the South Bank of Boat Basin within MRS 7 [a]

		Onsite: South Bank of Boat Basin				Background				Comparisons	
Chemical	Units	Detection Frequency	Minimum Concentration/ Qualifier [b]	Maximum Concentration/ Qualifier [c]	Mean Concentration [d]	Detection Frequency	Minimum Concentration/ Qualifier [b]	Maximum Concentration/ Qualifier [c]	Mean Concentration [d]	Site Maximum > Background Maximum	Site Mean > Background Mean
Surface Soil											
COPPER	mg/kg	1/1	75.0	75.0	NA	9/9	2.10	33.0	8.91	YES	NA
IRON	mg/kg	1/1	6,200	6,200	NA	10/10	1,740	10,900	7,590	NO	NA
Sediment											
COPPER	mg/kg	6/6	1.80 J	42.0	10.7	2/2	1.90 J	8.00 J	4.95	YES	YES

[a] With the exception of sediment samples, historical surface soil background data was used for comparison to site surface soil samples (Table 4.24; NASA 2004).
[b] Minimum concentration of analyte detected.
[c] Maximum concentration of analyte detected.
[d] Non-detects are carried forth as one-half of the reporting limit (RL) in the calculation of the mean concentration.

J = The associated value is an estimated quantity.
mg/kg = Milligram per kilogram.
NA = Not applicable, only one site sample was obtained.
NASA. 2004. Background Soil and Groundwater Investigation Report for the Main Base. NASA Wallops Flight Facility, Wallops Islands, Virginia. National Aeronautics and Space Administration, Goddard Space Flight Center.

6. SUMMARY AND CONCLUSIONS

6.0.1 WFF Project 07 is located in Accomack County, VA and contains one MRS: MRS 7, Boat Basin/Visitors Information Center. MRS 7 is approximately 1.53 acres of land located at the Main Base Sector of WFF. MRS 7 was used by NAOTS between 1946 and 1959 and has four areas: Pyrotechnics Burn Area, Gun Butt No. 1, Gun Butt No. 2, and South Bank of Boat Basin. The South Bank of Boat Basin had no known munitions use; however, numerous munitions items have been observed in this area. The other areas were used for testing, firing, or disposing of munitions. A summary of the results and conclusions is presented below and is summarized in Table 6-1.

6.1 Boat Basin/Visitors Information Center (MRS 7)

6.1.1 Potential human receptors for the WFF Project 07 include visitors/trespassers, construction workers, and employees, and residents (future only). Potential ecological receptors are soil invertebrates, terrestrial-feeding mammals, and terrestrial-feeding birds.

6.1.2 Since military use of WFF Project 07 ceased by 1959, MD have been observed in the four areas within WFF Project 07. Only spent and inert MD have been observed historically, and no confirmed MEC was found during the SI field activities. However, MPPEH items were observed that could not be determined to not contain energetic material. Based on the confirmed known finds (inert) of the MD observed at MRS 7, and the condition of MPPEH items found during field activities (too rusty to determine), the possible presence of a MEC source is moderate. The human interaction, accessibility, and site stability categories are rated as moderate. Therefore the qualitative MEC hazard evaluation for MRS 7 is moderate.

6.1.3 In the SS-WP, surface soil, sediment, and surface water were media with potentially complete exposure pathways for human and ecological receptors at the WFF Project 07. In addition, subsurface soil and groundwater were identified as media with potentially complete exposure pathways for human receptors. Metal MCs were detected above background concentrations in surface and subsurface soil, sediment, and groundwater; therefore, the pathways are complete for these media. No MC were detected in surface water above background concentrations; however, since the RL for NG is higher than the human health screening level, the pathway is noted as being potentially complete.

6.2 Pyrotechnics Burn Area

6.2.1 In surface soil, no explosive constituents or PAHs were detected above their respective RLs. Iron was the only COPC identified for surface soil. Iron was detected below background concentrations; therefore, based on the limited data available for evaluation (samples could not be collected from within the fenced Pyrotechnics Burn Area), no risks to human receptors from FUDS-related activities were determined. Antimony, copper, lead, and zinc were the only COPECs identified in surface soil. Based on the infrequent and negligible exceedance of the eco-SSL for copper, it is not assumed to present a potential risk. Potential risks to ecological receptors from antimony, lead, and zinc in surface soil were identified.

6.2.2 In subsurface soil, explosive constituents were not detected above their respective RLs. Aluminum and iron were the only identified COPCs. Aluminum in subsurface soil is not expected to have an adverse impact on human receptors based on the conservatism in the HHRA SL used to identify aluminum as a COPC. Iron was detected below background concentrations; therefore, based on the limited data available for evaluation (samples could not be collected from within the fenced Pyrotechnics Burn Area), no risk to human receptors from FUDS-related activities were determined. Aluminum and iron are not CERCLA hazardous substances.

6.2.3 In groundwater, explosive constituents were not detected above their respective RLs. Antimony and iron were the only MC identified as COPCs. Iron was detected below background concentrations; therefore, based on the limited data available for evaluation (samples could not be collected from within the fenced Pyrotechnics Burn Area), no risks to human receptors from FUDS-related activities were determined. Based on the limited data available, the WOE evaluation for antimony indicated no potentially unacceptable risks.

6.3 Gun Butts No. 1 and 2

6.3.1 In surface and subsurface soil, explosive constituents were not detected above their respective RLs. Iron was identified as a COPC in surface and subsurface soil; however, iron detections were below background concentrations. Based on the data available, no risks from FUDS-related activities were determined in surface or subsurface soil for human receptors. Copper and lead were identified as COPECs in surface soil. Lead was detected below background concentrations (no FUDS-related risk) and is not expected to present a potential risk due to infrequent and negligible exceedance of the eco-SSL. Copper is not expected to present a potential risk to ecological receptors due to infrequent and negligible exceedance of eco-SSL.

6.3.2 In groundwater, explosive constituents were not detected above their respective RLs. Iron was the only COPC identified in groundwater and was assumed to represent a potentially unacceptable risk in groundwater based on the WOE evaluation. However, iron is not a CERCLA hazardous substance.

6.4 South Bank of Boat Basin

6.4.1 In surface soil, explosive constituents were not detected above their respective SLs. Iron was the only COPC identified for surface soil; however, no unacceptable human health risks are expected based on the WOE evaluation. Therefore, based on the limited data available for evaluation, no risks from FUDS-related activities were determined for human receptors. Copper was identified as a COPEC in surface soil; however, it is not expected to present a potential risk due to infrequent and negligible exceedance of eco-SSL. In subsurface soil, none of the detected MCs exceeded their respective screening criteria selected for the HHRA; therefore, no COPCs were identified.

6.4.2 In sediment, explosive constituents were not detected above their respective RLs. None of the detected MCs in sediment exceeded their respective screening criteria selected for the HHRA; therefore, no COPCs were identified. Copper was identified as a COPEC in sediment. Based on the infrequent and negligible exceedance of the SL, no unacceptable risk from copper in sediment was determined for ecological receptors.

6.4.3 Surface water samples collected from the Boat Basin did not have detections of MC above the screening criteria selected for the HHRA or the SLERA; therefore, no COPCs or COPECs were identified.

Pyrotechnics Burn Area		Gun Butt No. 1 and 2		South Bank of Boat	
Health COPCs (HHRA) [a]	Ecological COPECs (SLERA) [a]	Human Health COPCs (HHRA) [a]	Ecological COPECs (SLERA) [a]	Human Health COPCs (HHRA) [a]	
eeds screening criterion. COPC. s not exceed background. S-related activities are determined.	Antimony, copper, lead and zinc exceed screening criterion. COPECs. Potentially unacceptable risk from antimony, lead and zinc based on WOE.	Iron exceeds screening criterion. COPC. Iron does not exceed background. No risks from FUDS-related activities are determined.	Copper and lead exceed screening criterion. COPECs. Lead does not exceed background. No lead risks from FUDS-related activities and no potentially unacceptable risk from copper based on WOE.	Iron exceeds screening criterion. COPC. No potentially unacceptable risk for iron based on WOE.	
iron exceeds screening criterion. COPCs. s not exceed background. m FUDS-related activities and no um risks based on WOE.	–	Iron exceeds screening criterion. COPC. Iron does not exceed background. No risks from FUDS-related activities are determined.	–	No exceedance of screening criteria. No COPCs.	
--	–	–	–	No exceedance of screening criteria. No COPCs.	No po
--	–	–	–	No exceedance of screening criteria. No COPCs.	
iron exceed screening criteria. COPCs. s not exceed background. m FUDS-related activities and no ny risks based on WOE.	–	Iron exceeds screening criterion. COPC. Potentially unacceptable risk from iron.	–	--	

r all receptors and environmental media in the HHRA and SLERA are detailed in Tables 5-1

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vithin specific MRS, in accordance with CSM and SS-WP.

7. RECOMMENDATIONS FOR FURTHER ACTION

7.0.1 Based on the results and conclusions of this SI, the following recommendations are provided:

> ***MRS 7 (Boat Basin/Visitors Information Center) Land Portion*** – An RI/FS is recommended for MRS 7. Additional studies should focus on MEC and MC. The qualitative MEC hazard was rated as moderate for MRS 7. No MEC is known to have been found historically and confirmed MEC was not observed during this SI; however, numerous MD is known to have been found at MRS 7 historically and during this SI. Numerous surface and 37 subsurface anomalies and five areas of concentrated subsurface anomalies (not individually counted) were detected at MRS 7 during the 2011 SI field event. Three MD and seven surface MPPEH (20mm, larger than 20mm, burnt pyrotechnic items) were observed during the SI field activities. The SI is a limited scope study and does not include the intrusive investigation of subsurface anomalies. Iron was detected in groundwater collected at Gun Butts No. 1 and 2 (COPC) above the background concentrations and may present a potentially unacceptable risk to human receptors at MRS 7; however, iron is not a CERCLA hazardous substance, so it was not used as the sole basis for an RI/FS recommendation. Antimony, copper, lead, and zinc were detected (COPECs) in surface soil and may present a potentially unacceptable risk to ecological receptors at the MRS 7. During field activities, samples were not collected within the Pyrotechnics Burn Area due to the high concentration of subsurface anomalies (i.e., an anomaly free sample location could not be identified). Therefore, samples could not be collected from the location most likely to contain the highest MC concentrations. This limitation, and that subsurface anomalies could not be investigated, were considered when recommending further work at MRS 7.

7.0.2 Neither a TCRA nor a NTCRA are recommended for WFF Project 07.

7.0.3 The Pyrotechnics Burn Area was found to be incorrectly positioned in the USACE-provided GIS. The correct location, as confirmed by visual evidence of burning contained within a deteriorated fence matching the description of the area cited in historical documents, was observed to be near the southwestern corner of the Pyrotechnic Burn Area. GPS coordinates were collected at each corner of the fence, which was approximately 500 square ft (20 ft by 25 ft). USACE should revise the MRS 7 GIS to reorient the Pyrotechnics Burn Area to encompass the four GPS coordinates collected during the 2011 SI field activities, as shown on the figures and Table 3-1 in this SI.

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APPENDIX A – SCOPE OF WORK

Located on CD.

APPENDIX B – TECHNICAL PROJECT PLANNING MEMORANDUM

- Data Quality Objective Verification Worksheets
- Technical Project Planning (TPP) #1 Memorandum (Located on CD)
- TPP #2 Memorandum (Located on CD)
- Public Notice of Availability of Munitions Response Site Prioritization Protocol (MRSPP) (Located on CD)

Data Quality Objective Verification Worksheet			
Site: Wallops Flight Facility Project 07			
Project: FUDS MMRP SI Project Number C03VA030107			
DQO Statement Number: 1 of 4			
DQO Element Description	**Site-Specific DQO Statement**	**Attained?**	**Required Corrective Action**
Intended Data Use(s):			
Project Objective(s) Satisfied	Determine if the site requires additional investigation through a remedial investigation/feasibility study (RI/FS) or if the site may be recommended for No Department of Defense Action Indicated (NDAI) designation based on the presence or absence of munitions and explosives of concern (MEC) and munitions constituents (MC).	Yes X No ___	
Data Needs Requirements:			
Data User Perspective(s)	Risk-MEC and MC, Compliance	Yes X No ___	
Contaminant or Characteristic of Interest	MEC or Material Potentially Presenting an Explosive Hazard (MPPEH) and MC	Yes X No ___	
Media of Interest	MEC: Surface and subsurface MC: Surface soil, Subsurface soil, Sediment, Surface Water and Groundwater (media varies per MRS, refer to the SS-WP for more detail)	Yes X No ___	
Required Sampling Locations or Areas	MEC and MC: Areas where military munition-related operations occurred and/or where MEC or MPPEH has been identified historically based on existing documentation and interviews.	Yes X No ___	
Number of Samples Required	MEC - Analog geophysical and visual reconnaissance data will be collected to accomplish this objective. These data will be collected using "meandering path" to and from the sampling points. The UXO Technician will collect data on an approximate 6-ft wide path using the geophysical equipment. The visual reach of observations is approximately 12 ft, and may be limited by the presence of vegetation. Once at the individual sampling point, the geophysical equipment will be used to assess an approximately 25-ft diameter circle for anomalies around the sampling point as site conditions permit. In some areas, there may be limitations to the ability to complete geophysical and visual observations. The total estimated area on the paths to/from the sampling locations is approximately 48,550 ft^2, and the area around the sampling locations is approximately 7,840 ft^2 (See Figure 8 in the SS-WP). MC –Collection of twelve surface soil samples, ten subsurface soil samples, seven sediment samples, one surface water sample and four groundwater samples (as well as appropriate QA/QC samples).	Yes X No ___	

Data Quality Objective Verification Worksheet			
Site: Wallops Flight Facility Project 07			
Project: FUDS MMRP SI Project Number C03VA030107			
DQO Statement Number: 1 of 4			
DQO Element Description	**Site-Specific DQO Statement**	**Attained?**	**Required Corrective Action**
Reference Concentration of Interest or Other Performance Criteria	MEC: If historical data indicate the presence of MEC and one anomaly classified as of MPPEH or confirmed MEC is found at the surface with the analog geophysical equipment, or if physical evidence indicating the presence of MEC is found during the visual inspection, then an RI/FS may be recommended. If no anomalies, MPPEH, or confirmed MEC are found, or if the UXO Technician indicates that there is no potential hazard from past use of munitions or MEC discoveries, then an NDAI designation may be recommended. In each of these instances, lines of evidence (e.g., historical data, field data, etc.) will be used to make a final recommendation for an NDAI designation or RI/FS. In both instances (RI/FS or NDAI designation), lines of evidence (e.g., historical data, field data, background concentration of metals, etc. for both MEC and MC) will be used to make a final recommendation for an NDAI designation or RI/FS.	Yes _X_ No ___	
	MC: If the maximum concentrations measured at the site exceed United States Environmental Protection Agency (USEPA) Regional Screening Levels based on current and future land use, or ecological risk screening values, or site-specific background levels (highest value), then an RI/FS may be recommended for the site. If the maximum concentrations measured at the site do not exceed the USEPA Regional Screening Levels or ecological risk screening values, then an NDAI designation may be recommended. In summary, lines of evidence including secondary lines of evidence, such as historical data, field data, and comparison to regional background concentration ranges for metals, may be used to make a final recommendation for an NDAI designation or RI/FS. Screening values selected for comparison at this site are specified in the chemical-specific measurement quality objective (MQO) tables.	Yes _X_ No ___	
Appropriate Sampling and Analysis Methods:			
Sampling Method and Depths	MEC: Geophysics will be conducted with handheld analog equipment, which is accurate to a depth of approximately 2 ft. The geophysical equipment does not have the capability to store data; therefore, Global Positioning System (GPS) equipment will be used to log locations of MEC items encountered. The data collected by the GPS is used to generate the figures in the SI Report. Visual observations will provide a continuous source of additional information which will be noted in the field log book with GPS coordinates. Photographs also will be used as an additional documentation method. Geophysical methods/procedures are described in detail in Section 3 of the SS-WP, and the Field Activities section of the programmatic field sampling plan (PFSP). MC: Sampling methods for MC are described in detail in Section 4 of the SS-WP and Field Activities section of the PFSP.	Yes _X_ No ___	

Data Quality Objective Verification Worksheet			
Site: Wallops Flight Facility Project 07			
Project: FUDS MMRP SI Project Number C03VA030107			
DQO Statement Number: 1 of 4			
DQO Element Description	**Site-Specific DQO Statement**	**Attained?**	**Required Corrective Action**
Analytical Method	MEC: Analytical methods are not used with analog geophysics. However, trained UXO professionals, engineers, and scientists will review data (historical data and MEC field observations) to determine whether evidence gathered indicates the presence or absence of MEC. This MEC analysis will be subject to an internal review by other qualified personnel who are independent of the field team within TPMC, and by the USACE Baltimore District Design Center (CENAB), USACE North Atlantic Norfolk (CENAO), and USACE Center of Expertise. MC: The methods that can be used for analysis include the following: Polycyclic Aromatic Hydrocarbons (PAHs) Method–8270C, Method 6860 for perchlorate, Explosives Methods–8330A (reduced list), Methods 8330A (mod); Metals Methods–6010B (reduced) and 6020; Perchlorate Method–8312M; PAHs Prep Method - 3540C; Explosives Prep Methods - 8330A, 8330A (mod); Perchlorate Prep Method–8312M;Metals Prep Method – 3050B.	Yes _X_ No ___	

Data Quality Objective Verification Worksheet			
Site: Wallops Flight Facility Project 07			
Project: FUDS MMRP SI Project Number C03VA030107			
DQO Statement Number: 2 of 4			
DQO Element Description	**Site-Specific DQO Statement**	**Attained?**	**Required Corrective Action**
Intended Data Use(s):			
Project Objective(s) Satisfied	Determine the potential need for a Time-Critical Removal Action (TCRA) for MEC and MC by collecting data from previous investigations/reports, conducting site visits, performing analog geophysical activities, and by collecting MC samples.	Yes X No ___	
Data Needs Requirements:			
Data User Perspective(s)	Risk-MEC and MC, Compliance	Yes X No ___	
Contaminant or Characteristic of Interest	MEC or Material Potentially Presenting an Explosive Hazard (MPPEH) and MC	Yes X No ___	
Media of Interest	MEC: Surface and subsurface MC: Surface soil, Subsurface soil, Sediment, Surface Water and Groundwater (media varies per MRS, refer to the SS-WP for more detail)	Yes X No ___	
Required Sampling Locations or Areas	Areas where military munitions-related operations occurred and/or where MEC or MPPEH has been identified historically based on existing documentation and interviews [*See Figure 8 of the SS-WP*].	Yes X No ___	
Number of Samples Required	Refer to DQO 1 for MC/MEC sampling parameters.	Yes X No ___	
Reference Concentration of Interest or Other Performance Criteria	If MC is reported in samples collected at the FUDS at concentrations exceeding screening criteria and those exceedances result in unacceptable risk and an imminent threat to receptors as identified through human health and ecological risk assessments or if one piece of confirmed MEC is found with the magnetometer or if physical evidence indicating the presence of MEC is found during the visual inspection, and if the item(s) is determined by a qualified UXO Technician, explosive ordnance disposal (EOD) unit, and/or the USACE to be an immediate or imminent threat, then one of two actions may be initiated:	Yes X No ___	
	TCRA- If there is a complete pathway between source and receptor and the MEC and the situation is viewed as an "imminent danger threat posed by the release or threat of a release, where cleanup or stabilization actions must be initiated within six months to reduce risk to public health or the environment", TPMC/HFA will immediately notify the Military Munitions Design Center Project Manager at USACE and the property owner. USACE will determine, with input from TPMC/HFA and stakeholders, whether or not a TCRA will be implemented.	Yes X No ___	
	Non-TCRA - A non-TCRA (NTCRA) may be initiated in response to a release or threat of release that poses a risk where more than six months planning time is available.	Yes X No ___	
Appropriate Sampling and Analysis Methods:			
Sampling Method and Depths	MEC: Geophysical methods/procedures are described in detail in Section 3 of the SS-WP and the Field Activities section of the programmatic field sampling plan (PFSP). MC: Sampling methods for MC are described in detail in Section 4 of the SS-WP and Field Activities section of the PFSP.	Yes X No ___	
Analytical Method	Refer to DQO 1 for MEC and MC analytical methods to be incorporated.	Yes X No ___	

Data Quality Objective Verification Worksheet			
Site: Wallops Flight Facility Project 07			
Project: FUDS MMRP SI Project Number C03VA030107			
DQO Statement Number: 3 of 4			
DQO Element Description	**Site-Specific DQO Statement**	**Attained?**	**Required Corrective Action**
Intended Data Use(s):			
Project Objective(s) Satisfied	Collect, or develop, additional data, as appropriate, in support of potential Hazard Ranking System (HRS) scoring by United States Environmental Protection Agency (USEPA).	Yes _X_ No ___	
Data Needs Requirements:			
Data User Perspective(s)	Risk MC, Compliance	Yes _X_ No ___	
Contaminant or Characteristic of Interest	Data for HRS worksheet parameters will be compiled by gathering basic identifying information, general site description, site type, waste description, demographics, water use, sensitive environments, and response actions.	Yes _X_ No ___	
Media of Interest	MEC: Surface and subsurface MC: Surface soil, Subsurface soil, Sediment, Surface Water and Groundwater (media varies per MRS, refer to the SS-WP for more detail)	Yes _X_ No ___	
Required Sampling Locations or Areas	Areas where MEC has been historically found, used, or disposed as documented in interviews or existing documentation.	Yes _X_ No ___	
Number of Samples Required	Refer to DQOs 1and 2.		
Reference Concentration of Interest or Other Performance Criteria	The HRS levels of contamination are Level I (concentrations that meet the criteria for actual contamination and are at or above media-specific benchmark levels), Level II (concentrations that either meet the criteria for actual contamination but are less than media-specific benchmarks, or meet the criteria for actual contamination based on direct observation), and Potential (no observed release is required but targets must be within the target distance limit). These levels are weighted for each target by USEPA (Level I carries the greatest weight) and scores of 28.5 or above are then eligible for listing on the National Priorities List (NPL).	Yes _X_ No ___	
Appropriate Sampling and Analysis Methods:			
Sampling Method and Depths	Methods associated with historic data field reconnaissance and sampling (see DQOs 1 and 2). Refer to NPL Characteristics Data Collection Form, Version 3.0 (USEPA 2001)	Yes _X_ No ___	
Analytical Method	Refer to DQOs 1and 2 for associated methods.		

Data Quality Objective Verification Worksheet			
Site: Wallops Flight Facility Project 07			
Project: FUDS MMRP SI Project Number C03VA030107			
DQO Statement Number: 4 of 4			
DQO Element Description	**Site-Specific DQO Statement**	**Attained?**	**Required Corrective Action**
Intended Data Use(s):			
Project Objective(s) Satisfied	Collect the additional data necessary to the complete the Munitions Response Site Prioritization Protocol (MRSPP).	Yes X No ___	
Data Needs Requirements:			
Data User Perspective(s)	Risk-MEC and MC, Compliance	Yes X No ___	
Contaminant or Characteristic of Interest	Explosive Hazard Evaluation (EHE), Chemical Warfare Matericl Hazard Evaluation (CHE), and Health Hazard Evaluation (HHE). For the EHE and CHE modules, factors evaluated include the details of the hazard, accessibility to the Munitions Response Site (MRS), and receptor information. HHE factors include an evaluation of MC and any non-munitions-related incidental contaminants present, receptor information, and details pertaining to environmental migration pathways. Typical information compiled includes details pertaining to historical use, current/future use and ownership, cultural/ecological resources, and structures.	Yes X No ___	
Media of Interest	MEC: Surface and subsurface MC: Surface soil, Subsurface soil, Sediment, Surface Water and Groundwater (media varies per MRS, refer to the SS-WP for more detail)	Yes X No ___	
Required Sampling Locations or Areas	Areas where MEC has been identified historically and where sampling is recommended.	Yes X No ___	
Number of Samples Required	Refer to DQOs 1 and 2 for related sampling required.		
Reference Concentration of Interest or Other Performance Criteria	An MRS priority is determined by USACE based on integrating the ratings from the EHE, CHE, and HHE modules. Refer to Federal Register/Vol. 70, No. 192/Wednesday, October 5, 2005/Rules and Regulations.	Yes X No ___	
Appropriate Sampling and Analysis Methods:			
Sampling Method and Depths	Data gathering prior to field activities as well as additional data gathered during field reconnaissance and sampling (DoD 2005).	Yes X No ___	
Analytical Method	Refer to DQOs 1and 2 for associated methods.		

APPENDIX C – INTERVIEW DOCUMENTATION

Appendix not used.

APPENDIX D – FIELD NOTES AND FORMS

- Daily Quality Control Reports
- Field Forms
- Logbook
- Chain of Custody

TERRANEARPMC, LLC/HUMAN FACTORS APPLICATIONS, INC.

DAILY QUALITY CONTROL REPORT

Report Number: 12-12-11-01		Date: 12 December 2011
Project Name: Wallops Flight Facility (WFF) Project 07 (C03VA030107)		Contract Number: W912DY-04-D-0017
Location of Work: WFF, Accomack County, Virginia		
Description of Work: Geophysical reconnaissance and sampling		
Weather: Sunny	Rainfall: none	Temperature: Min. 37°F Max. 51°F

1. Work performed today by TerranearPMC, LLC (TPMC)/Human Factors Applications, Inc. (HFA).

The TPMC/HFA field team (Temple Coffindaffer, UXO Technician; Steve Deeter, Sampling Technician; Sarah Moore, Field Team Lead/Sampling Technician) discussed objectives and health and safety concerns related to field work with David King (on-site USACE representative) upon arrival at MRS 7. Theodore J. "TJ" Meyer and Susan Dunn (National Aeronautics and Space Administration [NASA] property owner representatives) participated in a kickoff meeting with the field team at MRS 7 prior to beginning field activities. The field team also briefly met with Rodney Godwin (utilities representative for WFF) to confirm proposed sample locations for MRS 7 were not in vicinity of buried utilities. Changes to the field event were not required as a result of discussions with Mr. Godwin. Photographs were taken throughout the field event. Geophysical reconnaissance and sample collection were conducted as described below. Investigative Derived Waste (IDW) generated during field activities was containerized onsite in a 55-gallon drum and staged at a temporary location provided by NASA. The IDW was removed from WFF Project 07 on 23 February 2012.

Reconnaissance Acreage Discussion:

Geophysical reconnaissance using a Whites XLT was conducted in a meandering path within and near Gun Butts No. 1 and 2 at MRS 7 and for the purpose of clearing each sample location prior to collection. The area of the path covered by the Whites XLT was approximately 29,574 square feet (0.68 acres). Approximately 26 subsurface anomalies, two areas of concentrated subsurface anomalies, and two surface anomalies identified as munitions debris (MD) were detected during reconnaissance. In addition, the UXO Technician identified an intact 20-mm projectile located between Gun Butt No. 1 and Gun Butt No. 2 that possibly contained energetic material; however, the UXO Technician could not confirm this due to the rusty condition of the projectile. Mr. King notified the USACE PM of the item. The field team flagged and collected a GPS coordinate of the location of the item, and recommended to TJ Meyer that NASA contact a response team to remove the item as soon as possible. Although the area is accessible to the public when the Visitor Center is open, it was off season and no visitors were observed for the extent of the field work. NASA personnel arrived later to further mark the location of the item for removal.

Samples Collected:

Six collocated surface and subsurface soil samples and ten surface soil samples were collected within and between Gun Butt No. 1 and Gun Butt No. 2 at MRS 7. The surface soil samples were collected at depths of approximately 2- to 6-inches using disposable plastic trowels. The subsurface soil samples were collected at depths of approximately 12- to 24- inches using decontaminated hand augers. A 55-gallon drum was used to containerize IDW (i.e., excess soil, decontamination fluids) generated during the field activities. Laboratory and field QA/QC samples also were collected.

WFF-MRS7-SS-01-05	WFF-MRS7-SS-01-09	WFF-MRS7-SS-01-16
WFF-MRS7-SB-02-05	WFF-MRS7-SB-02-09	WFF-MRS7-SS-01-17
WFF-MRS7-SS-01-06	WFF-MRS7-SS-01-10	WFF-MRS7-SS-01-18
WFF-MRS7-SB-02-06	WFF-MRS7-SB-02-10	WFF-MRS7-SS-01-19
WFF-MRS7-SS-01-07	WFF-MRS7-SS-01-12	WFF-MRS7-SS-01-20
WFF-MRS7-SB-02-07	WFF-MRS7-SS-01-13	WFF-MRS7-SS-01-21
WFF-MRS7-SS-01-08	WFF-MRS7-SS-01-14	WFF-MRS7-SB-DUP1
WFF-MRS7-SB-02-08	WFF-MRS7-SS-01-15	WFF-MRS7-SS-DUP2

2. Work performed today by Subcontractors.

None.

3. Type and results of Control Phases and Inspection. (Indicate whether Preparatory – P, Initial – I, or Follow-Up – F and include satisfactory work completed or deficiencies with actions to be taken)

Preparatory phase inspections for field work were completed prior to mobilizing to WFF. Initial phase of inspections were completed upon site arrival. No follow-up inspections were completed today. Satisfactory work completed.

4. List type and location of tests performed and results of these tests.

Whites XLT and BHG-1 were checked prior to and throughout the field event and checked satisfactory.

GPS benchmark control point coordinates were collected in the morning and then again after completion of the fieldwork in the afternoon (see below). GPS readings were within one meter of the control point and deemed acceptable.

Benchmark coordinates: Northing 4198731.692 meters (m), Easting 463037.262 m (UTM, Zone 18N, Conus 1983). Benchmark is U.S. Coast and Geodetic Survey marker "QUEE", PID FW0827, located northwest of Chincoteague, approximately 0.1 mile west of bridge over Queen Sound Channel at reverse fork, south of Highway 175, USGS Quad Chincoteague West (1989).

Morning GPS reading: Northing 4198732.630 m, Easting 463037.123 m (UTM, Zone 18N, Conus 1983)

Post event GPS reading: Northing 4198732.531 m, Easting 463037.036 m (UTM, Zone 18N, Conus 1983)

5. List material and equipment received.

Soil and water bottle ware was provided by TestAmerica Laboratory, Arvada, CO. Trimble GeoXH GPS unit (provided by TPMC/HFA) with Zephyr antenna (provided by Eagle Instruments). Other equipment (e.g., sampling supplies) provided by TPMC/HFA. Additionally, a 55-gallon drum for onsite storage of IDW was provided by TPMC/HFA.

6. Submittals reviewed. (Include Transmittal No., Item No., Spec/Plan Reference, by whom, and any action.

None.

7. Off-site surveillance activities, including action taken.

None.

8. Job Safety. (Report safety violations observed and actions taken)

No health and safety issues and/or violations occurred during field work.

9. Remarks. (Instructions received or given. Conflicts in Plans or Specifications)

During the field event, samples were moved slightly to avoid subsurface anomalies. Mr. King provided concurrence in these instances, and the samples were moved accordingly.

A hand-augured well was temporarily installed at the location proposed in the Final SS-WP for groundwater sample WFF-MRS7-GW-00-04; however, sufficient groundwater volume could not be obtained during today's field activities so this sample was not collected today. The field team will return to the location tomorrow to determine if sufficient recharge of the location occurs overnight.

TERRANEARPMC, LLC/HUMAN FACTORS APPLICATIONS, INC.

DAILY QUALITY CONTROL REPORT

TPMC/HFA Verification: On behalf of TPMC/HFA, I certify this report is complete and correct, and materials and equipment used and work performed during this reporting period are in compliance with the contract plans and specifications, to the best of my knowledge, except as noted above.

C. Mitchell

Curtis Mitchell
Quality Control System Manager

DAILY SITE SAFETY JOURNAL
Page 1 of 2

DATE: 12-12-11 | PROJECT: WFF - Project Ø7

Field UXO Technician: TEMPLE CORRINDAMPER

AREA / ITEMS INSPECTED	SAT	UNSAT
Proper work attire (PPE)	✓	
Vehicle condition	✓	
Emergency equipment	✓	
Safe demolition procedures		
Field office, inside		
Field office grounds		

[ ] Last Work Days Events
[X] Site Description
[X] Work Area Description
[X] Work Area Hazards
[X] On-Site Emergency
[X] Site Evacuation Procedures
[X] Emergency Response Personnel
[X] Emergency Telephone Numbers
[ ] Directions to Hospital
[X] First Aid
[X] Heat / Cold Stress
[ ] Asbestos Awareness & ID
[ ] Ticks
[X] Safety Concerns
[X] Personnel Protective Equipment
[X] Safe Work Practices
[ ] Emergency Response Plan
[ ] Chemical Hazards
[X] Emergency Equipment, Location
[X] Emergency Equipment, by Type
[ ] Emergency Decontamination
[X] Safe Work Practices - General
[ ] Site specific OE Safety Precautions
[ ] Site specific OE Identification Features
[ ] Liquid Contaminates / Landfill Material
[ ] Other ____________

Comments:

UXO Technician in Field SIGNATURE: [signature]

DAILY SITE SAFETY JOURNAL
MEETING ATTENDEES
DATE: 12-12-11
Page 2 of 2

	Name	Affiliation
1	TEMPLE CORRINDAFFER	HFA/TPMC
2	SARAH MOORE	TPMC/HFA
3	STEVE DETER	TPMC/HFA
4	DAVID KING	ACOE
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HEALTH AND SAFETY PLAN REVIEW RECORD

SITE: Project 07

TPMC/HFA ~~[illegible]~~ Project No. C03VA030107

I have read the Health and Safety Plan (s) and have been briefed on the nature, level, and degree of exposure likely as a result of participation of field activities. I agree to conform to all the requirements of this Plan.

Name	Signature	Affiliation	Date
Sarah Moore	[signature]	TPMC/HFA	12/12/11
Steve Deeten	[signature]	TPMC	12/12/11
David King	[signature]	USACE	12/12/11
Rodney Brown	[signature]	VT Group	12/12/11
Susan Dunn	[signature]	URS/NASA	12/12/2011
TJ Meyer	[signature]	NASA	12/12/2011
T. Coffinbarger	[signature]	TPMC/HFA	12/12/2011
Steve Deeten	[signature]	TPMC	12/12/11
T. Coffinbarger	[signature]	TPMC/HFA	12/13/11
Sarah Moore	[signature]	TPMC/HFA	12/13/11
David King	[signature]	USACE Baltimore	12/13/2011
T. Coffinbarger	[signature]	TPMC/HFA	12/14/11
David King	[signature]	USACE	12/14/11
S Deeten	[signature]	TPMC	12/14/11
Sarah Moore	[signature]	TPMC	12/14/11

SITE ENTRY AND EXIT LOG

Project/Site: Project Ø7

Project No.: CØ3VAØ3Ø1Ø7

Date	Name	Representing	Time In	Time Out
12/12/11	Sarah Moore	TPMC/HFA	Ø73Ø	1600
12/12/11	T. Corkindaffer	TPMC/HFA	0730	1600
12/12/11	David King	USACE	7:30	1600
12/12/11	[signature]	TPMC	0730	1600
12/13/11	T. Corkindaffer	TPMC/HFA	0730	1630
12/13/11	[signature]	TPMC	0730	1630
12/13/11	Sarah Moore	TPMC/HFA	Ø73Ø	1630
12/13/11	David King	USACE	7:30	1630
12/14/11	T. Corkindaffer	TPMC/HFA	0730	1545
12/14/11	David King	USACE	0730	
12/14/11	[signature]	TPMC	0730	
12/14/11	Sarah Moore	TPMC/HFA	0730	

TERRANEARPMC, LLC/HUMAN FACTORS APPLICATIONS, INC.

DAILY QUALITY CONTROL REPORT

Report Number: 12-13-11-01		Date: 13 December 2011
Project Name: Wallops Flight Facility (WFF) Project 07 (C03VA030107)		Contract Number: W912DY-04-D-0017
Location of Work: WFF, Accomack County, Virginia		
Description of Work: Geophysical reconnaissance and sampling		
Weather: Sunny	Rainfall: none	Temperature: Min. 39°F Max. 52°F

1. Work performed today by TerranearPMC, LLC (TPMC)/Human Factors Applications, Inc. (HFA).

The TPMC/HFA field team (Temple Coffindaffer, UXO Technician; Steve Deeter, Sampling Technician; Sarah Moore, Field Team Lead/Sampling Technician) discussed objectives and health and safety concerns related to field work with David King (on-site USACE representative) upon arrival at the Boat Basin portion of the WFF Project 07. Additionally, the field team discussed objectives and health and safety concerns related to field work with the boat captain, Mr. Mark Baylis of the Marine Science Consortium, prior to beginning field activities that required use of a boat. Photographs were taken throughout the field event. Geophysical reconnaissance and sample collection were conducted as described below. Investigative Derived Waste (IDW) was containerized onsite in a 55-gallon drum during the field activities and staged at a temporary location provided by NASA. The IDW was removed from WFF Project 07 on 23 February 2012.

Reconnaissance Acreage Discussion:

Geophysical reconnaissance using a Whites XLT was conducted in a meandering path at the land portion of the boat basin and for the purpose of clearing each sample location prior to collection. The area of the path covered by the Whites XLT around the land portion of the boat basin was approximately 37,280 square feet (0.86 acres). Approximately five subsurface anomalies and four surface anomalies (munitions debris [MD] and cultural debris) were detected during reconnaissance. Numerous (more than 50) rusty items identified as MD were observed in an area underwater on the bank of the boat basin. In addition, the UXO technician identified three munitions items as intact projectiles (larger than 20 mm) near a tree on the bank of the boat basin; however, the UXO technician could not confirm identification or if these items contained energetic material due to the rusty condition of the three projectiles. Mr. King notified the USACE PM of the items. The property owner, TJ Meyer of NASA, was notified of the items, and the UXO technician recommended that NASA notify a response team to remove the item as soon as possible. A fence that is kept locked is present at the entrance to the Boat Basin; therefore, this area is not open to the public. NASA and the Marine Science Consortium have access; however, the location of the three items is not in an area that would be disturbed when using the boats in the basin.

Additional geophysical reconnaissance was completed from a boat in the water portion of the Boat Basin using a Bore Hole Gradiometer (BHG). Approximately 13,636 square feet (0.31 acres) was covered in the water using the BHG-1. Two anomalies were detected during the water reconnaissance and both were near the dock and entrance to the Boat Basin.

Samples Collected:

One collocated surface and subsurface soil samples and five sediment samples were collected along and in the vicinity of the Boat Basin within MRS 7. Two of the sediment samples (-03 and -05) were collected above the water line and the other three sediment samples were collected below the water line. The surface soil and sediment samples were collected at depths of approximately 2- to 6-inches and 0- to 6-inches, respectively, using disposable plastic trowels. The subsurface soil sample was collected at a depth of approximately 12- to 24- inches using a decontaminated hand auger. The grab method was used to collect a surface water sample from the boat basin. In addition, two groundwater samples were collected from hand-augured temporary wells at the Gun Butts using designated tubing and a peristaltic pump. Laboratory and field QA/QC samples also were collected. A 55-gallon drum was used to containerize IDW (i.e., excess soil, decontamination fluids, purged groundwater) generated during the field activities.

WFF-MRS7-SD-01-01	WFF-MRS7-SD-01-05	WFF-MRS7-SW-DUP1
WFF-MRS7-SD-01-02	WFF-MRS7-SS-01-11	WFF-MRS7-GW-00-03
WFF-MRS7-SD-01-03	WFF-MRS7-SB-02-11	WFF-MRS7-GW-00-04

WFF-MRS7-SD-01-04	WFF-MRS7-SW-00-01	WFF-MRS7-GW-00-DUP1
WFF-MRS7-SD-DUP1		

2. Work performed today by Subcontractors.

Boat transportation to conduct underwater reconnaissance of the Boat Basin was provided by the Marine Science Consortium.

3. Type and results of Control Phases and Inspection. (Indicate whether Preparatory – P, Initial – I, or Follow-Up – F and include satisfactory work completed or deficiencies with actions to be taken)

Preparatory phase inspections for field work were completed prior to mobilizing to WFF. Initial phase of inspections were completed upon site arrival. No follow-up inspections were completed today. Satisfactory work completed.

4. List type and location of tests performed and results of these tests.

Whites XLT and BHG-1 were checked prior to and throughout the field event and checked satisfactory.

GPS benchmark control point coordinates were collected in the morning and then again after completion of the fieldwork in the afternoon (see below). GPS readings were within one meter of the control point and deemed acceptable.

Benchmark coordinates: Northing 4198731.692 meters (m), Easting 463037.262 m (UTM, Zone 18N, Conus 1983). Benchmark is U.S. Coast and Geodetic Survey marker "QUEE", PID FW0827, located northwest of Chincoteague, approximately 0.1 mile west of bridge over Queen Sound Channel at reverse fork, south of Highway 175, USGS Quad Chincoteague West (1989).

Morning GPS reading: Northing 4198732.656 m, Easting 463037.091 m (UTM, Zone 18N, Conus 1983)

Post event GPS reading: Northing 4198732.531 m, Easting 463037.077 m (UTM, Zone 18N, Conus 1983)

5. List material and equipment received.

Soil and water bottle ware was provided by TestAmerica Laboratory, Arvada, CO. Trimble GeoXH GPS unit (provided by TPMC/HFA) with Zephyr antenna (provided by Eagle Instruments). Other equipment (e.g., sampling supplies) provided by TPMC/HFA.

6. Submittals reviewed. (Include Transmittal No., Item No., Spec/Plan Reference, by whom, and any action.

None.

7. Off-site surveillance activities, including action taken.

None.

8. Job Safety. (Report safety violations observed and actions taken)

No health and safety issues and/or violations occurred during field work.

9. Remarks. (Instructions received or given. Conflicts in Plans or Specifications)

The coordinates for the sediment samples provided in the Final SS-WP for the South Bank of Boat Basin were located within the water of the Boat Basin. Mr. King provided concurrence to move the sediment samples south to be located on the South Bank of the Boat Basin, and the samples were moved accordingly.

The field team returned to the proposed location of groundwater sample WFF-MRS7-GW-00-04 noted in the Daily Quality Control Report for 12/12/11. Sufficient recharge of the well had not occurred overnight, so the field team determined that the location proposed in the Final SS-WP was not conducive to transmitting groundwater. Therefore, groundwater sample WFF-MRS7-GW-00-04 was moved slightly south of the former impact area Gun Butt No. 2. Mr. King spoke with CENAB and concurred with this adjustment.

TERRANEARPMC, LLC/HUMAN FACTORS APPLICATIONS, INC.

DAILY QUALITY CONTROL REPORT

TPMC/HFA Verification: On behalf of TPMC/HFA, I certify this report is complete and correct, and materials and equipment used and work performed during this reporting period are in compliance with the contract plans and specifications, to the best of my knowledge, except as noted above.

C Mitchell

Curtis Mitchell
Quality Control System Manager

DAILY SITE SAFETY JOURNAL
Page 1 of 2

DATE: 12-13-11	PROJECT: WFF - Project 07	
Field UXO Technician: TEMPLE COFFINDAFFER		

AREA / ITEMS INSPECTED	SAT	UNSAT
Proper work attire (PPE)	✓	
Vehicle condition	✓	
Emergency equipment	✓	
Safe demolition procedures		
Field office, inside		
Field office grounds		

- [X] Last Work Days Events
- [X] Site Description
- [X] Work Area Description
- [X] Work Area Hazards
- [X] On-Site Emergency
- [X] Site Evacuation Procedures
- [X] Emergency Response Personnel
- [X] Emergency Telephone Numbers
- [ ] Directions to Hospital
- [X] First Aid
- [X] Heat / Cold Stress
- [ ] Asbestos Awareness & ID
- [ ] Ticks
- [X] Safety Concerns
- [X] Personnel Protective Equipment
- [X] Safe Work Practices
- [ ] Emergency Response Plan
- [ ] Chemical Hazards
- [X] Emergency Equipment, Location
- [X] Emergency Equipment, by Type
- [ ] Emergency Decontamination
- [X] Safe Work Practices - General
- [ ] Site specific OE Safety Precautions
- [ ] Site specific OE Identification Features
- [ ] Liquid Contaminates / Landfill Material
- [ ] Other ______

Comments:

UXO Technician in Field SIGNATURE: [signature]

DAILY SITE SAFETY JOURNAL
MEETING ATTENDEES
DATE: 12/13/11
Page 2 of 2

	Name	Affiliation
1	TEMPLE CORRINDAROO	TPMC/HFA
2	SARAH MOORE	TPMC/HFA
3	STEVE DOSTER	TPMC/HFA
4	DAVID KING	ACOE
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WELL PURGING AND SAMPLING RECORD

WELL ID WFF-MRS7-GW-00-03 SAMPLE NO. same as well ID

WELL/SITE DESCRIPTION Temporary well installed to ~10 ft. screened 5-10 ft.
1" PVC screen 0.010 slot

DATE 12 / 13 / 11 TIME 8:10 AIR TEMP. ~38°

WELL DEPTH Not Applicable (N/A) ft CASING HEIGHT N/A ft
WATER DEPTH N/A ft WELL DIAMETER N/A in
WATER COL. HEIGHT N/A ft SANDPACK DIAM. N/A in
EQUIVALENT VOLUME OF STANDING WATER N/A
(gal) (L)
PUMP RATE ~100 mL / per minute (gpm)
(LPM)
PUMP TIME ~55 minutes min
WELL WENT DRY? (Y) Yes (✓) No PUMP TIME N/A min
VOL. REMOVED ~2.5 (gal) (L) RECOVERY TIME min
PURGE AGAIN? (N/A) Yes ( ) No TOTAL VOL. REMOVED (gal) (L)

Date	Time	Volume Removed Unit:	pH	Cond.	Temp.	ORP	Turb.	DO	Depth to Water from TOC	Pump Rate	Sal.	TDS
12/13/11	8:10		5.68	.635	14.43	-69	999	4.73	N/A	100 mL per min.	0	.41
	8:15		5.72	.550	14.16	-67	999	3.37			0	.33
	8:20		5.64	.423	13.99	-59	999	3.18			0	.27
	8:25		5.56	.389	13.96	-54	658	3.26			0	.25
	8:30	~1 gal	5.58	.381	14.02	-57	312	2.96			0	.25
	8:35		5.59	.376	14.12	-56	199	2.91			0	.24
	8:40	~2 gal	5.56	.484	14.37	-55	999	3.08			0	.32
	845		5.65	.553	14.65	-56	999	3.84			0	.36
	852	2 1/2 gal	5.77	.682	15.28	-55	999	4.6			0	.44

Pumped dry

New location

WELL PURGING AND SAMPLING RECORD

WELL ID WFF-MRS7-GW-00-04 SAMPLE NO. same as well ID

2nd Attempt

WELL/SITE DESCRIPTION Temporary well installed to 10 ft
1" PVC Screen 0.010 slot

DATE 12 / 13 / 11 TIME 1240 AIR TEMP.

WELL DEPTH N/A ~10 ft CASING HEIGHT N/A ft
WATER DEPTH ft WELL DIAMETER in
WATER COL. HEIGHT N/A ft SANDPACK DIAM. N/A in
EQUIVALENT VOLUME OF STANDING WATER N/A
(gal) (L)
PUMP RATE ~ 100 mL / per min (gpm)
(LPM)
PUMP TIME ~20 min
WELL WENT DRY? (✓)Yes ( ) No PUMP TIME N/A min
VOL. REMOVED ~ 2 (gal) (L) RECOVERY TIME min
PURGE AGAIN? N/A ( )Yes (✓)No TOTAL VOL. REMOVED (gal) (L)

Date	Time	Volume Removed Unit:	pH	Cond.	Temp.	ORP	Turb.	DO	Depth to Water from TOC	Pump Rate	Sal	TDS
12/13/11	1245		6.26	0.681	15.50	-50	622	2.89	N/A	~100 mL per min	0	.44
	1250		6.21	.674	15.22	-53	999	2.39			0	.43
	1258	DRY										
	1450		6.39	.709	14.88	-51	999	3.94		~100 mL per min	0	.46
	1455		6.37	.749	14.71	-62	999	2.99			0	.48
	1500		6.38	.748	15.00	-66	768	3.39			0	.48
	1505	2gal	6.38	.742	15.08	-65	999	4.06			0	.47

OUT OF RANGE

1510 sample

TERRANEARPMC, LLC/HUMAN FACTORS APPLICATIONS, INC.

DAILY QUALITY CONTROL REPORT

Report Number: 12-14-11-01		Date: 14 December 2011
Project Name: Wallops Flight Facility (WFF) Project 07 (C03VA030107)		Contract Number: W912DY-04-D-0017
Location of Work: WFF, Accomack County, Virginia		
Description of Work: Geophysical reconnaissance and sampling		
Weather: Sunny	Rainfall: none	Temperature: Min. 40°F Max. 55°F

1. Work performed today by TerranearPMC, LLC (TPMC)/Human Factors Applications, Inc. (HFA).

The TPMC/HFA field team (Temple Coffindaffer, UXO Technician; Steve Deeter, Sampling Technician; Sarah Moore, Field Team Lead/Sampling Technician) discussed objectives and health and safety concerns related to field work with David King (on-site USACE representative) upon arrival at the Pyrotechnic Burn Area portion of WFF Project 07. Photographs were taken throughout the field event. Geophysical reconnaissance and sample collection were conducted as described below. Investigative Derived Waste (IDW) was containerized onsite in a 55-gallon drum during the field activities and staged at a temporary location provided by NASA. The IDW was removed from WFF Project 07 on 23 February 2012.

Reconnaissance Acreage Discussion:

Geophysical reconnaissance using a Whites XLT was conducted in a meandering path within and in the vicinity of the Pyrotechnics Burn Area and for the purpose of clearing each sample location prior to collection. The area of the path covered by the Whites XLT was approximately 9,648.9 square feet (0.22 acres). One pile of metal debris was observed, two areas containing numerous subsurface anomalies were identified, and approximately six subsurface anomalies were detected while completing reconnaissance outside of the Pyrotechnics Burn Area fence. The Pyrotechnics Burn Area within the fence was so heavily concentrated with subsurface anomalies that individual anomalies could not be demarcated and counted. A burn pile of approximately three munitions items, which the UXO technician identified as pyrotechnic or illumination flares, was observed within the fence. Due to the condition of these items, the UXO technician could not confirm that energetic material remained. Mr. King notified the USACE PM of the items. The property owner, TJ Meyer of NASA, was notified of the items, and the UXO technician recommended that NASA notify the response team to remove these items and the other items found during the past two days of field work as soon as possible. The Pyrotechnics Burn Area is not in an area that would be readily accessible to the public.

Samples Collected:

Four collocated surface and subsurface soil samples were collected from outside the fence corners of the Pyrotechnics Burn Area. Additionally, two groundwater samples were collected from hand-augured wells using designated tubing and a peristaltic pump. Surface samples were collected at depths of approximately 2- to 6-inches using disposable plastic trowels and the subsurface soil samples were collected at depths of approximately 12- to 24-inches using decontaminated hand auger. Laboratory and field QA/QC samples also were collected. A 55-gallon drum was used to containerize IDW (i.e., excess soil, decontamination fluids, purged groundwater) generated during the field activities. In addition, three background sediment samples were collected at 0- to 6-inch depth with disposable plastic trowels.

WFF-MRS7-SS-01-01	WFF-MRS7-SB-02-03	WFF-MRS7-GW-DUP2
WFF-MRS7-SB-02-01	WFF-MRS7-SS-01-04	WFF-MRS7-SS-DUP3
WFF-MRS7-SS-01-02	WFF-MRS7-SB-02-04	WFF-MBBG-SD-00-01
WFF-MRS7-SB-02-02	WFF-MRS7-GW-00-01	WFF-MBBG-SD-00-02
WFF-MRS7-SS-01-03	WFF-MRS7-GW-00-02	WFF-MBBG-SD-00-03
WFF-MRS7-EB1		

2. Work performed today by Subcontractors.

None.

3. Type and results of Control Phases and Inspection. (Indicate whether Preparatory – P, Initial – I, or Follow-Up – F and include satisfactory work completed or deficiencies with actions to be taken)

Preparatory phase inspections for field work were completed prior to mobilizing to WFF. Initial phase of inspections were completed upon site arrival. No follow-up inspections were completed today. Satisfactory work completed.

4. List type and location of tests performed and results of these tests.

Whites XLT and BHG-1 were checked prior to and throughout the field event and checked satisfactory..

GPS benchmark control point coordinates were collected in the morning and then again after completion of the fieldwork in the afternoon (see below). GPS readings were within one meter of the control point and deemed acceptable.

Benchmark coordinates: Northing 4198731.692 meters (m), Easting 463037.262 m (UTM, Zone 18N, Conus 1983). Benchmark is U.S. Coast and Geodetic Survey marker "QUEE", PID FW0827, located northwest of Chincoteague, approximately 0.1 mile west of bridge over Queen Sound Channel at reverse fork, south of Highway 175, USGS Quad Chincoteague West (1989).

Morning GPS reading: Northing 4198732.739 m, Easting 463036.900 m (UTM, Zone 18N, Conus 1983)

Post event GPS reading: Northing 4198732.595 m, Easting 463037.067 m (UTM, Zone 18N, Conus 1983)

5. List material and equipment received.

Soil and water bottle ware was provided by TestAmerica Laboratory, Arvada, CO. Trimble GeoXH GPS unit (provided by TPMC/HFA) with Zephyr antenna (provided by Eagle Instruments). Other equipment (e.g., sampling supplies) provided by TPMC/HFA.

6. Submittals reviewed. (Include Transmittal No., Item No., Spec/Plan Reference, by whom, and any action.

None.

7. Off-site surveillance activities, including action taken.

None.

8. Job Safety. (Report safety violations observed and actions taken)

No health and safety issues and/or violations occurred during field work.

9. Remarks. (Instructions received or given. Conflicts in Plans or Specifications)

The Pyrotechnics Burn Area portion of MRS 7 was found to be incorrectly positioned in the USACE-provided Geographic Information Systems (GIS) used for the Final SS-WP. The correct location, as confirmed by visual evidence of burning contained within a deteriorated fence matching the description of the area cited in historical documents, was observed to be near the southwestern corner of the Pyrotechnic Burn Area shown in the Final SS-WP. GPS coordinates were collected at each corner of the fence. The fenced area was observed to be approximately 500 square feet (20 feet by 25 feet).

Mr. King verified with CENAB that the proposed samples for the Pyrotechnic Burn Area should be collected within the fenced area observed during field activities. However, due to a dense concentration of subsurface anomalies within the fenced area, the UXO Technician could not locate sample areas that were free of anomalies. Therefore, Mr. King verified with CENAB that samples should be collected just outside the fence where anomaly clearance could be obtained.

TERRANEARPMC, LLC/HUMAN FACTORS APPLICATIONS, INC.

DAILY QUALITY CONTROL REPORT

TPMC/HFA Verification: On behalf of TPMC/HFA, I certify this report is complete and correct, and materials and equipment used and work performed during this reporting period are in compliance with the contract plans and specifications, to the best of my knowledge, except as noted above.

C. Mitchell

Curtis Mitchell
Quality Control System Manager

DAILY SITE SAFETY JOURNAL
Page 1 of 2

DATE: 12-14-11	PROJECT:	
Field UXO Technician: TEMPLE COFFIN DAFFOX		
AREA / ITEMS INSPECTED	**SAT**	**UNSAT**
Proper work attire (PPE)	✓	
Vehicle condition	✓	
Emergency equipment	✓	
Safe demolition procedures		
Field office, inside		
Field office grounds		

- [X] Last Work Days Events
- [X] Site Description
- [X] Work Area Description
- [X] Work Area Hazards
- [X] On-Site Emergency
- [X] Site Evacuation Procedures
- [X] Emergency Response Personnel
- [ ] Emergency Telephone Numbers
- [ ] Directions to Hospital
- [X] First Aid
- [X] Heat / Cold Stress
- [ ] Asbestos Awareness & ID
- [ ] Ticks
- [X] Safety Concerns
- [X] Personnel Protective Equipment
- [X] Safe Work Practices
- [ ] Emergency Response Plan
- [ ] Chemical Hazards
- [X] Emergency Equipment, Location
- [X] Emergency Equipment, by Type
- [ ] Emergency Decontamination
- [X] Safe Work Practices - General
- [ ] Site specific OE Safety Precautions
- [ ] Site specific OE Identification Features
- [ ] Liquid Contaminates / Landfill Material
- [ ] Other ____________

Comments:

UXO Technician in Field SIGNATURE: [signature]

DAILY SITE SAFETY JOURNAL
MEETING ATTENDEES
DATE: 12-14-11
Page 2 of 2

	Name	Affiliation
1	TEMPLE CORRINDAFFER	TPMC / HFA
2	SARAH MOORE	TPMC / HFA
3	STEVE DOBTER	TPMC / HFA
4	DAVID KING	ACOE
5		
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WELL PURGING AND SAMPLING RECORD

WELL ID WFF-MRS7-GW-00-01 SAMPLE NO. Same as well I.D

WELL/SITE DESCRIPTION Temporary Well

DATE 12 / 14 / 11 TIME 1130 AIR TEMP. ______

WELL DEPTH ~5 ft 10 slot ft CASING HEIGHT N/A ft
WATER DEPTH N/A ft WELL DIAMETER / in
WATER COL. HEIGHT N/A ft SANDPACK DIAM. N/A in
EQUIVALENT VOLUME OF STANDING WATER ______ (gal) (L)
PUMP RATE ~125 mL per minute (gpm) (LPM)
PUMP TIME ~40 minutes min
WELL WENT DRY? ( ) Yes (✓) No PUMP TIME N/A min
VOL. REMOVED ~3 (gal) (L) RECOVERY TIME ______ min
PURGE AGAIN? N/A ( )Yes (✓) No TOTAL VOL. REMOVED ______ (gal) (L)

Sample 1210

Date	Time	Volume Removed Unit:	pH	Cond.	Temp.	ORP	Turb.	DO	Depth to Water from TOC	Pump Rate	Sal	TDS
12/14/11	1135	~.5 gal	6.49	50.1	9.94	-348	397	2.80	N/A	125 mL per min	3.2	30
	1140		6.41	50.0	9.62	-349	158	2.48			3.2	30
	1145	~1 gal	6.38	49.6	9.58	-351	72.8	2.40			3.2	30
	1150		6.36	49.2	9.57	-351	51.2	2.38			3.1	30
	1155	~2 gal	6.36	48.9	9.51	-350	53.4	2.40			3.1	30
	1200		6.36	48.8	9.43	-350	45.8	2.41			3.1	30
	1205	~3 gal	6.35	48.7	9.41	-348	35.8	2.42			3.1	30

WELL PURGING AND SAMPLING RECORD

WELL ID WFF-MRS7-GW-00-02 SAMPLE NO. Same as well I.D.

WELL/SITE DESCRIPTION Temporary well installed to ~5ft
1" PVC screen 0.010 slot (10 slot screen)

DATE 12/14/11 TIME 1039 AIR TEMP. ______

6 inch vegetation loose sand

WELL DEPTH ~5 feet ft CASING HEIGHT Not Applicable (N/A) ft
WATER DEPTH N/A ft WELL DIAMETER N/A in
WATER COL. HEIGHT N/A ft SANDPACK DIAM. N/A in
EQUIVALENT VOLUME OF STANDING WATER N/A (gal) (L)
PUMP RATE ~125 mL per minute (gpm) (LPM)
PUMP TIME ~30 minutes min
WELL WENT DRY? ( ) Yes (✓) No PUMP TIME N/A min
VOL. REMOVED ~3 (gal) (L) RECOVERY TIME min
PURGE AGAIN? N/A ( )Yes (✓) No TOTAL VOL. REMOVED (gal) (L)

Date	Time	Volume Removed Unit:	pH	Cond.	Temp.	ORP	Turb.	DO	Depth to Water from TOC	Pump Rate	Sal	TDS
12/14/11	1041		6.27	48.8	9.25	-303	601	3.93	125 mL per min	←	3.1	30
	1046	~1 gal	6.38	51.3	8.67	-319	36.7	3.02	" "	←	3.3	31
	1052	~1.5 gal	6.44	56.6	8.90	-331	14.1	3.15	100 mL per min	←	3.3	31
	1058		6.41	51.9	8.82	-338	11.4	2.55	↓	←	3.3	31
	1103	~2.5 gal	6.42	51.9	8.82	-345	10.2	2.36	↓	←	3.3	31
	1108	~3 gal	6.42	51.5	8.75	-350	11.3	2.31	↓	←	3.3	31

1047 well started to run dry, slow pump 100 mL per minute

1115 Collect Sample

Wallops Flight Facility
Project Ø7
Project # CØ3VAØ3Ø1Ø7
Contract # W912DY-Ø4-ØØ17
Delivery Order # ØØ17ØØØ1

Name. Jeff Case
Terranear PMC, LLC
Address 222 Valley Creek Blvd.
Suite 210 Exton, PA. 19341
Phone. 610 862 5064

This book is published on a fine 50% cotton-content ledger paper, specially treated for maximum archival service, and protected by a water resistant surface sizing.

Projects Wallops Flight Facility
Project 87

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Meredith, N.H. 03253

Projects (continued)

Signature Page

3

Print	Sign	Initials
Sarah Moore	[illegible]	S
TEMPLE COFFINDAFFER	[illegible]	[illegible]

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757.894.4048(c)

Marine Science Consortium:

757.824.5636 Anne, Ali, Cindy

Table of Contents:

e

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WEATHER: Sunny, high low 50's
clear, windy

Ø73Ø Meet NASA at gate of Visitor Center. Security ~~takes our~~ reviews identification and opens gate. TJ Meyer, Susan Dunn, (NASA), David King (USACE)

Ø8ØØ H & S briefing with
Steve Deeter (TPMC)
Temple Coffindaffer (TPMC UXO)
Sarah Moore (TPMC tech)
David King (USACE)
Susan Dunn (NASA)
T.J Meyer (NASA)
Rodney Godwin (NASA, utilities)

Ø815 Rodney discusses utility lines (underground) & shows the markings for the test cell areas.

* A grounding grid may interfer with clearing GunButt No. 1 impact area sample locations. Since lines are throughout & marked at ~~a~~ surface.

* Note: During discussion of tower installation, MD was observed →

flagged. Temple indicated ~~that~~ the rusting of MD makes it difficult to confirm that it isn't ~~[illegible]~~ an HE round. Temple told TJ that he recommended NASA's H&S remove this item immediately.

0915 Set up for field work. Go to benchmark &

0940 Collect benchmark.

N. 4198731.692(m) E. 463037.262 m

UTM 18N CONUS 1983. ~~[illegible]~~

~~1000~~ "QUEE", PID FW 0827

0955 Start walking Gun Butt 2 conducting QR and marking sample locations. The area just into test cell is saturated with subsurface anomalies. Start identifying areas instead of points? Several potential MD identified at surface in the vicinity of tower. Cultural debris observed (aluminum can etc.) aluminum can

Surface Anomalies:

Description of Field Observations	Northing (m)	Easting (m)
munitions item (20mm intact)	4198981.912	459876.690
MD	4198985.173	459874.800
MD	4198982.472	459884.713
3 munitions items (larger than 20mm)	4199205.002	460019.827
MD	4198984.821	459935.183
Marston matting	4199250.678	460078.139
Burn pile with burnt pyrotechnics	4199132.656	460106.078

SAMPLE I.D. Collected	Time
WPF-MBS7-SS-01-05	1425
SB-02-05	1430
SS-01-06	1445
SB-02-06	1450
SS-01-07	1435
SB-02-07	1438
SS-01-08	1245
SB-02-08	1250
SS-01-09	1300
SB-02-09	1305
SS-01-10	1310
SB-02-10	1318
SS-01-12	1455
SS-01 13	1500
SS-01 14	1505
SS-01 15	1200
SS-01 16	1208
SS-01 17	1150

1150 Collect WFF-MRS7-SS-Ø1-17
at approximate location
of former firing point
Soil is silty clay fine sand
for ~~Sample~~ collected for TNT, DNT
DNT & TNT breakdown, NG, RDX, Tetryl & select metals
12ØØ WFF-MRS7-SS-Ø1-15
collected for select explosives &
metals
12Ø8 Collect WFF-MRS7-SS-Ø1-16
at Gun Butt No. 2
1215 Collect WFF-MRS7-SS-Ø1-Ø8
122Ø Decon soil augers for
subsurface sampling
125Ø Collect WFF-MRS7-SB-Ø2-Ø8
13ØØ Collect WFF-MRS7-SS-Ø1-Ø9
13Ø5 Collect WFF-MRS7-SB-Ø2-Ø9
131Ø Collect WFF-MRS7-SS-Ø1-1Ø
and Matrix Spike (MS)/MS Duplicate
1318 Collect WFF-MRS7-SB-Ø2-1Ø
133Ø Attempt to collect
WFF-MRS7-GW-ØØ-Ø4
found water sample at approx. 3ft

$\boxed{\text{* Subsurface soil sample depths were between 18"-24"}}$

[signature]

Although water was found at
approximately 3 feet from
WFF-MRS7-GW-ØØ-Ø4, the
formation does not appear to
be conducive for producing
water. Leave for well to
recharge. Decon equipment. (135Ø)
1425 Collect WFF-MRS7-SSØ1-Ø5
143Ø Collect WFF-MRS7-SB-Ø2-Ø5
and DUPLICATE (1435)
1445 Collect WFF-MRS7-SS-Ø1-Ø6
145Ø Collect WFF-MRS7-SB-Ø2-Ø6
1435 Collect WFF-MRS7-SS-Ø1-Ø7
1438 Collect WFF-MRS7-SB-Ø2-Ø7
1455 Collect WFF-MRS7-SS-Ø1-12
15ØØ Collect WFF-MRS7-SS-Ø1-13
15Ø5 Collect WFF-MRS7-SS-Ø1-14
from approximate former
firing point at Gun Butt No. 1
Put temporary well in at
WFF-MRS7-GW-ØØ-Ø3
Simillar formation as Ø4
location. Approximately
1Ø feet.

[signature]

(12)

12/12/11

1525 Collect WFF-MRS7-SS-Ø1-20
plus duplicate
1535 Collect WFF-MRS7-SS-Ø1-19
154Ø Collect WFF-MRS7-SS-Ø1-21
1558 Collect WFF-MRS7-SS-Ø1-18
* Note: Four sample locations between Gun Butt No. 1 and 2 were surface soil, not sediment. Discuss with David King talking to USACE regarding moving one bkgd sediment to be in similar background sediment as the sediment that we will find at Boat basin.
161Ø Return to vehicles. Decon equipment and pack up for day.
165Ø Leave site for day.

12/13/11

(13)

WEATHER: Windy, partly cloudy
H: low 5Ø's, mid-upper 3Ø's low
Ø73Ø Meet at Visitor Center / Boat Basin. Temple Coffindaffer gives health and safety meeting.
Ø75Ø Set up and purge temporary well at WFF-MRS7-GW-ØØ-Ø4
Well purges dry quickly.
Ø8Ø5 Set up at WFF-MRS7GWØØØ3
Purge and collect water quality measurements.
Ø855 Well is dry. Mobilize to Boat Basin to complete QR & sample collection and allow well to recharge.
1135 Collect WFF-MRS7 GW-00-03
* see page 15 for sample information from Boat Basin.
*see pg. 17 for well info
Numerous metal debris observed on South bank including MD. Identify an area during sampling to return during low tide for further access/inspection.

(14)

12/13/11

Collect Sample WFF-MRS7-SD-Ø1-Ø1, Ø2 & Ø4 below water line. Wait to collect Ø3 and Ø5 until low tide So that the shore is accessible.

1250 Meet Marine Science Consortium representatives to conduct analog geophics in boat basin waters from boat. Two spikes on BHG-1 at start. No other detections with BHG-1. in Boat Basin water.

1355 Return to dock & unload equipment.

→ Ali Redman and boat captain Mark Baylis.

1420 Collect WFF-MRS7-SD-Ø1-Ø3

1425 Collect WFF=MRS7-SD-Ø1-Ø5

Both Ø3 & Ø5 samples collected along shore above current water line (tide is lower than when samples where collected this morning) Return to Gun Butts to collect Groundwater.

(15)

SAMPLE I.D.	Date / Time		location	Notes:
WFF-MRS7-SD-Ø1-Ø1	12/13/11	939	Boat Basin	DUP #3 Below H2O line
WFF-MRS7-SD-Ø1-Ø2		1Ø35		
WFF-MRS7-SD-Ø1-Ø3		142Ø		Along shore (low tide)
WFF-MRS7-SD-Ø1-Ø4		955		Below H2O line
WFF-MRS7-SD-Ø1-Ø5		1425		Along shore (Low tide)
WFF-MRS7-SS-Ø1-11		1ØØ5		
WFF-MRS7-SO-Ø2-11		1Ø1Ø		
WFF-MRS7-SW-ØØ-Ø1		1Ø2Ø		MS/MSD & Dup Ø1
WFF-MRS7-GW-ØØ-Ø3		1135	Gun Butt No. 1	MS/MSD & DUP Ø1
WFF-MRS7-GW-ØØ-Ø4		151Ø	Gun Butt No. 2	

(16)

NFF-MRS7-GW-00-03 collected
*1135 ~~Collected MRS7~~ 12/13/11 so move
to new approved location
for WFF-MRS7-GW-00-04.
1510 Collect WFF-MRS7-GW-00-04
(see pg. 18 for purge info.)
1550 Put samples on ice &
decon equipment
1630 Leave site for day

12/13/11

(17)

12/13/2011

12/13/11 PURGE INFORMATION FOR WFF-MRS7-GW-00-03

Time	pH	Conductivity	Temp.	ORP	Turb.	D.O	Salinity	TDS	Pump rate	Volume removed
8:10	5.68	.635	14.43	-69	999	4.73	0	.41	100 mL/min	~100 mL/min
8:15	5.72	.550	14.16	-67	999	3.37	0	.33		
8:20	5.64	.423	13.99	-59	999	3.18		.27		
8:25	5.56	.389	13.96	-54	658	3.26		.25		
8:30	5.58	.381	14.02	-57	312	2.96		.25		~1 gallon
8:35	5.59	.376	14.12	-56	199	2.91		.24		
8:40	5.56	.484	14.37	-55	999	3.08		.32		~2 gallon
8:45	5.65	.553	14.65	-56	999	3.84		.36		
8:52	5.77	.682	15.28	-55	999	4.6		.44		~2.5 gallon

PUMPED DRY

Sample Time: 11:35
Pump Time: ~55 minutes

PURGE INFORMATION FOR WFF-MRS7-ØØ-Ø4 12/13/11 (18)

Time	PH	Conductivity	Temp.	ORP	Turb.	D.O.	Salinity	TDS	Pump rate	Volume removed
1249	6.26	Ø.681	15.5Ø	-58	622	2.89	Ø	.44	~100mL per min	
1250	6.21	Ø.674	15.22	-53	999	2.39	Ø	.49		
1258	DRY						Ø			
145Ø	6.39	Ø.709	14.88	-51	999	3.94	Ø	.46		
1455	6.37	Ø.749	14.71	-62	999	2.99	Ø	.48		
15ØØ	6.38	Ø.748	15.ØØ	768	-66	3.39	Ø	.48		
15Ø3	6.38	Ø.742	15.Ø8	-65	999	4.06	Ø	.47		~2gallon
151Ø	Collect Sample.									

12/14/11 (19)

WEATHER: Sunny H: mid 5Ø's L: 4Ø

Ø73Ø Arrive at gate of NASA Visitor Information Center.

Ø745 Call NASA to ~~notify~~ request access to WFF Project Ø7 PBA

Ø8ØØ Guard arrives to open gate. Set up to mobilize to the Pyrotechnics Burn Area. Temple Coffindaffer completes Health and Safety meeting for:
Steve Deeter (TPMC)
Sarah Moore (TPMC)
David King (USACE)

Ø835 Conduct qualitative reconnaissance at Pyrotechnics Burn Area. The fenced area is not correct in GIS used for SSWP. The correct location of the fenced ~20x25ft. Pyrotechnics Burn Area was confirmed visually and the fence corners (GPS'd) recorded in GIS.

Ø93Ø Collect Equipment Blank see pg. 25

Jlh

 12/14/11

Request to move samples within ~~fens~~ correct fenced Pyrotechnics Burn Area location. Mr. King (USACE) provides concurrance after confirming w/ CENAB.

Start at eastern corner, just outside fence since inside fence can not be cleared. Subsurface anomalies throughout the area inside fence. UXO Tech clears an area just outside fence.

1030 Set up for sample collection. (see page #21 for sample information)

1110 See page #22 for groundwater purge information at WFF-MRS7-GW-00-02

See page #23 for groundwater purge information at WFF-MRS7-GW-00-01

The only items observed where within the fenced area in a burn pile (~ 3 pyrotechnic items)

continued on page 24

12/14/11

Sample I.D.	Date	Time	Notes
WFF-MRS7-SS-01-01	12/14/11	1220	+ PAHs, Dup #3 (1225 time)
WFF-MRS7-SB-02-01		1235	
WFF-MRS7-SS-01-02		1320	
WFF-MRS7-SB-02-02		1325	
WFF-MRS7-SS-01-03		1245	ms/msd
WFF-MRS7-SB-02-03		1255	
WFF-MRS7-SS-01-04		1305	
WFF-MRS7-SB-02-04		1310	
WFF-MRS7-GW-00-01		1210	see pg #23
WFF-MRS7-GW-00-02		1115	GW Dup #2 (1120) see pg #22

12/14/11

(22)

WFF-MRS7-GW-ØØ-Ø2

12/14/11

Time	pH	Cond.	Temp.	ORP	Turb.	D.O.	Sal.	TDS	Pump rate	Volume removed
10:41	6.27	48.8	9.25	-3Ø3	6Ø1	3.93	3.1	30	125 mL per min	—
1Ø:46	6.38	51.3	8.67	-319	36.7	3.Ø2	3.3	31	↓	~1 gallon
1Ø:52	6.44	51.6	8.9Ø	-331	14.1	3.15	3.3	31	1ØØ mL per min	~1.5 gal
1Ø58	6.41	51.9	8.82	-338	11.4	2.55	↓	31	↓	~2 gal
11Ø3	6.42	51.9	8.82	-345	10.2	2.36	↓	31	↓	~2.5 gal
11Ø8	6.42	51.5	8.75	-35Ø	11.3	2.31	↓	31	↓	~3 gallon

1Ø:47 - well started to run dry, slowed pump to ~ 100mL per minute

1115 Collected sample

12/14/11

12/14/11 WFF-MRS7-GW-ØØ-Ø1 pumprate ~125 mL per minute

Time	pH	Cond.	Temp.	ORP	Turb.	DO	Sal	TDS	~Volume Removed
1135	6.49	5Ø.1	9.94	-348	397	2.8Ø	3.2	3Ø	~.5 gallon
114Ø	6.41	5Ø.Ø	9.62	-349	158	2.48	↓	↓	~.75 gal
1145	6.38	49.6	9.58	-351	72.8	2.4Ø	↓	↓	~1 gallon
115Ø	6.36	49.2	9.57	-351	51.2	2.38	3.1	↓	~1.5 gal
1155	↓	48.9	9.51	-35Ø	53.4	2.4Ø	↓	↓	~2 gallon
12ØØ	↓	48.8	9.43	-35Ø	45.8	2.41	↓	↓	~2.5 gallon
12Ø5	6.35	48.7	9.41	-348	35.8	2.42	↓	↓	~3 gallon

Collect Sample @ 121Ø

12/14/11 (23)

(24) 12/14/11

continued from pg. 20.
Although the only items observed were within the pyrotechics burn area, what appeared to be a burn area was observed at the northern fence line outside pyrotechnics burn area.
~Burn debris center coordinates:
N 4199132.66 E 460106.078
1330 Complete sampling. Pack up equipment and take back to vehicles at dock. Put samples on ice. Return to Visitor Information Center to decon equipment.
Walk T.J. Meyer (NASA) and Susan Dunn through Boat Basin and Pyrotechics Burn Area so Temple can show items observed during SI for removal. Discuss background sediment locations with T.J. and pack up to collect three background sediment samples.
1545 leave for day

GIS Information 12/14/11 (25)

Fence corners (Pyrotechics Burn Area):

1)	N 4199134.074	E 460109.983
2)	4199131.216	460104.376
3)	4199137.465	460100.867
4)	4199140.781	460105.867

Metal debris pile (~4ft. diameter)
N 4199147.116 E. 460103.561
← Burn debris center (outside fence)

BACKGROUNG SEDIMENT SAMPLES:

WFF-MBBG-SD-01	Time 1510
WFF-MBBG-SD-02	1528
WFF-MBBG-SD 03	1500

collected in similar sediment as sediment on south bank of Boat Basin.

Chain of Custody Record

Sampler ID ______

Temperature on Receipt ______

Drinking Water? Yes ☐ No ☑

TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

~~[illegible]~~ GUN BUTTS

TAL-4124-280 (0508)

Client	Project Manager	Date	Chain of Custody Number
TPMC/HTA	Sarah Moore	12/15/11	149469

Address	Telephone Number (Area Code)/Fax Number	Lab Number	Page
500 Herndon Parkway Suite 120	703-437-7655		Page 1 of 3

City	State	Zip Code	Site Contact	Lab Contact
Herndon	VA	20170	Sarah Moore	Elaine Walker

Project Name and Location (State)	Carrier/Waybill Number
Wallops Flight Facility Project 07	

Contract/Purchase Order/Quote No.: C03VA03017 MRP PDS SI

Analysis (Attach list if more space is needed): 8330 DNT* ; NS RDX Tol ; ~~6010C-[illegible]~~ ; 6020A-Pb,Cu ; SL Pb NTO

Sample I.D. No. and Description (Containers for each sample may be combined on one line)	Date	Time	Air	Aqueous	Sed.	Soil	Unpres.	H2SO4	HNO3	HCl	NaOH	ZnAc/NaOH	8330 DNT*	NS RDX Tol	~~6010C~~	6020A-Pb,Cu	SL Pb NTO	Special Instructions/ Conditions of Receipt
WFF-MRS7-SS-01-05	12/12/11	1425				2							X	X	~~X~~	X	X	After samples were shipped, TPMC directed TestAmerica to revise some of the requested analyses. Refer to the note and table following these chains of custody.
WFF-MRS7-SB-02-05	12/12/11	1430				2							X	X	~~X~~	X	X	
WFF-MRS7-SS-01-06	↓	1445				2							X	X	~~X~~	X	X	
WFF-MRS7-SB-02-06		1450				2							X	X	~~X~~	X	X	
WFF-MRS7-SS-01-07		1435				2							X	X	~~X~~	X	X	
WFF-MRS7-SB-02-07		1438				2							X	X	~~X~~	X	X	
WFF-MRS7-SS-01-08		1215				2							X	X	~~X~~	X	X	
WFF-MRS7-SB-02-08		1250				2							X	X	~~X~~	X	X	
WFF-MRS7-SS-01-09		1300				2							X	X	~~X~~	X	X	
WFF-MRS7-SB-02-09		1305				2							X	X	~~X~~	X	X	
WFF-MRS7-SS-01-10		1310				6							X	X	~~X~~	X	X	ms/msd
WFF-MRS7-SB-02-10	↓	1318				2							X	X	~~X~~	X	X	

Possible Hazard Identification: ☐ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☐ Unknown

Sample Disposal: ☐ Return To Client ☐ Disposal By Lab ☐ Archive For ____ Months (A fee may be assessed if samples are retained longer than 1 month)

Turn Around Time Required: ☐ 24 Hours ☐ 48 Hours ☐ 7 Days ☐ 14 Days ☐ 21 Days ☐ Other Standard

QC Requirements (Specify)

1. Relinquished By	Date	Time	1. Received By	Date	Time
[signature]	12/15/11	1300	FedEx	12/15/11	1300
2. Relinquished By	Date	Time	2. Received By	Date	Time
3. Relinquished By	Date	Time	3. Received By	Date	Time

Comments: *TNT breakdown products – 2-Amino-4,6-DNT; 4-Amino-2,6-DNT; Nitrobenzene; 2,6-DNT; 1,3,5-TNB
DNT breakdown products – 2,4-DNT; 2-Amino-4,6-DNT; 2-Nitrotoluene; 3-NT; 4-NT; 2,6-DNT, 4-Amino-2,6-DNT

DISTRIBUTION: WHITE - Returned to Client with Report; CANARY - Stays with the Sample; PINK - Field Copy

[redacted]

Chain of Custody Record

TAL-4124-280 (0508)

Sampler ID ______

Temperature on Receipt ______

Drinking Water? Yes ☐ No ☑

TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

Client: TPMC/HFA	Project Manager: Sarah Moore	Date: 12/15/11	Chain of Custody Number: 149471
Address: 500 Herndon Parkway	Telephone Number (Area Code)/Fax Number: 703-437-1685	Lab Number	Page 2 of 3
City: Herndon / State: VA / Zip Code	Site Contact: Sarah Moore / Lab Contact: Elaine Walker		
Project Name and Location (State): Wallops Flight Facility-Project 07	Carrier/Waybill Number		
Contract/Purchase Order/Quote No.: CP3VA030107 MMRP FUDS SI			

Sample I.D. No. and Description (Containers for each sample may be combined on one line)	Date	Time	Matrix: Air	Aqueous	Sed.	Soil		Containers & Preservatives: Unpres.	H2SO4	HNO3	HCl	NaOH	ZnAc/NaOH	Analysis: 8330 INT	Ng, Dox, [illegible]	6010-[illegible]	6020 [illegible]	Sb, Pb, N, Zn	Special Instructions/ Conditions of Receipt
WFF-MRS7-SS-01-12	12/12/11	1455				2								X	X	X	X	X	After samples were shipped, TPMC directed TestAmerica to revise some of the requested analyses. Refer to the note and table following these chains of custody.
WFF-MRS7-SS-01-13		1500				2								X	X	X	X	X	
WFF-MRS7-SS-01-14		1505				2								X	X	X	X	X	
WFF-MRS7-SS-01-15		1200				2								X	X	X	X	X	
WFF-MRS7-SS-01-16		1208				2								X	X	X	X	X	
WFF-MRS7-SS-01-17		1150				2								X	X	X	X	X	
WFF-MRS7-SS-01-18		1558				2								X	X	X	X	X	
WFF-MRS7-SS-01-19		1535				2								X	X	X	X	X	
WFF-MRS7-SS-01-20		1525				2								X	X	X	X	X	
WFF-MRS7-SS-01-21		1540				6								X	X	X	X	X	ms/msd
~~WFF-MRS7-SS-DUP1~~		~~1435~~				~~2~~								~~X~~	~~X~~	~~X~~	~~X~~	~~X~~	
WFF-MRS7-SS-DUP2	↓	1530				2								X	X	X	X	X	

SS 12/19/11 see page 3

SS 12/19/11

Possible Hazard Identification: ☐ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☐ Unknown

Sample Disposal: ☐ Return To Client ☐ Disposal By Lab ☐ Archive For ______ Months (A fee may be assessed if samples are retained longer than 1 month)

Turn Around Time Required: ☐ 24 Hours ☐ 48 Hours ☐ 7 Days ☐ 14 Days ☐ 21 Days ☐ Other Std

QC Requirements (Specify)

1. Relinquished By: [signature]	Date: 12/15/11	Time: 1300	1. Received By: FedEx	Date: 1300	Time: 12/15/11
2. Relinquished By	Date	Time	2. Received By	Date	Time
3. Relinquished By	Date	Time	3. Received By	Date	Time

Comments: See page 1 for TNT & DNT Breakdown products

DISTRIBUTION: WHITE - Returned to Client with Report; CANARY - Stays with the Sample; PINK - Field Copy

Sampler ID

Temperature on Receipt

Drinking Water? Yes ☐ No ☐

Chain of Custody Record

TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

TAL-4124-280 (0508)

Client: See pg 1	Project Manager: See pg 1	Date: 12/15/11
Address: See pg 1	Telephone Number (Area Code)/Fax Number: See pg 1	Chain of Custody Number: 149474
City / State / Zip Code	Site Contact / Lab Contact	Lab Number
Project Name and Location (State)	Carrier/Waybill Number	Page 3 of 3
Contract/Purchase Order/Quote No.		

Sample I.D. No. and Description (Containers for each sample may be combined on one line)	Date	Time	Matrix: Air	Aqueous	Sed.	Soil	Containers & Preservatives: Unpres.	H2SO4	HNO3	HCl	NaOH	ZnAc/NaOH	8330B-TNT, DNT	NG, RDX, Tetryl	Perchlorate	6010B-Fe	6020A-Sb, Cu	Pb, Ni, Zn	Special Instructions/ Conditions of Receipt
WFF-MRS7-GW-DD-03	12/13/11	1135		12									X	X	X	X	X	X	ms/msd
WFF-MRS7-GW-DD-04	↓	1510		4									X	X	X	X	X	X	After samples were shipped, TPMC directed TestAmerica to revise some of the requested analyses. Refer to the note and table following these chains of custody.
WFF-MRS7-GW-DUP1	↓	1140		4									X	X	X	X	X	X	
SW 12/19/11 WFF-MRS7-SB-DUP1	↓	1435				2							X	X			X	X	

Possible Hazard Identification: ☐ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☐ Unknown

Sample Disposal: ☐ Return To Client ☐ Disposal By Lab ☐ Archive For ____ Months (A fee may be assessed if samples are retained longer than 1 month)

Turn Around Time Required: ☐ 24 Hours ☒ 48 Hours ☐ 7 Days ☐ 14 Days ☐ 21 Days ☐ Other Standard

QC Requirements (Specify)

	Date	Time		Date	Time
1. Relinquished By: [signature]	12/15/11	1300	1. Received By: FedEx	12/15/11	1300
2. Relinquished By			2. Received By		
3. Relinquished By			3. Received By		

Comments: See page 1 for TNT & DNT Breakdown products; perchlorate not filtered

DISTRIBUTION: WHITE - Returned to Client with Report; CANARY - Stays with the Sample; PINK - Field Copy

BOAT BASIN

[redacted]

Chain of Custody Record

Sampler ID ______

Temperature on Receipt ______

Drinking Water? Yes ☐ No ☑

TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

TAL-4124-280 (0508)

Client: TPMC / HFA	Project Manager: Sarah Moore	Date: 12/15/11	Chain of Custody Number: 149473
Address: 500 Herndon Parkway Suite 120	Telephone Number (Area Code)/Fax Number: 703 437 - 9685	Lab Number	Page 1 of 1
City: Herndon / State: VA / Zip Code: 20170	Site Contact: Sarah Moore / Lab Contact: Elaine Walker	Analysis (Attach list if more space is needed)	
Project Name and Location (State): WFF - Project 07	Carrier/Waybill Number		
Contract/Purchase Order/Quote No.: C03VA030107			

Sample I.D. No. and Description (Containers for each sample may be combined on one line)	Date	Time	Matrix: Air	Aqueous	Sed.	Soil		Containers & Preservatives: Unpres.	H2SO4	HNO3	HCl	NaOH	ZnAc/NaOH	[illegible] DNT	RDX - tetryl	Perchlorate	[illegible]	[illegible]	Se, Pb, Ni, Zn	Special Instructions/ Conditions of Receipt
WFF-MRS7-SD-01-01	12/13/11	939			2									X	X		X	X		After samples were shipped, TPMC directed TestAmerica to revise some of the requested analyses. Refer to the note and table following these chains of custody.
WFF-MRS7-SD-01-02	↓	1035			2									X	X		X	X		
WFF-MRS7-SD-01-03		1420			2									X	X		X	X		
WFF-MRS7-SD-01-04		955			2									X	X		X	X		The sample bottles for the sediment duplicate on this page was inadvertantly mislabeled and included with the samples for the Gun Butts. TPMC directed TestAmerica to re-label the sample and report the requested analytes.
WFF-MRS7-SD-01-05		1425			2									X	X		X	X		
WFF-MRS7-SB-01-~~06~~ 11		1005			~~Sd~~	2								X	X		X	X		
WFF-MRS7-SB-02-11		1010				2								X	X		X	X		
WFF-MRS7-SW-06-01	↓	1220		11 SM 12/15/11										X	X	X				11 ms/msd
~~WFF-MRS7-SD-DUP1~~														~~X~~	~~X~~			~~X~~		SM 12/15/11
WFF-MRS7 SW-DUP1	↓	1030		3 SM 12/19/11										X	X	X	~~X~~ SM 12/19/11	~~X~~		no metals 12/19/11
~~WFF-MRS7-SD-DUP3~~					2									~~X~~	~~X~~			~~X~~	SM 12/19/11	

Possible Hazard Identification: ☐ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☐ Unknown

Sample Disposal: ☐ Return To Client ☐ Disposal By Lab ☐ Archive For ______ Months (A fee may be assessed if samples are retained longer than 1 month)

Turn Around Time Required: ☐ 24 Hours ☐ 48 Hours ☐ 7 Days ☐ 14 Days ☐ 21 Days ☐ Other Standard

QC Requirements (Specify)

1. Relinquished By: [signature]	Date: 12/15/11	Time: 1300	1. Received By: FedEx	Date: 12/15/11	Time: 1300
2. Relinquished By	Date	Time	2. Received By	Date	Time
3. Relinquished By	Date	Time	3. Received By	Date	Time

Comments: Perchlorate not filtered

DISTRIBUTION: WHITE - Returned to Client with Report; CANARY - Stays with the Sample; PINK - Field Copy

Pyrotechnics Burn Area

Chain of Custody Record

TAL-4124-280 (0508)

Sampler ID ______

Temperature on Receipt ______

Drinking Water? Yes ☐ No ☑

TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

Client: TPMC/HFA	Project Manager: Sarah Moore	Date: 12/15/11	Chain of Custody Number: 149472
Address: 560 Herndon Parkway Suite 120	Telephone Number (Area Code)/Fax Number: 703-437-9685	Lab Number	Page 1 of 2
City: Herndon / State: VA / Zip Code: 20170	Site Contact: Sarah Moore / Lab Contact: Elaine Walker		
Project Name and Location (State): VA-Wallops Flight Facility-Project 07	Carrier/Waybill Number		
Contract/Purchase Order/Quote No.: C03VA03007 MMRP PA SSI			

Sample I.D. No. and Description (Containers for each sample may be combined on one line)	Date	Time	Matrix: Air	Aqueous	Sed.	Soil	Containers & Preservatives: Unpres.	H2SO4	HNO3	HCl	NaOH	ZnAc/NaOH	TNT & Breakdown*	Perchlorate	6010C-Al, Fe, Mn	6020A-Ba, Cu	Sb, Pb, Ni, Zn	PAHs	SW 12/19/11	Special Instructions/ Conditions of Receipt
WFF-MRS7-SS-01-01	12/14/11	1220				2							X		X	X		X		After samples were shipped, TPMC directed TestAmerica to revise some of the requested analyses. Refer to the note and table following these chains of custody.
WFF-MRS7-SB-02-01		1235				2							X		X	X				
WFF-MRS7-SS-01-02		1320				2							X		X	X				
WFF-MRS7-SB-02-02		1325				2							X		X	X				
WFF-MRS7-SS-01-03		1245				6							X		X	X	~~X~~	X		ms/msd
WFF-MRS7-SB-02-03		1255				2							X		X	X				
WFF-MRS7-SS-01-04		1305				2							X		X	X				
WFF-MRS7-SB-02-04		1310				2							X		X	X				
WFF-MRS7-GW-00-01		1210		4									X	X	~~X~~	~~X~~				
WFF-MRS7-GW-00-02		1115		4									X	X	X	X				
WFF-MRS7-GW-DUP2		1120		4									X	X	X	X				
WFF-MRS7-SS-DUP3		1225				2							X		X	X		X		

Possible Hazard Identification: ☑ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☐ Unknown

Sample Disposal: ☐ Return To Client ☐ Disposal By Lab ☐ Archive For ____ Months (A fee may be assessed if samples are retained longer than 1 month)

Turn Around Time Required: ☐ 24 Hours ☐ 48 Hours ☐ 7 Days ☐ 14 Days ☐ 21 Days ☐ Other Standard

QC Requirements (Specify)

	Date	Time		Date	Time
1. Relinquished By: [signature]	12/15/11	1300	1. Received By: FedEx	12/15/11	1300
2. Relinquished By			2. Received By		
3. Relinquished By			3. Received By		

CAM 12/15/11

Comments: ~~*DNT Breakdown products = 2,4DNT; 2,6DNT; 2-Amino-4,6-DNT; 4-Amino-2,6DNT; 2-Nitrotoluene; 3-NT; 4-NT~~

*TNT Breakdown products = 2, Amino-4,6-DNT; 4-Amino-2,6-DNT; Nitrobenzene; 2,6-DNT; 1,3,5-TNB

DISTRIBUTION: WHITE - Returned to Client with Report; CANARY - Stays with the Sample; PINK - Field Copy

Chain of Custody Record

TAL-4124-280 (0508)

Sampler ID ______

Temperature on Receipt ______

Drinking Water? Yes ☐ No ☑

TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

Client: TPMC/HFA	Project Manager: Sarah Moore	Date: 12/15/11	Chain of Custody Number: 149470
Address: 560 Herndon Parkway Suite 120	Telephone Number (Area Code)/Fax Number: 703-437-9685	Lab Number	Page 2 of 2
City: Herndon / State: VA / Zip Code: 20170	Site Contact: Sarah Moore / Lab Contact: Elaine Walker		
Project Name and Location (State): WFF - Project 07	Carrier/Waybill Number		
Contract/Purchase Order/Quote No.: C03VA03017			

Analysis (Attach list if more space is needed)

Special Instructions/ Conditions of Receipt

Sample I.D. No. and Description (Containers for each sample may be combined on one line)	Date	Time	Matrix: Air	Aqueous	Sed.	Soil	Containers & Preservatives: Unpres.	H2SO4	HNO3	HCl	NaOH	ZnAc/NaOH	TNT & Breakdowns	Perchlorate	6020 Al, Fe, Mn	6020 - Ba, Cu	Sb, Pb, Ni, Zn
WFF-MRS7-EB1	12/14/11	930		4									X	X	X	X	
~~WFF-MRS7-26~~ SW																	
~~WFF-MRS7~~ SW 12/15/11																	
~~WFF-MRS7~~ SW																	
WFF-MBBG-SD-01	12/14/11	1510			2										X	X	
WFF-MBBG-SD-02	↓	1528			2										X	X	
WFF-MBBG-SD-03	↓	1500			2										X	X	

After samples were shipped, TPMC directed TestAmerica to revise some of the requested analyses. Refer to the note and table following these chains of custody.

Possible Hazard Identification: ☐ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☐ Unknown

Sample Disposal: ☐ Return To Client ☐ Disposal By Lab ☐ Archive For ____ Months (A fee may be assessed if samples are retained longer than 1 month)

Turn Around Time Required: ☐ 24 Hours ☐ 48 Hours ☐ 7 Days ☐ 14 Days ☐ 21 Days ☐ Other ______

QC Requirements (Specify)

	Date	Time		Date	Time
1. Relinquished By: [signature]	12/15/11	1300	1. Received By: FedEx	12/15/11	1300
2. Relinquished By			2. Received By		
3. Relinquished By			3. Received By		

Comments: See page 1 for ~~[illegible]~~ TNT breakdown CAW 12/15/11

DISTRIBUTION: WHITE - Returned to Client with Report; CANARY - Stays with the Sample; PINK - Field Copy

After the WFF Project 07 Chain of Custody forms were submitted, TPMC requested that TestAmerica revise some analytes to match Table 3-2 from the Final SSWP dated 30 December 2011 (see below). Appendix F of the SI Report contains the WFF Project 07 analytical results, which reflect the analyses shown below.

Table 3-2. Sample Identification Table

Location	Sampling ID	Media					Analysis (Method)							Quality Control Samples[1]	
		Surface Soil	Subsurface Soil	Sediment	Surface Water	Groundwater	PAHs[4] (8270)	Select Explosive Constituents[2] (8330A)			Per-chlorate (6860)	Select Metals[3]		Field Duplicate[4]	MS/ MSD[5]
								TNT	NG, DNT	RDX, Tetryl		Al & Mg (6010C), Ba (6020A)	Fe (6010C) Sb, Cu, Pb, Ni, Zi (6020A)		
Pyro-technics Burn Area	WFF-MRS7-SS-01-01	X					X	X				X	X	X	
	WFF-MRS7-SB-02-01		X					X				X	X		
	WFF-MRS7-SS-01-02	X						X				X	X		
	WFF-MRS7-SB-02-02		X					X				X	X		
	WFF-MRS7-SS-01-03	X					X	X				X	X		X
	WFF-MRS7-SB-02-03		X					X				X	X		
	WFF-MRS7-SS-01-04	X						X				X	X		
	WFF–MRS7-SB-02-04		X					X				X	X		
	WFF-MRS7-GW-00-01					X		X			X	X	X		
	WFF-MRS7-GW-00-02					X		X			X	X	X	X	
Gun Butt No. 1	WFF-MRS7-SS-01-05	X						X		X			X		
	WFF-MRS7-SB-02-05		X					X		X			X	X	
	WFF-MRS7-SS-01-06	X						X		X			X		
	WFF-MRS7-SB-02-06		X					X		X			X		
	WFF-MRS7-SS-01-07	X						X		X			X		
	WFF-MRS7-SB-02-07		X					X		X			X		
	WFF-MRS7-SS-01-12	X						X	X	X			X		
	WFF-MRS7-SS-01-13	X						X	X	X			X		
	WFF-MRS7-SS-01-14	X						X	X	X					
	WFF-MRS7-GW-00-03					X		X	X	X	X		X	X	

Table 3-2. Sample Identification Table

Location	Sampling ID	Media					Analysis (Method)							Quality Control Samples[1]	
		Surface Soil	Subsurface Soil	Sediment	Surface Water	Groundwater	PAHs[6] (8270)	Select Explosive Constituents[2] (8330A)			Perchlorate (6860)	Select Metals[3]		Field Duplicate[4]	MS/ MSD[5]
								TNT	NG, DNT	RDX, Tetryl		Al & Mg (6010C), Ba (6020A)	Fe (6010C) Sb, Cu, Pb, Ni, Zi (6020A)		
Gun Butt No. 2	WFF-MRS7-SS-01-08	X						X		X			X		
	WFF-MRS7-SB-02-08		X					X		X			X		
	WFF-MRS7-SS-01-09	X						X		X			X		
	WFF-MRS7-SB-02-09		X					X		X			X		
	WFF-MRS7-SS-01-10	X						X		X			X		X
	WFF-MRS7-SB-02-10		X					X		X			X		
	WFF-MRS7-SS-01-15	X						X	X	X			X		
	WFF-MRS7-SS-01-16	X						X	X	X			X		
	WFF-MRS7-SS-01-17	X						X	X	X					
	WFF-MRS7-GW-00-04					X		X	X	X	X		X		X
Outside MRS/ Drainage Area between Gun Butt No. 1 & 2	WFF-MRS7-SS-01-18/ WFF-MRS7-SD-01-06	X		X				X		X			X		
	WFF-MRS7-SS-01-19/ WFF-MRS7-SD-01-07	X		X				X		X			X		
	WFF-MRS7-SS-01-20/ WFF-MRS7-SD-01-08	X		X				X		X			X	X	
	WFF-MRS7-SS-01-21/ WFF-MRS7-SD-01-09	X		X				X		X			X		X
South Bank of Boat Basin	WFF-MRS7-SD-01-01			X				X	X	X			X	X	
	WFF-MRS7-SD-01-02			X				X	X	X			X		
	WFF-MRS7-SD-01-03			X				X	X	X			X		
	WFF-MRS7-SD-01-04			X				X	X	X			X		
	WFF-MRS7-SD-01-05			X				X	X	X			X		
	WFF-MRS7-SS-01-11	X						X	X	X			X		
	WFF-MRS7-SB-02-11		X					X	X	X			X		
	WFF-MRS7-SW-00-01				X			X	X	X	X			X	X

Table 3-2. Sample Identification Table

Location	Sampling ID	Media					Analysis (Method)							Quality Control Samples[1]	
		Surface Soil	Subsurface Soil	Sediment	Surface Water	Groundwater	PAHs[6] (8270)	Select Explosive Constituents[2] (8330A)			Per-chlorate (6860)	Select Metals[7]		Field Duplicate[4]	MS/ MSD[5]
								TNT	NG, DNT	RDX, Tetryl		Al & Mg (6010C), Ba (6020A)	Fe (6010C) Sb, Cu, Pb, Ni, Zi (6020A)		
TOTAL		**17 to 20**	**11**	**5 to 9**	**1**	**4**	**2**	**36**	**20**	**36**	**5**	**10**	**39**	**7**	**5**

1. For each QC sample, the marked sample type will be gathered for every MC category that is being sampled. Dedicated equipment will be used. Proposed QA sample locations may change depending on sampling conditions and sampling media available (i.e. may change if adequate media is not available to collect additional volume).
2. Where DNT is listed, DNT break-down products currently on the approved PWP (Alion 2005) will also be analyzed (2,4-Dinitrotoluene; 2,6-Dinitrotoluene; 2-Amino-4,6-dinitrotoluene; 2-Nitrotoluene; 3-Nitrotoluene; 4-Nitrotoluene; 4-Amino-2,6-dinitrotoluene). Where TNT is listed, TNT breakdown products currently on the approved PWP (Alion 2005) will also be analyzed (2-Amino-4,6-dinitrotoluene; 4-Amino-2,6-dinitrotoluene; Nitrobenzene; 2,6-dinitrotoluene; 1,3,5-trinitrobenzene).
3. Zinc will be analyzed at the Pyrotechnics Burn Area only.
4. FD# will replace sample ID (the sample ID and its corresponding FD# will be indicated in the field notebook); duplicate samples will be analyzed at a frequency of 10%.
5. MS/MSD samples will be analyzed at a frequency of 5%. Additional volume will be collected for MS/MSD analysis.
6. PAHs include Acenanaphthylene, Acenaphthene, Anthracene, Benz[a]anthracene, Benzo[a]pyrene, Benzo[b]fluoranthene, Benzo[g,h,i]perylene, Benzo[k]fluoranthene, Chrysene, Dibenz[a,h]anthracene, Fluoranthene, Fluorene, Indeno[1,2,3-cd]pyrene, Naphthalene, Phenanthrene, Pyrene.
7. Samples collected at each MRS will be soil or sediment, depending on which medium is present at each sample location.

FD#: Field Duplicate Number
GW: Groundwater
ID: Identification
MC: Munition Constituent
MRS: Munitions Response Site
MS: Matrix Spike
MSD: Matrix Spike Duplicate
PWP: Programmatic Work Plan for Formerly Used Defense Sites Military Munitions Response Program Site Inspections in the Northeast Region
SB: Subsurface Soil
SD: Sediment
SS: Surface Soil
SW: Surface Water
QA: Quality Assurance
QC: Quality Control

GENERATOR

NON-HAZARDOUS WASTE MANIFEST	1. Generator ID Number: CESQG	2. Page 1 of: 1	3. Emergency Response Phone: 757-201-7726	4. Waste Tracking Number: 19170

5. Generator's Name and Mailing Address

USACE-NORFOLK DISTRICT
803 FRONT STREET
NORFOLK, VA 23510

Generator's Phone: 757 201-7726

Generator's Site Address (if different than mailing address)

NASA WALLOPS VISITOR CENTER
WALLOPS VISITOR CENTER
WALLOPS ISLAND, VA 23337

6. Transporter 1 Company Name: Environmental Options, Inc — U.S. EPA ID Number: VA0000122994

7. Transporter 2 Company Name — U.S. EPA ID Number:

8. Designated Facility Name and Site Address

CMEG, INC.
917 INDUSTRIAL ROAD
WALTERBORO, SC 29488

Facility's Phone: (843) 538-8131

U.S. EPA ID Number: SCR000003442

9. Waste Shipping Name and Description	10. Containers No.	10. Containers Type	11. Total Quantity	12. Unit Wt./Vol.
1. SOIL CUTTINGS & PURTE WATER, #13536, NON HAZARDOUS/NON REGULATED	001	DM	055	G ~~34~~
2.				
3.				
4.				

13. Special Handling Instructions and Additional Information

A: 13536
B:
C:
D:

14. GENERATOR'S/OFFEROR'S CERTIFICATION: I hereby declare that the contents of this consignment are fully and accurately described above by the proper shipping name, and are classified, packaged, marked and labeled/placarded, and are in all respects in proper condition for transport according to applicable international and national governmental regulations.

Generator's/Offeror's Printed/Typed Name: JEFF ZOECKLER — Signature: [signature] — Month 02 Day 23 Year 12

INT'L

15. International Shipments ☐ Import to U.S. ☐ Export from U.S. Port of entry/exit:
Transporter Signature (for exports only): Date leaving U.S.:

TRANSPORTER

16. Transporter Acknowledgment of Receipt of Materials
Transporter 1 Printed/Typed Name: Don Hix — Signature: [signature] — Month 02 Day 23 Year 12
Transporter 2 Printed/Typed Name — Signature — Month Day Year

DESIGNATED FACILITY

17. Discrepancy
17a. Discrepancy Indication Space ☐ Quantity ☐ Type ☐ Residue ☐ Partial Rejection ☐ Full Rejection

Manifest Reference Number:

17b. Alternate Facility (or Generator) — U.S. EPA ID Number

Facility's Phone:

17c. Signature of Alternate Facility (or Generator) — Month Day Year

18. Designated Facility Owner or Operator: Certification of receipt of materials covered by the manifest except as noted in Item 17a
Printed/Typed Name: Timothy Carpenter — Signature: [signature] — Month 2 Day 29 Year 12

169-BLS-C 6 10497 (Rev. 9/09) DESIGNATED FACILITY TO GENERATOR

APPENDIX E – PHOTO DOCUMENTATION LOG

APPENDIX E – PHOTOGRAPHIC LOG

Project/Site: Wallops Flight Facility (WFF) Project 07/Boat Basin/Visitor Center (MRS 7)
Project No.: C03VA030107

Date	Photo ID	Description
12/12/11	E.1	Facing the Visitor Information Center and the former Gun Butt firing points at MRS 7.
12/12/11	E.2	Metal debris observed on the surface while completing QR at Gun Butt No. 1 and 2.
12/12/11	E.3	An intact 20-mm projectile located between Gun Butt No. 1 and Gun Butt No. 2 that possibly contained energetic material (MPPEH) but was too rusty for UXO technician to confirm.
12/12/11	E.4	Completing QR at Gun Butt No. 1.
12/13/11	E.5	Metal debris observed while completing QR around the perimeter of the Boat Basin.
12/13/11	E.6	Three MPPEH (larger than 20-mm) near a tree on the bank of the Boat Basin that may contain energetic material (too rusty to confirm).
12/13/11	E.7	Completing QR around the perimeter of the Boat Basin.
12/13/11	E.8	The dock at the Boat Basin facing the location of the MPPEH and metal items observed during QR.
12/13/11	E.9	Marston matting and rusty metal debris at higher tide.
12/13/11	E.10	Marston matting and rusty metal debris at lower tide.
12/14/11	E.11	Fence at the Pyrotechnics Burn Area.
12/14/11	E.12	Burn pile within the fenced Pyrotechnics Burn Area.
12/14/11	E.13	Metal debris north and just outside of the Pyrotechnics Burn Area fence.
12/14/11	E.14	Purging groundwater sample WFF-MRS7-GW-00-01.

Photographer: Sarah Moore Location of Photograph: MRS 7 GPS Coordinates (m): N 4198995.78 E 459837.54 (UTM Zone 18N) Direction of Photo: Northwest Comments: Facing the Visitor Information Center and the former Gun Butt firing points at MRS 7 Photograph No.: E.1 Date: 12/12/11 Time: 10:27 AM	Photographer: Sarah Moore Location of Photograph: MRS 7 GPS Coordinates (m): N 4198982.47 E 459884.71 (UTM Zone 18N) Direction of Photo: Toward the ground Comments: Metal debris observed on the surface while completing QR at Gun Butt No. 1 and 2. Photograph No.: E.2 Date: 12/12/11 Time: 10:28 AM

Photographer:	Sarah Moore
Location of Photograph:	MRS 7
GPS Coordinates(m): (UTM Zone 18N)	N 4198981.91 E 459876.69
Direction of Photo:	Toward the ground
Comments:	An intact 20-mm projectile located between Gun Butt No. 1 and Gun Butt No. 2 that possibly contained energetic material (MPPEH) but was too rusty for UXO technician to confirm.
Photograph No.:	E.3 Date: 12/12/11 Time: 10:30 AM

Photographer:	Sarah Moore
Location of Photograph:	MRS 7
GPS Coordinates(m): (UTM Zone 18N)	N 4199000.72 E 459942.64
Direction of Photo:	Southeast
Comments:	Completing QR at Gun Butt No. 1.
Photograph No.:	E.4 Date: 12/12/11 Time: 10:47 AM

Photograph E.5	Photograph E.6
Photographer: Sarah Moore	Photographer: Sarah Moore
Location of Photograph: MRS 7	Location of Photograph: MRS 7
GPS Coordinates (m): N 4199198.93 E 460008.24 (UTM Zone 18N)	GPS Coordinates (m): N 4199205.00 E 460019.83 (UTM Zone 18N)
Direction of Photo: Toward the ground	Direction of Photo: Toward the ground
Comments: Metal debris observed while completing QR around the perimeter of the Boat Basin.	Comments: Three MPPEH (larger than 20-mm) near a tree on the bank of the Boat Basin that may contain energetic material (too rusty to confirm).
Photograph No.: E.5 Date: 12/13/11 Time: 9:34 AM	Photograph No.: E.6 Date: 12/13/11 Time: 9:47 AM

WFF Project 07 – Field Photographs

Photographer: Sarah Moore
Location of Photograph: MRS 7
GPS Coordinates (m): N 4199262.42 E 460075.26
(UTM Zone 18N)
Direction of Photo: Northwest

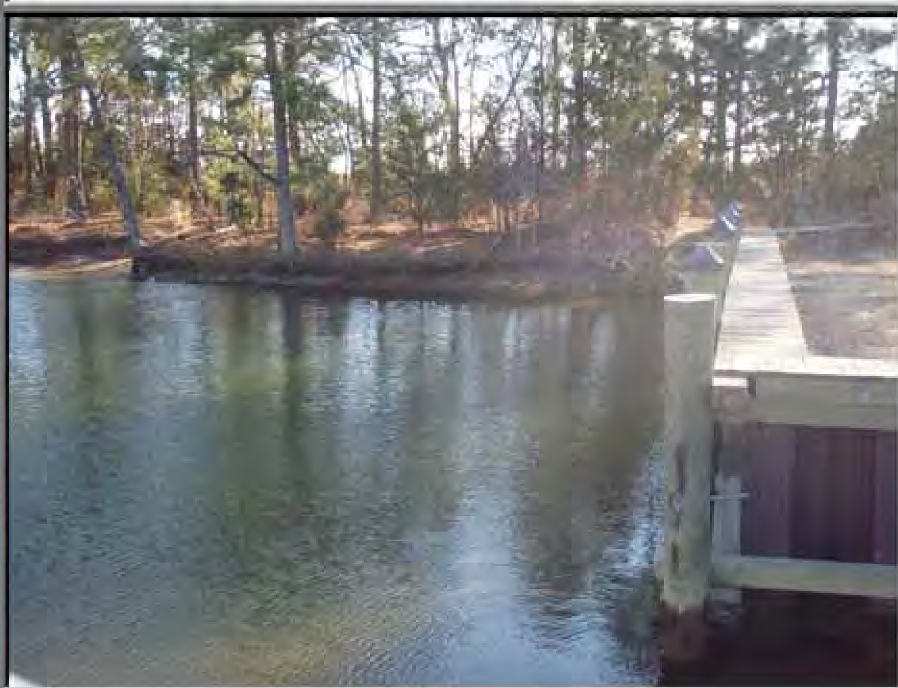
Comments: Completing QR around the perimeter of the Boat Basin.

Photograph No.: E.7 Date: 12/13/11 Time: 11:00 AM

Photographer: Sarah Moore
Location of Photograph: MRS 7
GPS Coordinates (m): N 4199214.32 E 460015.79
(UTM Zone 18N)
Direction of Photo: South

Comments: The dock at the Boat Basin facing the location of the MPPEH and metal items observed during QR.

Photograph No.: E.8 Date: 12/13/11 Time: 13:07 PM



Photographer: Sarah Moore Location of Photograph: MRS 7 GPS Coordinates (m): N 4199202.04 E 460013.01 (UTM Zone 18N) Direction of Photo: Toward the ground Comments: Marston matting and rusty metal debris at higher tide. Photograph No.: E.9 Date: 12/13/11 Time: 9:35 AM	Photographer: Sarah Moore Location of Photograph: MRS 7 GPS Coordinates (m): N 4199202.04 E 460013.01 (UTM Zone 18N) Direction of Photo: Toward the ground Comments: Marston matting and rusty metal debris at lower tide. Photograph No.: E.10 Date: 12/14/11 Time: 2:18 PM
	

Photographer: Sarah Moore Location of Photograph: MRS 7 GPS Coordinates (m): N 4199128.89 E 460103.59 (UTM Zone 18N) Direction of Photo: Northeast Comments: Fence at the Pyrotechnics Burn Area. Photograph No.: E.11 Date: 12/14/11 Time: 9:26 AM	Photographer: Sarah Moore Location of Photograph: MRS 7 GPS Coordinates (m): N 4199132.66 E 460106.08 (UTM Zone 18N) Direction of Photo: Toward the ground Comments: Burn pile within the fenced Pyrotechnics Burn Area. Photograph No.: E.12 Date: 12/14/11 Time: 9:54 AM

Photographer: Sarah Moore
Location of Photograph: MRS 7
GPS Coordinates (m): N 4199147.12 E 460103.56
(UTM Zone 18N)
Direction of Photo: Toward the ground

Comments: Metal debris north and just outside of the Pyrotechnics Burn Area fence.

Photograph No.: E.13 Date: 12/14/11 Time: 9:59 AM

Photographer: Temple Coffindaffer
Location of Photograph: MRS 7
GPS Coordinates (m): N 4199131.82 E 460107.11
(UTM Zone 18N)
Direction of Photo: Southeast

Comments: Purging groundwater sample WFF-MRS7-GW-00-01.

Photograph No.: E.14 Date: 12/14/11 Time: 11:36 AM

APPENDIX F – ANALYTICAL DATA

- Automated Data Review Library
- Automated Data Review Electronic Data Deliverable (EDD)
- Environmental Data Management System (EDMS)
- Analytical Summary Reports
- Analytical Data Reports
- Staged Electronic Data Deliverable (SEDD)

Located on CD.

APPENDIX G – ANALYTICAL DATA QUALITY ASSURANCE/ QUALITY CONTROL REPORT

- Validated Data
- Chemical Quality Assurance Report (CQAR) of Split Samples (Split Samples not collected in accordance with CENAB direction.)
- Chemical Data Quality Assessment Report (CDQAR)

Located on CD.

APPENDIX H – GEOGRAPHIC INFORMATION SYSTEMS DATA

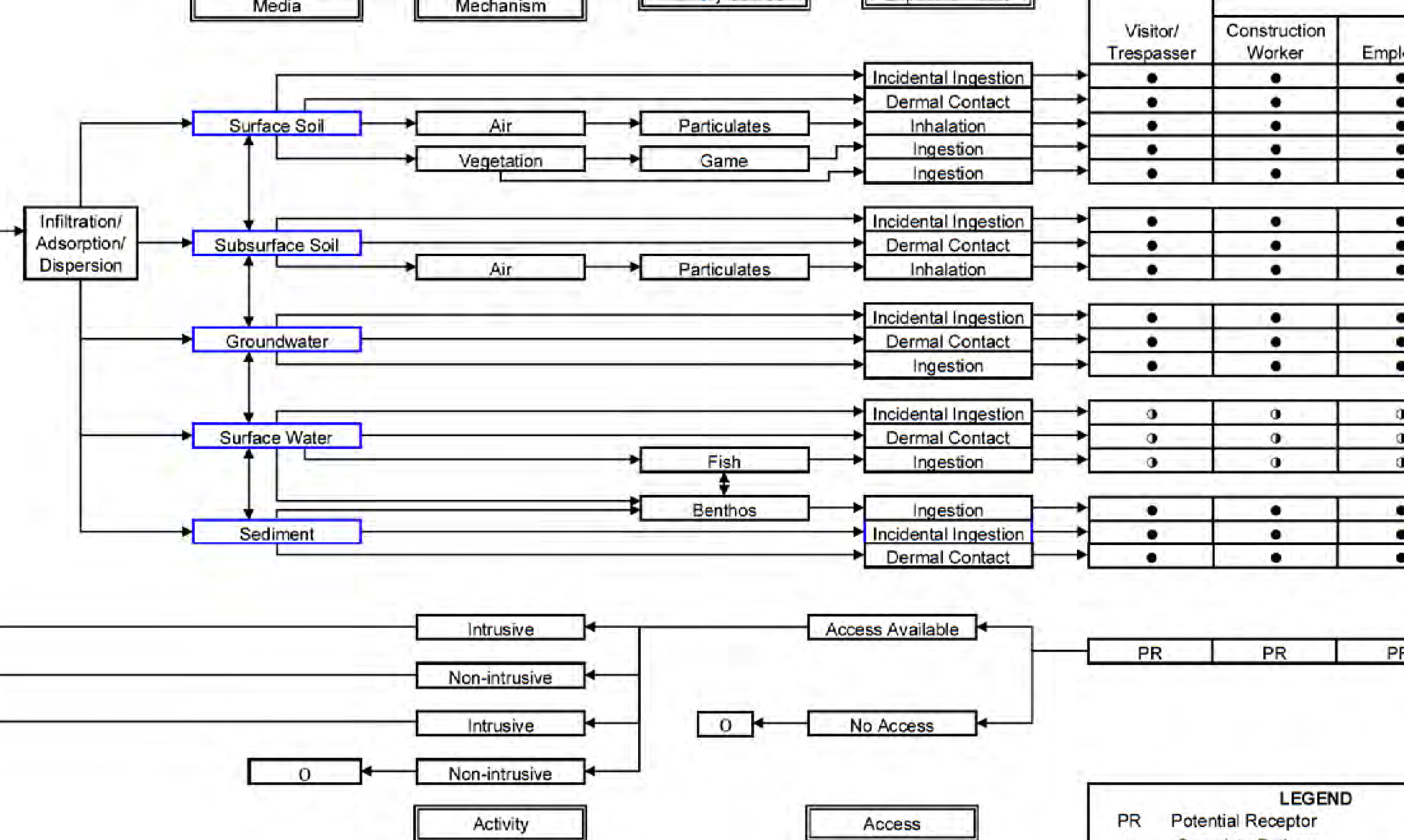
Located on CD.

APPENDIX I – GEOPHYSICAL DATA

Appendix not used.

APPENDIX J – CONCEPTUAL SITE MODEL

- MRS 7 – Boat Basin/Visitors Information Center



LEGEND

PR Potential Receptor
● Complete Pathway
◑ Potentially Complete Pathwa
○ Incomplete Pathway (no expe

ty, this CSM summarizes the potential risk exposure scenarios for MRS 7. For a pathway to be complete, it must include a route, and a receptor. A complete pathway may also include a release mechanism and a transport medium. Interaction two components: access and activity.

is where historical munitions activities occurred (disposal burn areas, firing points, impact areas). Numerous MD have ed during the 2011 SI field activities. No confirmed MEC was observed during the SI field event; however, seven MPPEH s were detected throughout MRS 7 including five areas of concentrated anomalies; therefore, MEC at surface and

concentrations in surface and subsurface soil, sediment, and groundwater; therefore, the pathway is complete for these

DIAGRAM OF THE INTEGRATED CONCEPT

Wallops Flight Facility Boat Basin and

MRS 7 - Boat Basin/Visitors Infor

Revised June 2012

APPENDIX K – MUNITIONS REPONSE SITE PRIORITIZATION PROTOCOL RESULTS

- MRS 7 – Boat Basin/Visitors Information Center

Table A

MRS Background Information

DIRECTIONS: Record the background information below for the MRS to be evaluated. Much of this information is available from Service and DoD databases. If the MRS is located on a FUDS property, the suitable FUDS property information should be substituted. In the MRS summary, briefly describe the UXO, DMM, or MC that are known or suspected to be present, the exposure setting (the MRS's physical environment), any other incidental nonmunitions-related contaminants (e.g., benzene, trichloroethylene) found at the MRS, and any potentially exposed human and ecological receptors. If possible, include a map of the MRS.

Munitions Response Site Name: Boat Basin/Visitors Information Center

Component: U.S. Army

Installation/Property Name: Wallops Flight Facility (FFID: VA39799F169700)

Location (City, County, State): Wattsville, Accomack County, VA

Site Name/Project Name (Project No.): Boat Basin/Visitors Information Center/Wallops Flight Facility Project 07 ((C03VA030107)

Date Information Entered/Updated: 3/16/2012 4:26:42 AM

Point of Contact (Name/Phone): Sher Zaman/410-962-3134

Project Phase (check only one):

☐ PA	■ SI	☐ RI	☐ FS	☐ RD
☐ RA-C	☐ RIP	☐ RA-O	☐ RC	☐ LTM

Media Evaluated (check all that apply):

■ Groundwater	■ Sediment (human receptor)
■ Surface soil	■ Surface Water (ecological receptor)
■ Sediment (ecological receptor)	■ Surface Water (human receptor)

MRS Summary:

MRS Description: Describe the munitions-related activities that occurred at the installation, the dates of operation, and the UXO, DMM or MC known or suspected to be present. When possible, identify munitions, CWM, and MC by type:

The WFF Project 07 is approximately 1.53 acres of land located in the Main Base Sector. It is comprised of four areas: Pyrotechnics Burn Area, Gun Butt No. 1, Gun Butt No. 2, and Boat Basin. The WFF was used by the Naval Aviation Ordnance Test Station (NAOTS) between 1946 and 1959 to conduct secret aviation ordnance tests and munitions experiments. Munitions historically used or burned at WFF Project 07 include AN Mk4 signals, AN Mk5/Mk23/Mk43 practice bombs, Mk6 parachute flares, 20-mm, 27-mm, and .50-caliber. Since military use ended, no confirmed MEC is known to have been found, but numerous MD items have been found and subsurface anomalies have been recorded. Refer to Paragraphs 2.1.2, 2.1.3, 2.1.4, 2.2.2, and 4.2.1.1 and Table 2-2 of the SI Report.

The MRSPP was addressed with stakeholders during an initial Technical Project Planning (TPP) meeting. Appendix B of the Final SI Report contains the TPP #1 and #2 memorandums and a copy of the public notice indicating availability of the MRSPP.

Description of Pathways for Human and Ecological Receptors:

Surface soil, subsurface soil (12- to 24-inch depth, not included in MRSPP per the MRSPP Primer), sediment, surface water, and groundwater were sampled at MRS 7. Refer to the CSM for MRS 7 (Appendix J) and Paragraphs 3.3.2.1, 5.2.0.2, and 5.2.0.3 of the SI Report.
Description of Receptors (Human and Ecological):
Visitor/trespasser, construction worker, employee, and biota. Refer to the CSM for the land portion of MRS 7 (Appendix J) and Paragraphs 5.2.0.2 and 5.2.0.3 of the SI Report.

Table 1

EHE Module: Munitions Type Data Element Table

DIRECTIONS: Below are 11 classifications of munitions and their descriptions. Circle the scores that correspond with **all** the munitions types known or suspected to be present at the MRS.

Note: The terms practice munitions, small arms ammunition, physical evidence, and historical evidence are defined in Appendix C of the Primer.

Classification	Description	Score
Sensitive	• UXO that are considered likely to function upon any interaction with exposed persons (e.g., submunitions, 40mm high-explosive [HE] grenades, white phosphorus [WP] munitions, high-explosive antitank [HEAT] munitions, and practice munitions with sensitive fuzes, but excluding all other practice munitions). • Hand grenades containing energetic filler. • Bulk primary explosives, or mixtures of these with environmental media, such that the mixture poses an explosive hazardard.	30
High explosive (used or damaged)	• UXO containing a high-explosive filler (e.g., RDX, Composition B), that are not considered "sensitive." • DMM containing a high-explosive filler that have: ▪ Been damaged by burning or detonation ▪ Deteriorated to the point of instability.	25
Pyrotechnic (used or damaged)	• UXO containing a pyrotechnic fillers other than white phosphorous (e.g., flares, signals, simulators, smoke grenades). • DMM containing pyrotechnic fillers other than white phosphorous (e.g., flares, signals, simulators, smoke grenades) that have: ▪ Been damaged by burning or detonation ▪ Deteriorated to the point of instability.	20
High explosive (unused)	• DMM containing a high explosive filler that: ▪ Have not been damaged by burning or detonation ▪ Are not deteriorated to the point of instability.	15
Propellant	• UXO containing mostly single-, double-, or triple-based propellant, or composite propellants (e.g., a rocket motor). • DMM containing mostly single-, double-, or triple-based propellant, or composite propellants (e.g., a rocket motor) that are: ▪ Damaged by burning or detonation ▪ Deteriorated to the point of instability.	15
Bulk secondary high explosives, pyrothechnics, or propellant	• DMM containing mostly single-, double-, or triple-based propellant, or composite propellants (e.g., a rocket motor). • DMM that are bulk secondary high explosives, pyrotechnic compositions, or propellant (not contained in a munition), or mixtures of these with environmental media such that the mixture poses an explosive hazard.	10
Pyrotechnic (not used or damaged)	• DMM containing a pyrotechnic fillers (i.e., red phosphorous), other than white phosphorous filler, that: ▪ Have not been damaged by burning or detonation ▪ Are not deteriorated to the point of instability.	10
Practice	• UXO that are practice munitions that are not associated with a sensitive fuze. • DMM that are practice munitions that are not associated with a sensitive fuze and that have not: ▪ Been damaged by burning or detonation ▪ Deteriorated to the point of instability.	5
Riot control	• UXO or DMM containing a riot control agent filler (e.g., tear gas).	3
Small arms	• Used munitions or DMM that are categorized as small arms ammunition [Physical evidence or historical evidence that no other types of munitions (e.g., grenades, subcaliber training rockets, demolition charges) were used or are present on the MRS is required for selection of this category.].	2
Evidence of no munitions	• Following investigation of the MRS, there is physical evidence that there are no UXO or DMM present, or there is historical evidence indicating that no UXO or DMM are present.	0
MUNITIONS TYPE	**DIRECTIONS:** Record **the single highest score** from above in the box to the right (maximum score = 30).	25

DIRECTIONS: Document any MRS-specific data used in selecting the ***Munitions Type*** classifications in the space provided.

Munitions used or disposed of included practice (rated in this table as "Practice") and HE (rated in this table as "High explosive [used or damaged]") medium (20-mm) and large (37-mm) caliber, practice bombs; small arms (rated in this table as "Small arms"); flares and signals (rated in this table as "Pyrotechnic [used or damaged]"). Since military use ended, no confirmed MEC is known to have been found, but numerous MD items have been found and subsurface anomalies have been recorded. Refer to Paragraphs 2.4.1.2, 2.4.3.2, 3.3.1.2, and 4.2.1.1 and Tables 2-2 and 4-2 of this SI Report for more information.

Table 2

EHE Module: Source of Hazard Data Element Table

DIRECTIONS: Below are 11 classifications describing sources of explosive hazards. Circle the scores that correspond with **all** the sources of explosive hazards known or suspected to be present at the MRS.

Note: The terms former range, practice munitions, small arms range, physical evidence, and historical evidence are defined in Appendix C of the Primer.

Classification	Description	Score
Former range	• The MRS is a former military range where munitions (including practice munitions with sensitive fuzes) have been used. Such areas include impact or target areas and associated buffer and safety zones.	10
Former munitions treatment (i.e., OB/OD) unit	• The MRS is a location where UXO or DMM (e.g., munitions, bulk explosives, bulk pyrotechnic, or bulk propellants) were burned or detonated for the purpose of treatment prior to disposal.	8
Former practice munitions range	• The MRS is a former military range on which only practice munitions without sensitive fuzes were used.	6
Former maneuver area	• The MRS is a former maneuver area where no munitions other than flares, simulators, smokes, and blanks were used. There must be evidence that no other munitions were used at the location to place an MRS into this category.	5
Former burial pit or other disposal area	• The MRS is a location where DMM were buried or disposed of (e.g., disposed of into a water body) without prior thermal treatment.	5
Former industrial operating facilities	• The MRS is a location that is a former munitions maintenance, manufacturing, or demilitarization facility.	4
Former firing points	• The MRS is a firing point, where the firing point is delineated as an MRS separate from the rest of a former military range.	4
Former missile or air defense artillery emplacements	• The MRS is a former missile defense or air defense artillery (ADA) emplacement not associated with a military range.	2
Former storage or transfer points	• The MRS is a location where munitions were stored or handled for transfer between different modes of transportation (e.g., rail to truck, truck to weapon system).	2
Former small arms range	• The MRS is a former military range where only small arms ammunition was used. (There must be evidence that no other types of munitions [e.g., grenades] were used or are present to place an MRS into this category.)	1
Evidence of no munitions	• Following investigation of the MRS, there is physical evidence that no UXO or DMM are present, or there is historical evidence indicating that no UXO or DMM are present.	0
SOURCE OF HAZARD	**DIRECTIONS:** Record **the single highest score** from above in the box to the right (maximum score = 10).	10

DIRECTIONS: Document any MRS-specific data used in selecting the ***Source of Hazard*** classifications in the space provided.

WFF Project 07 comprises Gun Butts No. 1 and 2 (former ranges), Pyrotechnics Burn Area (former munitions treatment), and South Bank of Boat Basin (former transfer point). Refer to Paragraphs 2.1.3 and 2.4.3.2 of the SI Report.

Table 3

EHE Module: Location of Munitions Data Element Table

DIRECTIONS: Below are eight classifications of munitions locations and their descriptions. Circle the scores that correspond with **all** the locations where munitions are known or suspected to be present at the MRS.

Note: The terms confirmed, surface, subsurface, small arms ammunition, physical evidence, and historical evidence are defined in Appendix C of the Primer.

Classification	Description	Score
Confirmed surface	• Physical evidence indicates that there are UXO or DMM on the surface of the MRS. • Historical evidence (i.e., a confirmed report such as an explosive ordnance disposal [EOD], police, or fire department report that an incident or accident that involved UXO	25
Confirmed subsurface, active	• Physical evidence indicates the presence of UXO or DMM in the subsurface of the MRS,and the geological conditions at the MRS are likely to cause UXO or DMM to be exposed, in the future, by naturally occurring phenomena (e.g., drought, flooding, erosion, frost heave, tidal action), or intrusive activities (e.g., plowing, construction, dredging) at the MRS are likely to expose UXO or DMM. • Historical evidence indicates that UXO or DMM are located in the subsurface of the MRS and the geological conditions at the MRS are likely to cause UXO or DMM to be exposed, in the future, by naturally occurring phenomena (e.g., drought, flooding, erosion, frost heave, tidal action), or intrusive activities (e.g., plowing, construction, dredging) at the MRS are likely to expose UXO or DMM.	20
Confirmed subsurface, stable	• Physical evidence indicates the presence of UXO or DMM in the subsurface of the MRS and the geological conditions at the MRS are not likely to cause UXO or DMM to be exposed, in the future, by naturally occurring phenomena, or intrusive activities at the MRS are not likely to cause UXO or DMM to be exposed. • Historical evidence indicates that UXO or DMM are located in the subsurface of the MRS and the geological conditions at the MRS are not likely to cause UXO or DMM to be exposed, in the future, by naturally occurring phenomena, or intrusive activities at the MRS are not likely to cause UXO or DMM to be exposed.	15
Suspected (physical evidence)	• There is physical evidence (e.g., munitions debris, such fragments, penetrators, projectiles, shell casings, links, fins), other than the documented presence of UXO or DMM, indicating that UXO or DMM may be present at the MRS.	10
Suspected (historical evidence)	• There is historical evidence indicating that UXO or DMM may be present at the MRS.	5
Subsurface, physical constraint	• There is physical or historical evidence indicating that UXO or DMM may be present in the subsurface, but there is a physical constraint (e.g., pavement, water depth over 120 feet) preventing direct access to the UXO or DMM.	2
Small arms (regardless of location)	• The presence of small arms ammunition is confirmed or suspected, regardless of other factors such as geological stability (There must be evidence that no other types of munitions [e.g., grenades] were used or are present at the MRS to place an MRS into this category.)	1
Evidence of no munitions	• Following investigation of the MRS, there is physical evidence that there are no UXO or DMM present, or there is historical evidence indicating that no UXO or DMM are present.	0
LOCATION OF MUNITIONS	**DIRECTIONS:** Record **the single highest score** from above in the box to the right (maximum score = 25).	10

DIRECTIONS: Document any MRS-specific data used in selecting the ***Location of Munitions*** classifications in the space provided.

Since military use ended, no confirmed MEC is known to have been found, but numerous MD items have been found on the surface and subsurface anomalies have been recorded. Refer to Paragraphs 2.4.1.2, 2.4.3.2, 3.3.1.2, and 4.2.1.1 and Table 4-2 of this SI Report for more information.

Table 4

EHE Module: Ease of Access Data Element Table

DIRECTIONS: Below are four classifications of barrier types that can surround an MRS and their descriptions. The barrier type is directly related to the ease of public access to the MRS. Circle the score that corresponds with the ease of access to the MRS.

Note: The term barrier is defined in Appendix C of the Primer.

Classification	Description	Score
No barrier	• There is no barrier preventing access to any part of the MRS (i.e., all parts of the MRS are accessible).	10
Barrier to MRS access is incomplete	• There is a barrier preventing access to parts of the MRS, but not the entire MRS.	8
Barrier to MRS access is complete but not monitored	• There is a barrier preventing access to all parts of the MRS, but there is no surveillance (e.g., by a guard) to ensure that the barrier is effectively preventing access to all parts of the MRS.	5
Barrier to MRS access is complete and monitored	• There is a barrier preventing access to all parts of the MRS, and there is active, continual surveillance (e.g., by a guard, video monitoring) to ensure that the barrier is effectively preventing access to all parts of the MRS.	0
EASE OF ACCESS	**DIRECTIONS:** Record **the single highest score** from above in the box to the right (maximum score = 10).	8

DIRECTIONS: Document any MRS-specific data used in selecting the ***Ease of Access*** classifications in the space provided.

WFF Project 07 is located near the NASA Visitor Center, which is located behind a fence and gate that are open to the public during limited hours. Once at the Visitor Center, the public has access to Gun Butts No. 1 and 2, but not the Pyrotechnics Burn Area and South Bank of Boat Basin, which are located behind additional fences. The Marine Science Consortium and NASA employees have access to the Boat Basin. Refer to Paragraph 3.3.1.2 of the SI Report.

Gun Butts No. 1 and 2 are in an area outside of the Visitor Information Center that is open to the public. There is a gate at the entrance to the visitor center parking lot to regulate/control entering this area if necessary; however, the gate is open during daylight hours (10 am to 4 pm) on a schedule that is seasonal but a minimum of five days a week. 3.3.1.2

Table 5

EHE Module: Status of Property Data Element Table

DIRECTIONS: Below are three classifications of the status of a property within the Department of Defense (DoD) and their descriptions. Circle the score that corresponds with the status of property at the MRS.

Classification	Description	Score
Non-DoD control	• The MRS is at a location that is no longer owned by, leased to, or otherwise possessed or used by DoD. Examples are privately owned land or water bodies; land or water bodies owned or controlled by state, tribal, or local governments; and land or water bodies managed by other federal agencies.	5
Scheduled for transfer from DoD control	• The MRS is on land or is a water body that is owned, leased, or otherwise possessed by DoD, and DoD plans to transfer that land or water body to the control of another entity (e.g., a state, tribal, or local government; a private party; another federal agency) within 3 years from the date the Protocol is applied.	3
DoD control	• The MRS is on land or is a water body that is owned, leased, or otherwise possessed by DoD. With respect to property that is leased or otherwise possessed, DoD must control access to the MRS 24 hours per day, every day of the calendar year.	0
STATUS OF PROPERTY	**DIRECTIONS:** Record **the single highest score** from above in the box to the right (maximum score = 5).	5

DIRECTIONS: Document any MRS-specific data used in selecting the ***Status of Property*** classifications in the space provided.

WFF Project 07 currently is owned by NASA and operated as part of the NASA WFF. Refer to Paragraph 2.3.4.1 of the SI Report.

Table 6

EHE Module: Population Density Data Element Table

DIRECTIONS: Below are three classifications for population density and their descriptions. Determine the population density per square mile that most closely corresponds with the population of the MRS, including the area within a two-mile radius of the MRS's perimeter. Circle the most appropriate score.

Note: Note: Use the U.S. Census Bureau tract data available to capture the highest population density within a two-mile radius of the perimeter of the MRS.

Classification	Description	Score
> 500 persons per square mile	• There are more than 500 persons per square mile in the U.S. Census Bureau tract in which the MRS is located.	5
100–500 persons per square mile	• There are 100 to 500 persons per square mile in the U.S. Census Bureau tract in which the MRS is located.	3
< 100 persons per square mile	• There are fewer than 100 persons per square mile in the U.S. Census Bureau tract in which the MRS is located.	1
POPULATION DENSITY	**DIRECTIONS:** Record **the single highest score** from above in the box to the right (maximum score = 5).	1

DIRECTIONS: Document any MRS-specific data used in selecting the ***Population Density*** classifications in the space provided.

The WFF Project 03 is located near Wattsville in Accomack County, VA. The 2010 Census estimate indicates that the population density of Accomack County is 73.8 people per square mile. Refer to Paragraph 2.3.3.1 of the SI Report.

Table 7

EHE Module: Population Near Hazard Data Element Table

DIRECTIONS: Below are six classifications describing the number of inhabited structures near the MRS. The number of inhabited buildings relates to the potential population near the MRS. Determine the number of inhabited structures within two miles of the MRS boundary and select the score that corresponds with the number of inhabited structures.

Note: The term inhabited structures is defined in Appendix C of the Primer.

Classification	Description	Score
26 or more inhabited structures	• There are 26 or more inhabited structures located up to 2 miles from the boundary of the MRS, within the boundary of the MRS, or both.	5
16 to 25 inhabited structures	• There are 16 to 25 inhabited structures located up to 2 miles from the boundary of the MRS, within the boundary of the MRS, or both.	4
11 to 15 inhabited structures	• There are 11 to 15 inhabited structures located up to 2 miles from the boundary of the MRS, within the boundary of the MRS, or both.	3
6 to 10 inhabited structures	• There are 6 to 10 inhabited structures located up to 2 miles from the boundary of the MRS, within the boundary of the MRS, or both.	2
1 to 5 inhabited structures	• There are 1 to 5 inhabited structures located up to 2 miles from the boundary of the MRS, within the boundary of the MRS, or both.	1
0 inhabited structures	• There are no inhabited structures located up to 2 miles from the boundary of the MRS, within the boundary of the MRS, or both.	0
POPULATION NEAR HAZARD	**DIRECTIONS:** Record **the single highest score** from above in the box to the right (maximum score = 5).	5

DIRECTIONS: Document any MRS-specific data used in selecting the ***Population Near Hazard*** classifications in the space provided.

There are more than 26 inhabited structures within a two-mile radius of the MRS boundary. Refer to Paragraph 2.3.3.1 of the SI Report.

Table 8

EHE Module: Types of Activities/Structures Data Element Table

DIRECTIONS: Below are five classifications of activities and/or inhabited structures and their descriptions. Review the types of activities that occur and/or structures that are present withinn two miles of the MRS and circle the scores that correspond with **all** the activities/structures classifications at the MRS.

Note: The term inhabited structure is defined in Appendix C of the Primer.

Classification	Description	Score
Residential, educational, commercial, or subsistence	• Activities are conducted, or inhabited structures are located up to two miles from the MRS's boundary or within the MRS's boundary, that are associated with any of the following purposes: residential, educational, child care, critical assets (e.g., hospitals, fire and rescue, police stations, dams), hotels, commercial, shopping centers, playgrounds, community gathering areas, religious sites, or sites used for subsistence hunting, fishing, and gathering.	5
Parks and recreational areas	• Activities are conducted, or inhabited structures are located up to two miles from the MRS's boundary or within the MRS's boundary, that are associated with parks, nature preserves, or other recreational uses.	4
Agricultural, forestry	• Activities are conducted, or inhabited structures are located up to two miles from the MRS's boundary or within the MRS's boundary, that are associated with agriculture or forestry.	3
Industrial or warehousing	• Activities are conducted, or inhabited structures are located up to two miles from the MRS's boundary or within the MRS's boundary, that are associated with industrial activities or warehousing.	2
No known or recurring activities	• There are no known or recurring activities occurring up to two miles from the MRS's boundary or within the MRS's boundary.	1
TYPES OF ACTIVITIES/STRUCTURES	**DIRECTIONS:** Record **the single highest score** from above in the box to the right (maximum score = 5).	**5**

DIRECTIONS: Document any MRS-specific data used in selecting the ***Types of Activities/Structures*** classifications in the space provided.

The NASA WFF visitor center (educational) is located adjacent to WFF Project 07 and visitors access Gun Butts No. 1 and 2 where rockets are on display. The Marine Science Consortium (educational) accesses their boats in the boat basin. The active NASA WFF Main Base (industrial or warehousing) and various bays and wetland areas (parks and recreational areas) are located within two miles of WFF Project 07. Refer to Paragraph 2.3.4.1 and Figure 2-3 of the SI Report.

Table 9

EHE Module: Ecological and/or Cultural Resources Data Element Table

DIRECTIONS: Below are four classifications of ecological and/or cultural resources and their descriptions. Review the types of resources present and circle the score that corresponds with the ecological and/or cultural resources present on the MRS.

Note: The terms ecological resources and cultural resources are defined in Appendix C of the Primer.

Classification	Description	Score
Ecological and cultural resources present	• There are both ecological and cultural resources present on the MRS.	5
Ecological resources present	• There are ecological resources present on the MRS.	3
Cultural resources present	• There are cultural resources present on the MRS.	3
No ecological or cultural resources present	• There are no ecological resources or cultural resources present on the MRS.	0
ECOLOGICAL AND/OR CULTURAL RESOURCES	**DIRECTIONS:** Record **the single highest score** from above in the box to the right (maximum score = 5).	3

DIRECTIONS: Document any MRS-specific data used in selecting the ***Ecological and/or Cultural Resources*** classifications in the space provided.

USFWS identified several federally threatened (Loggerhead sea turtle, Northeastern Beach tiger beetle, Piping Plover, Seabeach amaranth) and endangered (Delmarva Peninsula Fox squirrel, Roseate tern) species within WFF Project 07. No cultural resources were identified within WFF Project 07. Refer to Paragraphs 3.2.1.1, 3.2.1.2, and 3.2.2.1.

Table 10

Determining the EHE Module Rating

DIRECTIONS:

1. From Tables 1–9, record the data element scores in the **Score** boxes to the right.
2. Add the **Score** boxes for each of the three factors and record this number in the **Value** boxes to the right.
3. Add the three **Value** boxes and record this number in the **EHE Module Total** box below.
4. Circle the appropriate range for the **EHE Module Total** below.
5. Circle the **EHE Module Rating** that corresponds to the range selected and record this value in the **EHE Module Rating** box found at the bottom of the table.

Note:
An alternative module rating may be assigned when a module letter rating is inappropriate. An alternative module rating is used when more information is needed to score one or more data elements, contamination at an MRS was previously addressed, or there is no reason to suspect contamination was ever present at an MRS.

	Source	Score	Value
Explosive Hazard Factor Data Elements			
Munitions Type	Table 1	25	35
Source of Hazard	Table 2	10	
Accessibility Factor Data Elements			
Location of Munitions	Table 3	10	23
Ease of Access	Table 4	8	
Status of Property	Table 5	5	
Receptor Factor Data Elements			
Population Density	Table 6	1	14
Population Near Hazard	Table 7	5	
Types of Activities/ Structures	Table 8	5	
Ecological and /or Cultural Resources	Table 9	3	
EHE MODULE TOTAL			72

EHE Module Total	EHE Module Rating
92 to 100	A
82 to 91	B
71 to 81	C
60 to 70	D
48 to 59	E
38 to 47	F
less than 38	G
Alternative Module Ratings	Evaluation Pending
	No Longer Required
	No Known or Suspected Explosive Hazard
EHE MODULE RATING	C

Table 11

CHE Module: CWM Configuration Data Element Table

DIRECTIONS: Below are seven classifications of CWM configuration and their descriptions. Circle the scores that correspond to **all** the CWM configurations known or suspected to be present at the MRS.

Note: The terms CWM/UXO, CWM/DMM, physical evidence, and historical evidence are defined in Appendix C of the Primer.

Classification	Description	Score
CWM, that are either UXO, or explosively configured damaged DMM	The CWM known or suspected of being present at the MRS is: • CWM that are UXO (i.e., CWM/UXO). • Explosively configured CWM that are DMM (i.e., CWM/DMM) that have been damaged.	30
CWM mixed with UXO	• The CWM known or suspected of being present at the MRS are undamaged CWM/DMM or CWM not configured as a munition that are commingled with conventional munitions that are UXO.	25
CWM, explosive configuration that are undamaged DMM	• The CWM known or suspected of being present at the MRS are explosively configured CWM/DMM that have not been damaged.	20
CWM/DMM, not explosively configured or CWM, bulk container	The CWM known or suspected of being present at the MRS is: • Nonexplosively configured CWM/DMM either damaged or undamaged • Bulk CWM (e.g., ton container).	15
CAIS K941 and CAIS K942	• The CWM/DMM known or suspected of being present at the MRS is CAIS K941-toxic gas set M-1 or CAIS K942-toxic gas set M-2/E11.	12
CAIS (chemical agent identification sets)	• CAIS, other than CAIS K941 and K942, are known or suspected of being present at the MRS.	10
Evidence of no CWM	• Following investigation, the physical evidence indicates that CWM are not present at the MRS, or the historical evidence indicates that CWM are not present at the MRS.	0
CWM CONFIGURATION	**DIRECTIONS:** Record **the single highest score** from above in the box to the right (maximum score = 30).	0

DIRECTIONS: Document any MRS-specific data used in selecting the ***CWM Configuration*** classifications in the space provided.

CWM was not known to have been used, stored, or disposed of at WFF Project 06. Refer to Paragraph 2.4.3.1 of the SI Report.

TABLES 12 THROUGH 19 ARE INTENTIONALLY OMITTED ACCORDING TO ARMY GUIDANCE

Table 20

Determining the CHE Module Rating

DIRECTIONS:

1. From Tables 11–19, record the data element scores in the **Score** boxes to the right.
2. Add the **Score** boxes for each of the three factors and record this number in the **Value** boxes to the right.
3. Add the three **Value** boxes and record this number in the **CHE Module Total** box below.
4. Circle the appropriate range for the **CHE Module Total** below.
5. Circle the **CHE Module Rating** that corresponds to the range selected and record this value in the **CHE Module Rating** box found at the bottom of the table.

Note:
An alternative module rating may be assigned when a module letter rating is inappropriate. An alternative module rating is used when more information is needed to score one or more data elements, contamination at an MRS was previously addressed, or there is no reason to suspect contamination was ever present at an MRS.

	Source	Score	Value
CWM Hazard Factor Data Elements			
CWM Configuration	Table 11	0	0
Sources of CWM	Table 12		
Accessibility Factor Data Elements			
Location of CWM	Table 13		0
Ease of Access	Table 14		
Status of Property	Table 15		
Receptor Factor Data Elements			
Population Density	Table 16		0
Population Near Hazard	Table 17		
Types of Activities/ Structures	Table 18		
Ecological and /or Cultural Resources	Table 19		
CHE MODULE TOTAL			0

CHE Module Total	CHE Module Rating
92 to 100	A
82 to 91	B
71 to 81	C
60 to 70	D
48 to 59	E
38 to 47	F
less than 38	G
Alternative Module Ratings	Evaluation Pending
	No Longer Required
	No Known or Suspected CWM Hazard
CHE MODULE RATING	***No Known or Suspected CWM Hazard***

Table 21

HHE Module: Groundwater Data Element Table

Contaminant Hazard Factor (CHF)

DIRECTIONS: Record the maximum concentrations of all contaminants in the MRS's groundwater and their comparison values (from Appendix B of the Primer) in the table below. Additional contaminants can be recorded on Table 27. Calculate and record the ratios for each contaminant by dividing the maximum concentration by the comparison value. Determine the CHF by adding the contaminant ratios together, including any additional groundwater contaminants recorded on Table 27. Based on the CHF, use the CHF Scale to determine and display the CHF Value. If there is no known or suspected MC hazard present in the groundwater, select the box at the bottom of the table.

Note: Use dissolved, rather than total, metals analyses when both are available.

Contaminant	Maximum Concentration	Comparison Value	Unit	Ratios
Iron	65000	11000	ug/L	5.9
Antimony	5.7	15	ug/L	0.38

CHF Scale	CHF Value	
		Sum The Ratios 6.3
CHF > 100	H (High)	*CHF =* $\frac{\text{[Maximum Concentration of Contaminant]}}{\text{[Comparison Value for Contaminant]}}$
100 > CHF > 2	M (Medium)	
2 > CHF	L (Low)	

CONTAMINANT HAZARD FACTOR	**DIRECTIONS:** Record **the CHF Value** from above in the box to the right (maximum value = H).	*M*

Migratory Pathway Factor

DIRECTIONS: Circle the value that corresponds most closely to the groundwater migratory pathway at the MRS.

Classification	Description	Value
Evident	Analytical data or observable evidence indicates that contamination in the groundwater is present at, moving toward, or has moved to a point of exposure.	H
Potential	Contamination in groundwater has moved only slightly beyond the source (i.e., tens of feet), could move but is not moving appreciably, or information is not sufficient to make a determination of Evident or Confined.	M
Confined	Information indicates a low potential for contaminant migration from the source via the groundwater to a potential point of exposure (possibly due to geological structures or physical controls).	L
MIGRATORY PATHWAY FACTOR	**DIRECTIONS:** Record **the single highest value** from above in the box to the right (maximum value = H).	*M*

Receptor Factor

DIRECTIONS: Circle the value that corresponds most closely to the groundwater receptors at the MRS.

Classification	Description	Value
Identified	There is a threatened water supply well downgradient of the source and the groundwater is a current source of drinking water or source of water for other beneficial uses such as irrigation/agriculture (equivalent to Class I or IIA aquifer).	H
Potential	There is no threatened water supply well downgradient of the source and the groundwater is currently or potentially usable for drinking water, irrigation, or agriculture (equivalent to Class I, IIA, or IIB aquifer).	M
Limited	There is no potentially threatened water supply well downgradient of the source and the groundwater is not considered a potential source of drinking water and is of limited beneficial use (equivalent to Class IIIA or IIIB aquifer, or where perched aquifer exists only).	L
RECEPTOR FACTOR	**DIRECTIONS:** Record **the single highest value** from above in the box to the right (maximum value = H).	*M*
	No Known or Suspected Groundwater MC Hazard	☐

Table 21 Comments: Iron and antimony were detected at WFF Project 07 above maximum background concentrations derived from the "Background Soil and Groundwater Investigation Report for the Main Base, NASA Wallops Flight Facility" dated May 2004. Maximum concentrations at WFF Project 07 were detected in the following samples: WFF-MRS7-GW-00-03 (iron) and WFF-MRS7-GW-00-02 (antimony). Refer to Table 5-4 of the SI Report.

Table 22

HHE Module: Surface Water – Human Endpoint Data Element Table

Contaminant Hazard Factor (CHF)

DIRECTIONS: Record the maximum concentrations of all contaminants in the MRS's surface water and their comparison values (from Appendix B of the Primer) in the table below. Additional contaminants can be recorded on Table 27. Calculate and record the ratios for each contaminant by dividing the maximum concentration by the comparison value. Determine the CHF by adding the contaminant ratios together, including any additional surface water contaminants recorded on Table 27. Based on the CHF, use the CHF Scale to determine and record the CHF Value. If there is no known or suspected MC hazard for human endpoints present in the surface water, select the box at the bottom of the table.

Note: Use dissolved, rather than total, metals analyses when both are available.

Contaminant	Maximum Concentration	Comparison Value	Unit	Ratios

CHF Scale	CHF Value	Sum The Ratios	
CHF > 100	H (High)	$CHF = \frac{\text{[Maximum Concentration of Contaminant]}}{\text{[Comparison Value for Contaminant]}}$	
100 > CHF > 2	M (Medium)		
2 > CHF	L (Low)		
CONTAMINANT HAZARD FACTOR	**DIRECTIONS:** Record **the CHF Value** from above in the box to the right (maximum value = H).		

Migratory Pathway Factor

DIRECTIONS: Circle the value that corresponds most closely to the surface water migratory pathway at the MRS.

Classification	Description	Value
Evident	Analytical data or observable evidence indicates that contamination in the surface water is present at, moving toward, or has moved to a point of exposure.	H
Potential	Contamination in surface water has moved only slightly beyond the source (i.e., tens of feet), could move but is not moving appreciably, or information is not sufficient to make a determination of Evident or Confined.	M
Confined	Information indicates a low potential for contaminant migration from the source via the surface water to a potential point of exposure (possibly due to geological structures or physical controls).	L
MIGRATORY PATHWAY FACTOR	**DIRECTIONS:** Record **the single highest value** from above in the box to the right (maximum value = H).	

Receptor Factor

DIRECTIONS: Circle the value that corresponds most closely to the surface water receptors at the MRS.

Classification	Description	Value
Identified	Identified receptors have access to surface water to which contamination has moved or can move.	H
Potential	Potential for receptors to have access to surface water to which contamination has moved or can move.	M
Limited	Little or no potential for receptors to have access to surface water to which contamination has moved or can move.	L
RECEPTOR FACTOR	**DIRECTIONS:** Record **the single highest value** from above in the box to the right (maximum value = H).	
	No Known or Suspected Surface Water (Human Endpoint) MC Hazard	■

Table 22 Comments: None of the explosive analytes were detected in surface water samples collected. Refer to Table 5-3 of the SI Report.

Table 23

HHE Module: Sediment – Human Endpoint Data Element Table

Contaminant Hazard Factor (CHF)

DIRECTIONS: Record the maximum concentrations of all contaminants in the MRS's sediment and their comparison values (from Appendix B of the Primer) in the table below. Additional contaminants can be recorded on Table 27. Calculate and record the ratios for each contaminant by dividing the maximum concentration by the comparison value. Determine the CHF by adding the contaminant ratios together, including any additional sediment contaminants recorded on Table 27. Based on the CHF, use the CHF Scale to determine and record the CHF Value. If there is no known or suspected MC hazard with human endpoints present in the sediment, select the box at the bottom of the table.

Contaminant	Maximum Concentration	Comparison Value	Unit	Ratios
Copper	42	3100	mg/Kg	0.014

CHF Scale	CHF Value	Sum The Ratios	0.014
CHF > 100	H (High)	*CHF =* [Maximum Concentration of Contaminant] / [Comparison Value for Contaminant]	
100 > CHF > 2	M (Medium)		
2 > CHF	L (Low)		

CONTAMINANT HAZARD FACTOR	**DIRECTIONS:** Record **the CHF Value** from above in the box to the right (maximum value = H).	L

Migratory Pathway Factor

DIRECTIONS: Circle the value that corresponds most closely to the sediment migratory pathway at the MRS.

Classification	Description	Value
Evident	Analytical data or observable evidence indicates that contamination in the sediment is present at, moving toward, or has moved to a point of exposure.	H
Potential	Contamination in sediment has moved only slightly beyond the source (i.e., tens of feet), could move but is not moving appreciably, or information is not sufficient to make a determination of Evident or Confined.	M
Confined	Information indicates a low potential for contaminant migration from the source via the sediment to a potential point of exposure (possibly due to presence of geological structures or physical controls).	L
MIGRATORY PATHWAY FACTOR	**DIRECTIONS:** Record **the single highest value** from above in the box to the right (maximum value = H).	M

Receptor Factor

DIRECTIONS: Circle the value that corresponds most closely to the sediment receptors at the MRS.

Classification	Description	Value
Identified	Identified receptors have access to sediment to which contamination has moved or can move.	H
Potential	Potential for receptors to have access to sediment to which contamination has moved or can move.	M
Limited	Little or no potential for receptors to have access to sediment to which contamination has moved or can move.	L
RECEPTOR FACTOR	**DIRECTIONS:** Record **the single highest value** from above in the box to the right (maximum value = H).	M

No Known or Suspected Sediment (Human Endpoint) MC Hazard ☐

Table 23 Comments: Copper was detected at WFF Project 07 above the maximum concentration of background sediment samples collected during the 2011 SI field activities. The maximum concentration of copper at WFF Project 07 was detected in sample WFF-MRS7-SD-01-04. Refer to Table 5-2 of the SI Report.

Table 24

HHE Module: Surface Water – Ecological Endpoint Data Element Table

Contaminant Hazard Factor (CHF)

DIRECTIONS: Record the maximum concentrations of all contaminants in the MRS's surface water and their comparison values (from Appendix B of the Primer) in the table below. Additional contaminants can be recorded on Table 27. Calculate and record the ratios for each contaminant by dividing the maximum concentration by the comparison value. Determine the CHF by adding the contaminant ratios together, including any additional surface water contaminants recorded on Table 27. Based on the CHF, use the CHF Scale to determine and record the CHF Value. If there is no known or suspected MC hazard with ecological endpoints present in the surface water, select the box at the bottom of the table.

Contaminant	Maximum Concentration	Comparison Value	Unit	Ratios

CHF Scale	CHF Value	Sum The Ratios	
CHF > 100	H (High)	$CHF = \frac{\text{[Maximum Concentration of Contaminant]}}{\text{[Comparison Value for Contaminant]}}$	
100 > CHF > 2	M (Medium)		
2 > CHF	L (Low)		

CONTAMINANT HAZARD FACTOR	**DIRECTIONS:** Record **the CHF Value** from above in the box to the right (maximum value = H).	

Migratory Pathway Factor

DIRECTIONS: Circle the value that corresponds most closely to the surface water migratory pathway at the MRS.

Classification	Description	Value
Evident	Analytical data or observable evidence indicates that contamination in the surface water is present at, moving toward, or has moved to a point of exposure.	H
Potential	Contamination in surface water has moved only slightly beyond the source (i.e., tens of feet), could move but is not moving appreciably, or information is not sufficient to make a determination of Evident or Confined.	M
Confined	Information indicates a low potential for contaminant migration from the source via the surface water to a potential point of exposure (possibly due to presence of geological structures or physical controls).	L
MIGRATORY PATHWAY FACTOR	**DIRECTIONS:** Record **the single highest value** from above in the box to the right (maximum value = H).	

Receptor Factor

DIRECTIONS: Circle the value that corresponds most closely to the surface water receptors at the MRS.

Classification	Description	Value
Identified	Identified receptors have access to surface water to which contamination has moved or can move.	H
Potential	Potential for receptors to have access to surface water to which contamination has moved or can move.	M
Limited	Little or no potential for receptors to have access to surface water to which contamination has moved or can move.	L
RECEPTOR FACTOR	**DIRECTIONS:** Record **the single highest value** from above in the box to the right (maximum value = H).	

No Known or Suspected Surface Water (Ecological Endpoint) MC Hazard ■

Table 24 Comments: None of the explosive analytes were detected in surface water samples collected. Refer to Table 5 -3 of the SI Report.

Table 25

HHE Module: Sediment – Ecological Endpoint Data Element Table

Contaminant Hazard Factor (CHF)

DIRECTIONS: Record the maximum concentrations of all contaminants in the MRS's sediment and their comparison values (from Appendix B of the Primer) in the table below. Additional contaminants can be recorded on Table 27. Calculate and record the ratios for each contaminant by dividing the maximum concentration by the comparison value. Determine the CHF by adding the ratios together, including any additional sediment contaminants recorded on Table 27. Based on the CHF, use the CHF Scale to determine and record the CHF Value. If there is no known or suspected MC hazard with ecological endpoints present in the sediment, select the box at the bottom of the table.

Contaminant	Maximum Concentration	Comparison Value	Unit	Ratios
Copper	42	31.6	mg/Kg	1.3

CHF Scale	CHF Value	Sum The Ratios	1.3
CHF > 100	H (High)		
100 > CHF > 2	M (Medium)		
2 > CHF	L (Low)		

$$CHF = \frac{[\text{Maximum Concentration of Contaminant}]}{[\text{Comparison Value for Contaminant}]}$$

CONTAMINANT HAZARD FACTOR	**DIRECTIONS:** Record **the CHF Value** from above in the box to the right (maximum value = H).	*L*

Migratory Pathway Factor

DIRECTIONS: Circle the value that corresponds most closely to the sediment migratory pathway at the MRS.

Classification	Description	Value
Evident	Analytical data or observable evidence indicates that contamination in the sediment is present at, moving toward, or has moved to a point of exposure.	H
Potential	Contamination in sediment has moved only slightly beyond the source (i.e., tens of feet), could move but is not moving appreciably, or information is not sufficient to make a determination of Evident or Confined.	M
Confined	Information indicates a low potential for contaminant migration from the source via the sediment to a potential point of exposure (possibly due to presence of geological structures or physical controls).	L
MIGRATORY PATHWAY FACTOR	**DIRECTIONS:** Record **the single highest value** from above in the box to the right (maximum value = H).	*M*

Receptor Factor

DIRECTIONS: Circle the value that corresponds most closely to the sediment receptors at the MRS.

Classification	Description	Value
Identified	Identified receptors have access to sediment to which contamination has moved or can move.	H
Potential	Potential for receptors to have access to sediment to which contamination has moved or can move.	M
Limited	Little or no potential for receptors to have access to sediment to which contamination has moved or can move.	L
RECEPTOR FACTOR	**DIRECTIONS:** Record **the single highest value** from above in the box to the right (maximum value = H).	*M*

No Known or Suspected Sediment (Ecological Endpoint) MC Hazard ☐

Table 25 Comments: Copper was detected at WFF Project 07 above the maximum concentration of background sediment samples collected during the 2011 SI field activities. The maximum concentration of copper at WFF Project 07 was detected in sample WFF-MRS7-SD-01-04. Refer to Table 5-2 of the SI Report.

Table 26

HHE Module: Surface Soil Data Element Table

Contaminant Hazard Factor (CHF)

DIRECTIONS: Record the maximum concentrations of all contaminants in the MRS's surface soil and their comparison values (from Appendix B of the Primer) in the table below. Additional contaminants can be recorded on Table 27. Calculate and record the ratios for each contaminant by dividing the maximum concentration by the comparison value. Determine the CHF by adding the contaminant ratios together, including any additional surface soil contaminants recorded on Table 27. Based on the CHF, use the CHF Scale to determine and record the CHF Value. If there is no known or suspected MC hazard present in the surface soil, select the box at the bottom of the table.

Contaminant	Maximum Concentration	Comparison Value	Unit	Ratios
Zinc	1900	23000	mg/Kg	0.083
Lead	290	400	mg/Kg	0.72
Copper	92	3100	mg/Kg	0.03
Antimony	1.9	31	mg/Kg	0.061
Tetryl	0.35	240	mg/Kg	0.0015

CHF Scale	CHF Value	Sum The Ratios	0.91
CHF > 100	H (High)		
100 > CHF > 2	M (Medium)		
2 > CHF	L (Low)		

$$CHF = \frac{\text{[Maximum Concentration of Contaminant]}}{\text{[Comparison Value for Contaminant]}}$$

CONTAMINANT HAZARD FACTOR	**DIRECTIONS:** Record **the CHF Value** from above in the box to the right (maximum value = H).	L

Migratory Pathway Factor

DIRECTIONS: Circle the value that corresponds most closely to the surface soil migratory pathway at the MRS.

Classification	Description	Value
Evident	Analytical data or observable evidence indicates that contamination in the surface soil is present at, moving toward, or has moved to a point of exposure.	H
Potential	Contamination in surface soil has moved only slightly beyond the source (i.e., tens of feet), could move but is not moving appreciably, or information is not sufficient to make a determination of Evident or Confined.	M
Confined	Information indicates a low potential for contaminant migration from the source via the surface soil to a potential point of exposure (possibly due to presence of geological structures or physical controls).	L
MIGRATORY PATHWAY FACTOR	**DIRECTIONS:** Record **the single highest value** from above in the box to the right (maximum value = H).	M

Receptor Factor

DIRECTIONS: Circle the value that corresponds most closely to the surface soil receptors at the MRS.

Classification	Description	Value
Identified	Identified receptors have access to surface soil to which contamination has moved or can move.	H
Potential	Potential for receptors to have access to surface soil to which contamination has moved or can move.	M
Limited	Little or no potential for receptors to have access to surface soil to which contamination has moved or can move.	L
RECEPTOR FACTOR	**DIRECTIONS:** Record **the single highest value** from above in the box to the right (maximum value = H).	M

No Known or Suspected Surface Soil MC Hazard ☐

Table 26 Comments: Maximum metal and PAHs detections were compared to maximum background concentrations derived from the "Background Soil and Groundwater Investigation Report for the Main Base, NASA Wallops Flight Facility" dated May 2004. Maximum concentrations detected at WFF Project 07 were detected in the following samples: WFF-MRS7-SS-01-01 (antimony, acenaphthene, anthracene, naphthalene), WFF-MRS7-SS-01-03 (zinc), WFF-MRS7-SS-01-04 (lead), WFF-MRS7-SS-01-11 (nitrobenzene, tetryl), WFF-MRS7-SS-01-15 (nitroglycerine), and WFF-MRS7-SS-01-18 (copper). Refer to Table 5-1 in the SI Report.

Table 27

HHE Module: Supplemental Contaminant Hazard Factor Table

Contaminant Hazard Factor (CHF)

DIRECTIONS: Only use this table if there are more than five contaminants in any given medium present at the MRS. This is a supplemental table designed to hold information about contaminants that do not fit in the previous tables. Indicate the media in which these contaminants are present. Then record all contaminants, their maximum concentrations and their comparison values (from Appendix B of the Primer) in the table below. Calculate and record the ratio for each contaminant by dividing the maximum concentration by the comparison value. Determine the CHF for each medium on the

Note: Dissolved, rather than total, metals analyses are used when both are available.

Media	Contaminant	Maximum Concentration	Comparison Value	Ratio
Surface Soil	Acenaphthene	0.00077	3700	2.1E-07
Surface Soil	Anthracene	0.0033	22000	1.5E-07
Surface Soil	Naphthalene	0.0016	56	2.9E-05
Surface Soil	Nitrobenzene	0.16	20	0.008
Surface Soil	Nitroglycerine	0.29	1000	0.00029

Table 28
Determining the HHE Module Rating

DIRECTIONS:

1. Record the letter values (H, M, L) for the Contaminant Hazard, Migration Pathway, and Receptor Factors for the media (from Tables 21–26) in the corresponding boxes below.
2. Record the media's three-letter combinations in the Three-Letter Combination boxes below (three-letter combinations are arranged from Hs to Ms to Ls).
3. Using the HHE Ratings provided below, determine each media's rating (A-G) and record the letter in the corresponding Media Rating box below.

Media (Source)	Contaminant Hazard Factor Value	Migratory Pathway Factor Value	Receptor Factor Value	Three-Letter Combination (Hs-Ms-Ls)	Media Rating (A-G)
Groundwater (Table 21)	M	M	M	MMM	D
Surface Water/Human Endpoint (Table 22)					
Sediment/Human Endpoint (Table 23)	L	M	M	MML	E
Surface Water/Ecological Endpoint (Table 24)					
Sediment/Ecological Endpoint (Table 25)	L	M	M	MML	E
Surface Soil (Table 26)	L	M	M	MML	E

DIRECTIONS (cont.):

4. Select the single highest Media Rating (A is highest; G is lowest) and enter the letter in the HHE Module Rating box.

HHE MODULE RATING	D

Note:
An alternative module rating may be assigned when a module letter rating is inappropriate. An alternative module rating is used when more information is needed to score one or more media, contamination at an MRS was previously addressed, or there is no reason to suspect contamination was ever present at an MRS.

HHE Ratings (for reference only)

Combination	Rating
HHH	A
HHM	B
HHL	C
HMM	C
HML	D
MMM	D
HLL	E
MML	E
MLL	F
LLL	G
Alternative Module Ratings	Evaluation Pending
	No Longer Required
	No Known or Suspected MC Hazard

Table 29
MRS Priority

DIRECTIONS: In the chart below, circle the letter rating for each module recorded in Table 10 (EHE), Table 20 (CHE), and Table 28 (HHE). Circle the corresponding numerical priority for each module. If information to determine the module rating is not available, choose the appropriate alternative module rating. The MRS Priority is the single highest priority; record this relative priority in the MRS Prioriy or Alternative MRS Rating at the bottom of the table.

Note: An MRS assigned Priority 1 has the highest relative priority; an MRS assigned Priority 8 has the lowest relative priority. Only an MRS with CWM known or suspected to be present can be assigned Priority 1; an MRS that has CWM known or suspected to be present cannot be assigned Priority 8.

EHE Rating	Priority	CHE Rating	Priority	HHE Rating	Priority
		A	1		
A	2	B	2	A	2
B	3	C	3	B	3
C	4	D	4	C	4
D	5	E	5	D	5
E	6	F	6	E	6
F	7	G	7	F	7
G	8			G	8
Evaluation Pending		Evaluation Pending		Evaluation Pending	
No Longer Required		No Longer Required		No Longer Required	
No Known or Suspected Explosive Hazard		No Known or Suspected CWM Hazard		No Known or Suspected MC Hazard	
MRS PRIORITY or ALTERNATIVE MRS RATING				4	

APPENDIX L – REFERENCE COPIES

Located on CD.

FINAL

Response to Stakeholder Comments - Site Inspection Report for Wallops Flight Facility Project 07, Accomack County, Virginia

MMRP Project No. **C03VA030107**

Prepared for:

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June 2012

PROJECT: WALLOPS FLIGHT FACILITY FUDS			
STAKEHOLDER REVIEW COMMENTS			
		REVIEW: DATE: NAME:	Draft Final Site Inspection Report for Wallops Flight Facility Project 07, February 2012 16 May 2012 Paul E. Herman, P.E., VDEQ
ITEM	SECTION OR REFERENCE	COMMENT	ACTION
1.	General Comment	VDEQ agrees with the recommendation to conduct a remedial investigation/feasibility study at Project 07. Given this recommendation and in consideration of the workload of the VDEQ risk assessors, this Site Investigation Report was not provided to the VDEQ risk assessment staff for review. Risks to human and ecological receptors from MEC and MC are expected to be fully evaluated during the RI which will be reviewed by the VDEQ risk assessor.	A-ACCEPTED/CONCUR. No action necessary.
2.	Section ES.7	Regarding the 5th sentence which begins "Only expended and inert MD have been observed historically", does it refer to the entire MRS or only the water portion discussed in the 4th sentence? Please clarify.	A-ACCEPTED/CONCUR. The 5th sentence refers to the entire MRS. For clarification; the fourth sentence was moved to become the 10th sentence before the discussion of underwater anomalies detected.
3.	Section ES.8	Please revise the 6th sentence to acknowledge NASA owns the land associated with Project 07.	A-ACCEPTED/CONCUR. The 6th sentence of paragraph ES.8 was revised as suggested.
4.	Section 1.3	Please delete the last sentence as it does not seem necessary.	A-ACCEPTED/CONCUR. The last sentence of Section 1.3 was deleted.
5.	Section 2.2.2	Please delete the phrase "stakeholder and/or" from the last sentence.	A-ACCEPTED/CONCUR. The text was revised as suggested.
6.	Section 2.3.4	Please add future residents as a potential receptor and ensure future residents are considered throughout the document when developing the conceptual site model, evaluating exposures, and screening data.	A-ACCEPTED/CONCUR. The CSM was updated to include residents as potential future receptors and the following text was added to Paragraph 2.3.4, "*Although future land use plans do not include residential reuse, stakeholders have requested that residents be included as potential future receptors. The future residential use of MRS 7 is not expected due to the unlikely closure of NASA WFF.*" The following text was added to Section 5.1.3.2: "*Although future land use plans do not include residential reuse, stakeholders have requested that residents be included as potential future receptors and that COPCs are compared against USEPA regional SLs for residential soil to evaluate the upper bound for*

PROJECT: WALLOPS FLIGHT FACILITY FUDS			
STAKEHOLDER REVIEW COMMENTS			
		REVIEW:	Draft Final Site Inspection Report for Wallops Flight Facility Project 07, February 2012
		DATE:	16 May 2012
		NAME:	Paul E. Herman, P.E., VDEQ
ITEM	SECTION OR REFERENCE	COMMENT	ACTION
			potential site risks. However, future residential use of MRS 7 is not expected due to the unlikely closure of WFF."
7.	Section 2.3.7.1	Please note in this section some of the Town of Chincoteague drinking water comes from their wells in the Columbia aquifer and note the locations of these water supply wells relative to Project 07.	A-ACCEPTED/CONCUR. Information related to the Town of Chincoteague drinking water wells was added to Paragraph 2.3.7.1 per your suggestion.
8.	Section. 2.3.7.2	Please include the owners of the nearby wells such as Town of Chincoteague Wallops Flight Facility, NOAA, private residence, etc.	A-ACCEPTED/CONCUR. The last two sentences of Paragraph 2.3.7.2 were revised as follows, "*The ToC and NASA water supply well locations within a four mile radius of MRS 7 are shown on Figure 2-5. Information regarding the location of groundwater supply wells for private residences is not available to the general public, thus these wells are not included on Figure 2-5.*" No information was found regarding a well owned by NOAA in proximity to the WFF.
9.	Section 2.3.8.1	Please revise the last sentence as follows, "... within the Virginia Coastal Zone and *subject to the substantive requirements of* the Federal Coastal Zone Management Act (VDEQ 2010)."	A-ACCEPTED/CONCUR The last sentence of Paragraph 2.3.8.3.1 was revised as follows " *According to the VDEQ, the lead agency for the Virginia Coastal Zone Management Program, the WFF Project 07 is located within the Virginia Coastal Zone established as directed by the Federal Coastal Zone Management Act (VDEQ 2010)."*
10.	Section 2.5	Regarding the "citizen reports" referenced in the opening sentence, with whom would citizens file such reports and where would records of such reports be filed/archived?	A-ACCEPTED/CONCUR. Section 2.5 was updated as follows, "*Citizen reports are the result of a citizen calling the local authorities to remove a munitions item. Records of these reports can be filed with local EOD units, police, and/or fire and rescue who would maintain these records. Since military use of the MRS ceased, there are no known citizen reports of MEC or MD found at MRS 7 (USACE 2011). It would be expected that NASA would have knowledge of such records since their ownership of the property began; however, NASA is unaware of a citizen report occurring within WFF*

PROJECT: WALLOPS FLIGHT FACILITY FUDS			
STAKEHOLDER REVIEW COMMENTS			
		REVIEW: DATE: NAME:	Draft Final Site Inspection Report for Wallops Flight Facility Project 07, February 2012 16 May 2012 Paul E. Herman, P.E., VDEQ
ITEM	SECTION OR REFERENCE	COMMENT	ACTION
			Project 07 (TPMC 2012). Refer to Paragraph 3.1.1 for munitions finds mentioned by NASA during the TPP #1 meeting."
11.	Table 2-1	Why doesn't the table reflect the acreage of water investigated within the boat basin?	A-ACCEPTED/CONCUR. Table 2-1 represents the MRS 7 acreage for each of the four areas. The water acreage inspected during the SI activities was outside of the MRS 7 boundary. Therefore, no changes to the table have been made.
12.	Table 2-3, Number 14	Where is the Wallops Island National Wildlife Refuge border relative to Project 07?	A-ACCEPTED/CONCUR. The following comment was added to number 14 of Table 2-3, "*The Wallops Island National Wildlife Refuge is approximately 500 ft from the boundary of the MRS (USFWS 2011b).*"
13.	Section 3.1.4	Did the USEPA acknowledge the data collected for Project 07 would "support potential Hazard Ranking System scoring"? If so, please include a reference to this acknowledgement. If not, how is this DQO considered "attained" as only EPA is able to determine the suitability of the data for their HRS scoring purposes?	N- NON-CONCUR. Analytical data, environmental setting information, location of water supply wells, and other site-specific information collected during the SI may be relevant to an HRS score. Since an SI is a limited scope study, the data collected during this study can be used to support HRS scoring; however, this SI was not intended to be the only source of data used for HRS scoring. Therefore, since information collected during the SI may be relevant to an HRS score, the DQO was attained. As a result of USEPA's comment 2, the following text was added to Section 3.1.4: "*However, this SI was not intended to be the only source of data used to score WFF Project 07 in the HRS. While there is insufficient data in the SI for USEPA to perform an evaluation under the HRS Model, any data gaps will be discussed during the scoping process of the future RI.*"
14.	Section 3.1.6	Does the USEPA agree DQO 3 was attained? Who determines whether or not the DQO's were attained? Are the stakeholders queried? This section should state it is the opinion of the USACE the DQO's were attained but the ultimate determination of attainment requires input from the stakeholders.	N- NON-CONCUR. Refer to the response to VDEQ comment 13.

ACTION CODES: A-ACCEPTED/CONCUR; D-ACTION DEFERRED; W-WITHDRAWN; N-NON-CONCUR; V-VE POTENTIAL/VEP ATTACHED

PROJECT: WALLOPS FLIGHT FACILITY FUDS			
STAKEHOLDER REVIEW COMMENTS			
		REVIEW: DATE: NAME:	Draft Final Site Inspection Report for Wallops Flight Facility Project 07, February 2012 16 May 2012 Paul E. Herman, P.E., VDEQ
ITEM	SECTION OR REFERENCE	COMMENT	ACTION
15.	Section 3.2.1	Please note the proximity of Project 07 to the Wallops Island National Wildlife Refuge in this section.	A-ACCEPTED/CONCUR. The following sentence was added to Paragraph 3.2.1.1, "*In addition, the Wallops Island National Wildlife Refuge is approximately 500 feet from the boundary of the MRS (USFWS 2011b).*"
16.	Section 3.2.2	a) Please review the USACE February 28, 2011 letter to the Virginia State Historic Preservation Office (SHPO) and rewrite the entire section to reflect the tone of the letter. In the letter the USACE tells the Virginia SHPO "the proposed SI undertaking involves limited intrusive sampling, so significant impacts to cultural resources are not expected. The Baltimore District therefore has determined that the proposed project will have no effect on historic properties, and no further work is recommended at this time. However, if further remediation is recommended as a result of this inspection, or we become aware that historic properties are located at or near the property, we will continue coordination with your office." Clearly, this letter to the Virginia SHPO does not warrant or require a response as the USACE made a determination relative to the proposed project. The letter further states any future coordination between the offices would be initiated by the USACE. For any other efforts by USACE to contact a Virginia agency where no response was received, please include documentation of those efforts (letters, phone calls, persons contacted, etc.). Otherwise, please delete from this section all inferences to Virginia's unresponsiveness in this matter. As the purpose of the USACE letter was to consult with the Virginia SHPO as required by Section 106 of the National Historic Preservation Act more information is needed in this section to document how the USACE met the intent of the Programmatic Agreement Among U.S. Army Corps of Engineers Norfolk District Regulatory Office, Advisor)' Council on Historic Preservation, Virginia Department of Environmental Quality and Virginia State Historic Preservation Office Regarding Implementation of the Norfolk District Corps of Engineers State Program General Permit and Section 106 of the National Historic Preservation Act.	a) A-ACCEPTED/CONCUR. Inferences to Virginia's unresponsiveness have been deleted and Paragraph 3.2.2.1 was revised as follows, "*Prior to the SI field activities at WFF Project 07, USACE sent a letter with supporting figures (proposed sampling and areas of archaeological sensitivity) to the Virginia Department of Historic Resources for consultation. The letter indicated that, based on the cultural resource assessment completed in 2003 and the limited intrusive sampling proposed during the SI field activities, significant impacts to cultural resources were not expected. Given the limited field activities, USACE concluded that no adjustments were necessary to the sampling design to avoid impact on cultural resources. The letter and supporting figures sent by USACE, dated 28 February 2011, to VA SHPO is included in Appendix L.*" b) D-ACTION DEFERRED. Comment noted. This comment will be addressed during the scoping process of the future RI.

PROJECT: WALLOPS FLIGHT FACILITY FUDS			
STAKEHOLDER REVIEW COMMENTS			
		REVIEW: DATE: NAME:	Draft Final Site Inspection Report for Wallops Flight Facility Project 07, February 2012 16 May 2012 Paul E. Herman, P.E., VDEQ
ITEM	SECTION OR REFERENCE	COMMENT	ACTION
		b) Prior to initiating any intrusive investigative activities (I.e., excavation to acquire anomalies) will the USACE develop a plan to ensure possible encounters with cultural or archeological artifacts are properly managed and preserved?	
17.	Section 3.3.1.2	The opening sentence implies all QR occurred outside the boundaries of the 4 primary focus areas. Is this correct?	A-ACCEPTED/CONCUR. The sentence was revised as follows for clarification, "*...however, additional QR and sampling were completed outside of the boundary of these four areas.*"
18.	Section 3.3.2.4	Please revise the opening sentence to note NASA provided the background data set to the USACE.	A-ACCEPTED/CONCUR. The first sentence of Paragraph 3.3.2.2 was revised from "USACE" to "NASA".
19.	Section 4.2.1.1	Please consider rewriting the opening sentence as follows, "MRS 7 includes four areas (Gun Butt No.1, Gun Butt No.2, the South Bank of the Boat Basin, and the Pyrotechnics Bum Area). The SI field activities focused on these four areas and included some areas outside the boundary of the MRS 7."	A-ACCEPTED/CONCUR. The first two sentences of Paragraph 4.2.1.1 were revised as follows, "*MRS 7 comprises four areas (Gun Butt No. 1, Gun Butt No. 2, the South Bank of the Boat Basin, and the Pyrotechnics Burn Area) which were the focus of this SI. However, the SI field activities included some areas outside the boundary of MRS 7.*"
20.	Section 5.1.3.15	Were the Virginia Water Quality Standards (9 VAC25-260-1AO) considered when selecting screening criteria for surface water quality comparisons?	A-ACCEPTED/CONCUR. As documented in the approved Final Site Specific Work Plan (SS-WP) for WFF Project 07 and the SI Report, the National Ambient Water Quality Criteria were used for screening COPECs in surface water.
21.	Section 5.1.3.21	Please describe how cumulative impacts were considered during the screening process.	A-ACCEPTED/CONCUR. The following sentence was added to the relevant Paragraph 5.1.3.10, "*These adjustments to the residential screening values used in the HHRA account for the potential cumulative effect of simultaneous exposures to multiple non-carcinogens.*"
22.	Section 5.1.4.14 and Section 5.1.4.16	In the opening sentence please replace "risk assessment" with "SLERA".	A-ACCEPTED/CONCUR. The text was revised as suggested.
23.	Section 5.2.0.5	Why is a chemical detection at levels that exceed maximum and/or	N-NON-CONCUR. As shown on the CSM included in

PROJECT: WALLOPS FLIGHT FACILITY FUDS			
STAKEHOLDER REVIEW COMMENTS			
		REVIEW: DATE: NAME:	Draft Final Site Inspection Report for Wallops Flight Facility Project 07, February 2012 16 May 2012 Paul E. Herman, P.E., VDEQ
ITEM	SECTION OR REFERENCE	COMMENT	ACTION
		mean site background sample concentrations necessary in order for a pathway to be considered complete? The mere act of drinking groundwater or working in surface soil presents a complete pathway to those media. Whether or not the receptor is at risk from a specific exposure pathway depends on the concentration of chemicals in the specific media.	the approved SS-WP, for a pathway to be complete, it must include a source, an exposure medium, an exposure route, and a receptor. Constituent concentrations at or below background are not considered indicative of a source but reflective of background (non-influenced) conditions. The first sentence in Section 5.2.0.5 was revised as follows: "*Under the MMRP program, a pathway is complete for this SI…*"
24.	Table 5-1 through 5-4	Is it possible to incorporate the screening values into these tables? Please define the use of shaded, bold, and italicized data in Table 5-2.	A-ACCEPTED/CONCUR. The tables were revised as suggested.
25.	Section 5.4.2	Why weren't ecological receptors considered during the screening of subsurface soil? Burrowing animals are expected to inhabit uplands adjacent to marshes and could be exposed to subsurface soil in these areas.	A-ACCEPTED/CONCUR. Ecological receptors (biota) were not identified in the Final SS-WP as potential receptors for subsurface soil at MRS 7. Therefore, the SLERA used the EcoSSLs for the most sensitive ecological receptors for surface soils. These receptors were identified in the Final SS-WP. Potential subsurface ecological receptors will be addressed during the scoping process of the future RI.
26	Section 6, General Comment	Please ensure specific results and conclusions for each media (soil, subsurface soil, groundwater, surface water, and sediment) and receptor (human or ecological) are presented for each portion of the MRS. As there are 4 areas associated with the MRS, the text for each area should discuss results and conclusions for each receptor and each media. Perhaps each area could be assigned a subsection and each media assigned a sub-subsection, i.e., Section 6 - Summary and Conclusions - Boat Basin/Visitors Information Center (MRS 7), Section 6.1-Pyrotechnic Burn Area, Section 6.1.1-Surface Soil (human and eco receptors), Section 6.1.2- Subsurface Soil (human and eco receptors), etc.	A-ACCEPTED/CONCUR. The text was revised to discuss the MC results and conclusions for each medium at each area of MRS 7.
27	Section 6.1.1	Add future residents and burrowing animals to the lists of potential human and ecological receptors.	A-ACCEPTED/CONCUR. Future residents were added as potential human receptors to the text and CSM (refer

PROJECT: WALLOPS FLIGHT FACILITY FUDS			
STAKEHOLDER REVIEW COMMENTS			
		REVIEW: DATE: NAME:	Draft Final Site Inspection Report for Wallops Flight Facility Project 07, February 2012 16 May 2012 Paul E. Herman, P.E., VDEQ
ITEM	SECTION OR REFERENCE	COMMENT	ACTION
			to response to comment #6). Burrowing animals were not included as potential ecological receptors in subsurface soil (refer to response to comment #25).
28	Section 6.1.2	Please include some discussion of the surface and subsurface anomalies detected during the QR and any SI sampling limitations the anomalies may have presented.	A-ACCEPTED/CONCUR. The sampling limitations due to surface and subsurface anomalies occurred in the Pyrotechnics Burn Area and this discussion is included in Paragraph ES.12, Section 3.4, and Section 7.0.1.
29	Section 6.1.4	Please consider revising the 3rd sentence as follows, "In the Pyrotechnics Bum Area and the Gun Butt No. 1 and 2 Area iron concentrations were below background; therefore, based on the limited data available the evaluation identified no risks to human receptors due to iron released from MD."	A-ACCEPTED/CONCUR. Paragraph 6.1.4 through 6.1.9 was revised as result of VDEQ comment 26. Paragraph 6.2.1 was revised as follows, "*Iron was detected below background concentrations; therefore, based on the limited data available for evaluation (samples could not be collected from within the fenced Pyrotechnics Burn Area), no risks to human receptors from FUDS-related activities were determined.*" "*Based on the data available,..*" was added to Paragraph 6.3.1 which discusses the surface and subsurface soil risk conclusions for Gun Butts No 1 and 2.
30	Section 6.1.5	Are all portions of the MRS (Pyro, Gun Butt, Basin) subject to the result/conclusion presented? Please consider revising the 4th sentence as follows, "Based on the limited data available, iron concentrations in the South Bank of the Boat Basin, Pyrotechnics Burn Area and the Gun Butt No.1 and 2 Area were below background levels indicating no risk to human receptors due to iron released from MD."	A-ACCEPTED/CONCUR. Refer to response to VDEQ comment 29 for the revision to Paragraph 6.2.2.
31	Section 6.1.9	Please consider revising the 3rd sentence as follows, "However, based on the limited data available, iron concentrations detected in the Pyrotechnics Burn Area were below background levels indicating no risk to human receptors due to iron released to groundwater from MD."	A-ACCEPTED/CONCUR. Refer to response to VDEQ comment 29 for the revision to Paragraph 6.2.3.

ACTION CODES: A-ACCEPTED/CONCUR; D-ACTION DEFERRED; W-WITHDRAWN; N-NON-CONCUR; V-VE POTENTIAL/VEP ATTACHED

PROJECT: WALLOPS FLIGHT FACILITY FUDS			
STAKEHOLDER REVIEW COMMENTS			
		REVIEW: DATE: NAME:	Draft Final Site Inspection Report for Wallops Flight Facility Project 07, February 2012 22 May 2012 TJ Meyer, NASA WFF
ITEM	SECTION OR REFERENCE	COMMENT	ACTION
Intro	No reference	I have completed the review of the Project 7 Site Investigation Report and appreciate the opportunity to review this report. I concur with the report recommendation to conduct a remedial investigation/feasibility study at Project 7. In addition, I have the following comments:	A-ACCEPTED/CONCUR. No action necessary.
1.	p. 2-5, Section 2.3.7	Please indicate that the drinking water wells near Project 7 supply the Town of Chincoteague. It would be beneficial to the reader to have a figure showing the location, well name, user and depth of nearby wells.	A-ACCEPTED/CONCUR. Refer to the responses to VDEQ comments 7 and 8.
2.	p. 5-16, Section 5.2.0.5, 1st bullet	This is not required to have a complete pathway. Please delete.	N-NON-CONCUR. Refer to the response to VDEQ comment 23.

ACTION CODES: A-ACCEPTED/CONCUR; D-ACTION DEFERRED; W-WITHDRAWN; N-NON-CONCUR; V-VE POTENTIAL/VEP ATTACHED

PROJECT: WALLOPS FLIGHT FACILITY FUDS			
STAKEHOLDER REVIEW COMMENTS			
		REVIEW: DATE: NAME:	Draft Final Site Inspection Report for Wallops Flight Facility Project 07 24 May 2012 Dawn Fulsher, USEPA
ITEM	SECTION OR REFERENCE	COMMENT	ACTION
1	General	EPA agrees with the United State Army Corps of Engineers (USACE's) recommendation that a Remedial Investigation/ Feasibility Study (RI/FS) is warranted for Site 7, Boat Basin and Visitor's Information Center (Land portion).	A-ACCEPTED/CONCUR. No action necessary.
2	Section 2.3.7.1	EPA suggests modifying the sentence that indicates that the Columbia aquifer is not a major source of drinking water and changing the sentence to read that the Columbia aquifer is used minimally or in a limited capacity for drinking water. The NASA Site Management Plan (SMP) for 2012 and 2013 indicates that: "Three of the Town of Chincoteague wells, TOC 3A, 3B and 3C, are completed within the Columbia aquifer at depths of 40 to 60 feet below ground surface. Two of these wells are operated on a seasonal as-needed basis and the other is inoperable." The text should be modified to include the information on the Town of Chincoteague wells.	A-ACCEPTED/CONCUR. Refer to the responses to VDEQ comments 7 and 8. Please note that the most recent water withdrawal permit indicates the Columbia aquifer wells are used on a daily basis and the water is blended with water withdrawn from the Yorktown-Eastover aquifer.
3	Section 2.3.7.2	While specific locations of domestic and community wells are not typically available to the public, utilities may provide maps depicting which structures and homes are connected to the municipal water system. To obtain an estimate of the population served by private wells in a 4 mile radius you would count the structures not connected to public water then multiply that number by the average number of individuals per household as reported in the most recent census. EPA uses this information when evaluating a site under the Hazardous Ranking System (HRS) model. EPA suggests adding this information to the report in this section.	D-ACTION DEFERRED. Comment noted. This comment will be addressed during the scoping process of the future RI. Refer to the responses to VDEQ comments 7 and 8.
4	Section 2.3.8	Please indicate if there are any identified commercial or recreational fisheries within the boundary of NASA Wallops.	D-ACTION DEFERRED. Comment noted. This comment will be addressed during the scoping process of the future RI.
5		While there is insufficient data in the Project 7 SI for EPA to perform an evaluation under the Hazardous Ranking System (HRS) Model, EPA expects that any data gaps need be	D-ACTION DEFERRED. Comment noted. This comment will be addressed during the scoping process of the future RI.

PROJECT: WALLOPS FLIGHT FACILITY FUDS			
STAKEHOLDER REVIEW COMMENTS			
		REVIEW:	Draft Final Site Inspection Report for Wallops Flight Facility Project 07
		DATE:	24 May 2012
		NAME:	Dawn Fulsher, USEPA
ITEM	SECTION OR REFERENCE	COMMENT	ACTION
		addressed during the Remedial Investigation. EPA will provide more specific comments regarding these data gaps once the USACE issues the sampling plan for the RI to the regulators.	

ACTION CODES: A-ACCEPTED/CONCUR; D-ACTION DEFERRED; W-WITHDRAWN; N-NON-CONCUR; V-VE POTENTIAL/VEP ATTACHED

APPENDIX C

PROJECT POINTS OF CONTACT

Project Points of Contact

Name	Title/Project Function	Address	Contact Information
USACE			
Linda Evans	USACE Contracting Officer (KO)	U.S. Army Corps of Engineers, Baltimore District 10 South Howard Street Baltimore, MD 21201-1715	410-962-3710 (office) linda.evans@usace.army.mil
Sesh Lal	USACE Contracting Officer's Representative (COR)	U.S. Army Corps of Engineers, Baltimore District 10 South Howard Street Baltimore, MD 21201-1715	410-962-6728 (office) sesh.lal@usace.army.mil
Sher Zaman	USACE Project Manager	U. S. Army Corps of Engineers, Baltimore District 10 South Howard Street Baltimore, MD 21201-1715	410-962-3134 (office) sher.zaman@usace.army.mil
Tom Delaney	Contract Specialist	U. S. Army Corps of Engineers, Baltimore District 10 South Howard Street Baltimore, MD 21201-1715	410-962-2063 (office) thomas.delaney@usace.army.mil
EPA Region III			
Steve Hirsh	Remedial Project Manager	EPA Region 3 1650 Arch Street Philadelphia, PA19103	215 814-3352 (office) hirsh.steven@epa.gov
NASA			
T.J. Meyer	Restoration Program Manager	NASA Wallops Flight Facility Goddard Space Flight Center Environment Office, Code 250 Wallops Island, VA 23337	757-824-2319 Theodore.j.meyer@nasa.gov
VDEQ			
Paul Herman	Remediation Project Manager	Virginia Department of Environmental Quality 629 East Main Street Richmond, VA 23218	804-698-4464 (office) peherman@deq.virginia.gov

Project Points of Contact (Continued)

Name	Title/Project Function	Address	Contact Information
WESTON			
Greg Daloisio	Program Manager	Weston Solutions, Inc. 1400 Weston Way P.O. Box 2653, Bldg 4-2 West Chester, PA 19380	610-701-3786 (office) 610-780-0966 (mobile) 610-701-3187 (fax) G.Daloisio@westonsolutions.com
Tony Pace	Project Manager	Weston Solutions, Inc. 2551 Eltham Ave. Suite I Norfolk, VA 23513-2505	757-819-5310 (office) 757-362-2461 (mobile) 757-548-0774 (fax) anthony.pace@westonsolutions.com
Scott Collier	Senior UXO Supervisor (SUXOS)	Weston Solutions, Inc. 1400 Weston Way P.O. Box 2653, Bldg 4-2 West Chester, PA 19380	256-282-2180 (mobile) eodscott@yahoo.com
Dan Dorrell	UXO Quality Control Specialist/ Safety Officer	Weston Solutions, Inc. 1400 Weston Way P.O. Box 2653, Bldg 4-2 West Chester, PA 19380	716-573-6780 (mobile) dcdorrell@yahoo.com

APPENDIX D

RESUMES

GREG DALOISIO, PMP — PROGRAM MANAGER

EXPERIENCE SUMMARY

- More than 27 years of experience in hazardous, radioactive, and mixed waste management including SIs, RI/FSs, RAs, RDs, PPs, and RODs.
- Project Manager for $22M award-winning program at LEAD, recipient of the Army's 2002 National Award for Environmental Restoration.
- More than 16 years of experience managing RI/FS projects within the geographical area including the TOAR MEC RI/FS project.
- Led various PBA/FFP/CR TOs at FUDS, FUSRAP, IRP, and BRAC sites.

Education/Registration:

B.S., Mechanical Engineering

Project Management Professional, Project Management Institute

Munitions Response Site Prioritization Protocol Training Modules and Reference Material

Society of American Military Engineers, Baltimore Post

American Society of Mechanical Engineers (ASME)

Experience:

Program Manager, Multiple Award Military Munitions Services (MAMMS) and Environmental Response Services Contracts, Various Locations, U.S. Army Corps of Engineers, (USACE), Baltimore District. Program Manager for $180M contract, including current execution of seven performance-based delivery orders valued at over $30M conducting Site Inspections, Remedial Investigations, and Remedial Actions at MMRP sites. Responsible for all contractual requisites such as cost, schedule, project staffing, technical requirements, and small business participation. Develops and enforces program-level systems and practices for ensuring TO safety, quality control, consistency, sharing of lessons learned and best practices, continuous improvement, and closeout.

Program Manager, Hazardous, Toxic, and Radioactive Waste (HTRW) Contracts, Various Locations, USACE, Baltimore District. Program Manager for $25-million and $15-million indefinite delivery-type, firm fixed price (FFP) and cost reimbursement contracts to perform HTRW and MEC studies, investigations, and designs for the USACE, Baltimore District.

Program Manager, RI/RAs of 60+ Base Realignment and Closure (BRAC) Parcels, LEAD, Chambersburg, PA, USACE, Baltimore District, and U.S. Army Environmental Center (USAEC). Responsible for simultaneous investigations at up to 20 parcels to determine if the property is suitable for industrial reuse by the Local Redevelopment Authority (LRA). Work conducted under two contracts: USACE Balt. HTRW and USAEC PBA contracts.

Program Manager, RI/FS for the Tobyhanna Artillery Ranges Formerly Used Defense Site (TOAR-FUDS), Tobyhanna, PA, PADEP. Led RI/FS to characterize the nature of MEC and MC and related contamination, evaluate current and future risks, and evaluate remedial alternatives at the 25,000-acre TOAR-FUDS. Managed geophysical and UXO crews of up to 25 personnel to conduct geophysical mapping, data processing, anomaly reacquisition, intrusive investigations, and safe disposal of all UXO items. Coordinated with PADEP, USACE, EPA Region 3, the local Technical Review Committee, and current property owners (State Park and State Game Lands).

ANTHONY PACE — PROJECT MANAGER

EXPERIENCE SUMMARY

- **30+ years of environmental experience for federal, state, and municipal clients. 20+ years of project management experience.**
- **Highly developed understanding of applicable federal, state, and local laws, regulations, and guidance.**
- **20+ years of experience dealing with various state and EPA regulations related to CERCLA, and MMRP at numerous Army installations.**
- **Extensive MEC experience; working knowledge of munitions site inspections/investigations.**

Education/Registration:

B.S., Civil Engineering (1981)
Association of Engineering Geologists
Society of American Military Engineers

Experience:

Project Manager/Leader, HTRW Contracts, USACE, Baltimore District. Led client-successful multi-delivery order (DO) projects for the Army as project manager/leader for numerous installations including ***Fort Eustis, Fort Story, Fort Lee, and the Former Nansemond Ordnance Depot***. Provided ***on-site supervision.*** Studies included HTRW/***MEC remedial investigations, risk assessments,*** fate and transport modeling, ***remediation assessments,*** feasibility studies, and long-term monitoring at sites (IRP and RCRA SWMUs) contaminated with pesticides, explosives, dioxins and furans, PCBs, chlorinated solvents, and lead. Successful completion of the deliverables included ensuring compliance with various VDEQ, EPA Region 3, and Army environmental regulations and guidance documents. HTRW contract, including MEC.

Project Manager/Team Leader, HTRW Contract, USACE, Baltimore District. Managed multiple Army Southeast Region DOs, which included planning, management, billing, and progress reporting for Army installations. Led the preparation of the Operational Range Assessment Program (ORAP) Qualitative Assessment Reports for three installations (Redstone Arsenal, Pelham Range, and Fort McClellan) in Alabama. Combined and analyzed the data from the Fort McClellan and Pelham Range sites into one report providing a substantial cost savings. Successfully completed the deliverables and ensured compliance with various state, EPA, and Army environmental regulations and guidance documents.

Project Manager, MMRP HRR, Bazooka Range, Fort Pickett, VA. Provided project management and technical leadership for the performance of an SI at a former Bazooka Range at Fort Pickett, Virginia. The project included the performance of a Historical Records Review including archive research, interviews, site visits, preparation of a HRR Work Plan, data quality objectives, conceptual site model, and data and data gap uncertainty analysis. Results of the study indicated that the site was not program-eligible because the site was not located within the operational footprint of the installation.

Project Manager, RI/FS, Remedial Design, Record of Decision, Fort Story, VA. Provided project management and technical leadership on multiple sites and projects at Fort Story, Virginia including the completion of RIs at four hazardous waste disposal sites, the detailed analysis of various remedial alternatives for groundwater and soil contamination, public interface through the preparation of two Proposed Plans and attendance at public meetings, and the completion of two Records of Decision to document the selected remedy for each site.

Army Environmental Command, Technical Leader/Regulatory Specialist. Provided technical leadership and on-site supervision for a PBC contract at Fort Eustis and Fort Lee resulting in cost savings through reduction of the long-term monitoring programs for several sites. Projects included numerous RAs, RIs, feasibility studies, proposed plans, records of decision, long-term monitoring plans and reports for contaminated sediment sites involving the cleanup of tidal wetlands, pesticide sites, and groundwater sites with chlorinated solvent contamination.

JOHN WILLIAMS, P.G. — SENIOR GEOPHYSICIST RI

EXPERIENCE SUMMARY

- **More than 36 years of experience in geological and geophysical investigations, including subsurface profiling with GPR, electrical resistivity (ER) and EM conductivity, TDEM, magnetics, VLF, SP, shallow seismic refraction, magnetotelluric, GPS techniques.**
- **Experience in analysis, interpretation, integration, and reporting of geological and geophysical data; and 6 years of experience in bathymetric, hydrographic, and aquatic biological studies.**

Education/Registration:

B.S., Earth Science (Geology)—West Chester University

Graduate Studies, Geophysics—West Chester University

40-Hour Hazardous Waste Site Training Course, OSHA 29 CFR 1910.120(e)(3), Weston

Experience:

Senior Geophysicist, Remedial Investigation (RI), Fort Indiantown Gap (FIG) Military Reservation in Annville, PA, National Guard Bureau (NGB). Responsible for technical matters involving geophysical tools and techniques employed on this project. The duties include attending TPP and Community Awareness meetings, selecting proper geophysical and navigation equipment, design and implementation of a geophysical investigation plan to accomplish the project's objectives, and assurance of the overall quality and integrity of the geophysical effort. Also responsible for QC of anomaly selection, and preparation of project variance documentation.

Senior Geophysicist, Time-Critical-Removal Action (TCRA), Full-Scale Digital Geophysical Mapping for MEC, Surf City and Ship Bottom, Ocean County, NJ, USACE. Provided oversight and shared responsibility in the planning and development stage and data QC for the DGM mapping activities. Responsible for procurement of a second towed array.

Senior Geophysicist, For the Mag and Dig Operations for MEC, Former Tobyhanna Artillery Range (TOAR), Tobyhanna, PA, USACE. Responsible for data input and upload to project data base, development of Daily and Bi-weekly Reports, participation in bi-weekly conference call with stakeholders, and coordinating with SUXOs and CENAB QA specialist.

Senior Geophysicist, Geophysical Investigations at Various Sites, Spring Valley, DC, USACE, Baltimore District, HTRW 2000 and HTRW 2005 Contracts. Conducted and provided technical oversight for digital geophysical mapping of 56 property parcels under this high profile project for USACE, Baltimore District. Required close coordination with USACE based on limited time-frames for rights-of-entry (ROE). The project required state-of-the-art geophysical techniques for mapping anomalies, looking for evidence of MEC.

Senior Geophysicist, UXO Site Investigation (SI), Thule AB, Greenland, AFCEE Environmental Remedial Action Contract (ENRAC). Assisted in preparation of work scope. Provided technical oversight in the preliminary UXO site investigations, including digital geophysical mapping. Work consisted of visual sweeps of off-base areas where UXO had previously been found, delineation of other UXO source areas, and mapping of located UXO in other areas of environmental concern with electromagnetic instrumentation. Work was performed at remote locations in rigorous terrain.

APPENDIX E

ACCIDENT PREVENTION PLAN/SITE SAFETY AND HEALTH PLAN

APPENDIX E

ACCIDENT PREVENTION PLAN

MILITARY MUNITIONS RESPONSE PROGRAM
BOAT BASIN, VISITORS INFORMATION CENTER MRS
REMEDIAL INVESTIGATION
WALLOPS FLIGHT FACILITY, VIRGINIA

Contract No. W912DR-09-D-0015
Delivery Order No. 0035

Prepared by:
WESTON SOLUTIONS, INC.
2551 Eltham Avenue, Suite I
Norfolk, Virginia 23513

October 2013

Work Order No. 03886.550.035.0320

TABLE OF CONTENTS

Section **Page**

TABLE OF CONTENTS (Continued)

TABLE OF CONTENTS (Continued)

LIST OF ATTACHMENTS

LIST OF FIGURES

Title **Page**

LIST OF TABLES

Title **Page**

LIST OF ACRONYMS

ACGIH	American Conference of Governmental Industrial Hygienists
AHA	Activity Hazard Analysis
ANSI	American National Standards Institute
APP	Accident Prevention Plan
BBP	bloodborne pathogen
BBS	Behavior-Based Safety
BIP	blow-in-place
CEO	Chief Executive Officer
CFR	Code of Federal Regulations
CIH	Certified Industrial Hygienist
COR	Contracting Officer's Representative
CPR	cardiopulmonary resuscitation
CSP	Certified Safety Professional
DERP	Defense Environmental Restoration Program
DGM	digital geophysical mapping
DMM	discarded military munitions
DO	delivery order
DoD	Department of Defense
DOT	Department of Transportation
DPT	direct push technology
EHS	environmental health and safety
EMR	experience modification rate
EMS	emergency medical service
EOD	Explosive Ordnance Disposal
EPA	U.S. Environmental Protection Agency
ESP	Explosives Site Plan
FUDS	Formerly Used Defense Site
GDA	Government Designated Authority
GFCI	ground fault circuit interrupter
GPS	Global Positioning System
HAZWOPER	Hazardous Waste Operations and Emergency Response
HE	high explosive
HFA	Human Factors Applications, Inc.
HTRW	hazardous, toxic, and radioactive waste

LIST OF ACRONYMS (CONTINUED)

KO	Contracting Officer
LEL	lower explosive limit
MC	munitions constituents
MD	munitions debris
MEC	munitions and explosives of concern
MGFD	munition with the greatest fragmentation distance
MMRP	Military Munitions Response Program
MPPEH	material potentially presenting an explosive hazard
MRS	munitions response site
MSD	minimum separation distance
MSDS	material safety data sheet
NA	not applicable
NASA	National Aeronautics and Space Administration
NFPA	National Fire Protection Association
NIOSH	National Institute for Occupational Safety and Health
NOAA	National Oceanic and Atmospheric Administration
NOI	Notice of Incident
NWS	National Weather Service
OESS	Ordnance and Explosives Safety Specialist
OHP	Occupational Health Program
ORP	oxidation-reduction potential
OSHA	Occupational Safety and Health Administration
PFD	personal flotation device
PID	photoionization detector
PPE	personal protection equipment
PVC	polyvinyl chloride
PWS	performance work statement
QC	quality control
RAC	Risk Assessment Code
RI	remedial investigation
SI	site inspection
SOH	safety and occupational health
SSHO	Safety and Health Officer
SSHP	Site Safety and Health Plan

LIST OF ACRONYMS (CONTINUED)

SUXOS	Senior Unexploded Ordnance Supervisor
TBD	to be determined
TLV	threshold limit value
U.S.	United States
USACE	U.S. Army Corps of Engineers
USCG	U.S. Coast Guard
UXO	unexploded ordnance
UXOQCS	UXO Quality Control Specialist
UXOSO	Unexploded Ordnance Safety Officer
VDEQ	Virginia Department of Environmental Quality
WESTON®	Weston Solutions, Inc.
WFF	Wallops Flight Facility

1. SIGNATURE PAGE

ACCIDENT PREVENTION PLAN
MILITARY MUNITIONS RESPONSE PROGRAM
BOAT BASIN, VISITOR CENTER MRS REMEDIAL INVESTIGATION
WALLOPS FLIGHT FACILITY, VA

Prepared by: Craig LaCosse WESTON – Senior Scientist (757) 819-5312	10/3/2013 Date
Approved by: Greg Daloisio WESTON – Mid-Atlantic Federal Team Manager (610) 701-3786	10/3/2013 Date
Concurrence by: Chris Baer, Certified Safety Professional (CSP) WESTON – Federal Team Health and Safety Officer (610) 701-3653	10/3/2013 Date
Concurrence by: Anthony Pace WESTON – Project Manager (757) 819-5310	10/3/2013 Date

Team personnel assigned to this project shall be familiar with the possible hazards involved, the safety procedures, and other information outlined in this Accident Prevention Plan (APP) and all attachments. Prior to the commencement of work, the Site Safety and Health Officer (SSHO) or Site Unexploded Ordnance Safety Officer (UXOSO) will discuss additional procedures to be implemented, addressing any other site-specific conditions that may arise. All on-site personnel of Weston Solutions, Inc. (WESTON®) and all subcontractors must sign the Project Health and Safety Acknowledgement Form included as **Attachment 1**. A signature certifies that the individual has had the opportunity to review and ask questions about this APP, and that he or she understands the procedures, equipment, and restrictions of this APP and agrees to abide by them.

2. BACKGROUND INFORMATION

Contractor Name: Weston Solutions, Inc.

Contract Number: W912DR-09-D-0015, Delivery Order 0035

Project Name: Military Munitions Response Program Remedial Investigation, Boat Basin, Visitors Information Center Munitions Response Site, Wallops Flight Facility, Virginia

2.1 INTRODUCTION

This APP presents the minimum requirements for safety and health that must be met by WESTON and its subcontractors engaged in the site operations at the Wallops Flight Facility (WFF) Boat Basin, Visitors Information Center Remedial Investigation (RI) munitions response site (MRS). The APP does not in any way relieve site personnel, contractors, or subcontractors from responsibility for the safety and health of their personnel. Subcontractors shall be required to review the site conditions and the work to be performed to determine specific safety and health requirements for their personnel. When specified, subcontractors shall provide a written Health and Safety Plan and/or Activity Hazard Analysis (AHA) detailing the nature and plan for mitigation of hazards associated with specialized site activities.

The Senior Unexploded Ordnance Supervisor (SUXOS) - Site Manager will provide an escort for all visitors while on-site and maintain an on-site visitor log. Any visitors to the site shall be required to read, understand, and comply with the approved APP to gain entry to work sites.

The APP is the interface with WESTON's Corporate Environmental Health and Safety (EHS) Manual and has been prepared to be consistent with all applicable Army, federal, state, and local health and safety requirements, which include the following:

- 29 Code of Federal Regulations (CFR) 1904, 1910, and 1926 [Occupational Safety and Health Administration (OSHA) General Industry and Construction Standards, respectively].
- United States (U.S.) Environmental Protection Agency (EPA) Standard Operating Safety Guides, Office of Solid Waste and Emergency Response, June 1992.
- Resource Conservation and Recovery Act of 1976 Transport and Disposal.
- 49 CFR – U.S. Department of Transportation (DOT) Commercial Drivers License and Shipping.

- EM 385-1-1 – U.S. Army Corps of Engineers (USACE) Health and Safety Requirements Manual, 15 September 2008.
- EM 385-1-97 – Explosives Safety and Health Requirements Manual.
- Federal Acquisition Regulations 52.236-13.

2.2 PROJECT AND WORK DESCRIPTION

The U.S. Army Corps of Engineers (USACE) Baltimore District contracted with WESTON to complete an RI of the Boat Basin, Visitors Information Center MRS, which encompasses approximately 1.53 acres of land that includes four areas: Pyrotechnics Burn Area, Gun Butt Nos. 1 and 2, and South Bank Boat Basin.

Historical investigations include an unexploded ordnance (UXO) clearance conducted in January 2006 and most recently a Site Inspection (SI) conducted in December 2011. The SI was conducted at the Boat Basin, Visitors Information Center MRS by Human Factors Applications, Inc. (HFA), a wholly owned subsidiary of TerranearPMC, LLC. Based on historical evidence and the results from the SI, it was concluded that evidence of munitions and explosives of concern (MEC) and munitions constituents (MC) is present at the Boat Basin, Visitors Information Center MRS; therefore, an RI was recommended to address the presence of MEC and MC at the Boat Basin, Visitors Information Center MRS.

To determine the nature and extent of MEC, geophysical surveys will be performed over land and water. Geophysical activities will include conducting surveys of transects and/or grids established over the Pyrotechnics Burn Area, Gun Butt Nos. 1 and 2, and South Bank Boat Basin using an EM61-MK2 (all-metals detector) and performing analog surveys with Schonstedt magnetometers.

The digital geophysical mapping (DGM) results will be employed to develop follow-on intrusive activities to recover potential MEC anomalies. Anomalies detected during ground-based geophysical surveys will be investigated to determine whether MEC is present at that location. Recovered MEC will be demolished using a blow-in-place (BIP) approach as the primary method of destruction. When necessary, recovered MEC may be transported by qualified personnel to a common detonation area.

Environmental sampling in accordance with the Uniform Federal Policy for Quality Assurance Project Plan developed for the RI activities includes discrete sampling of surface soil for MC where MEC is detected and where MC is suspected to be present based on the identification of a potential release (e.g., broken munitions, soil staining). If MEC is identified, then MC sampling will be conducted at discrete locations, as deemed necessary. An anticipated 100 total environmental samples (including 15% quality control (QC) samples) will be collected from surface soil, subsurface soil, sediment, surface water, and groundwater to support the characterization of the Boat Basin, Visitors Information Center MRS.

The surface water areas (south bank of the Boat Basin) will be investigated by means of a magnetometer survey with subsequent reconnaissance of detected anomalies (i.e., mag and dig). Transects that will be investigated by dive personnel will vary in length. In accordance with Section 30.A.15 of EM 385-1-1, a separate Dive Plan has been prepared and is provided in **Appendix G** to the RI Work Plan to govern underwater operations conducted as part of the RI.

The RI activities are being performed in cooperation with USACE, the National Aeronautics and Space Administration (NASA), EPA, and the Commonwealth of Virginia Department of Environmental Quality (VDEQ). Investigations conducted at WFF are part of the ongoing Defense Environmental Restoration Program (DERP) - Formerly Used Defense Site (FUDS) Program to identify hazardous, toxic, and radioactive waste (HTRW) and ordnance-related hazards left during prior occupation by the Department of Defense (DoD) and to remediate areas within the FUDS.

2.3 LOCATION OF THE PROJECT

The WFF is located in Accomack County, Virginia, near the Atlantic Coast on the Delmarva Peninsula approximately 5 miles south of the Maryland-Virginia border and about 5 miles west of Chincoteague Island. The WFF FUDS property consists of the Main Base and Wallops Island. The Boat Basin, Visitors Information Center MRS is located on the Main Base portion of the FUDS property. The MRS boundary is illustrated in **Figure 2-1**.

The Boat Basin, Visitors Information Center MRS was used by the Naval Aviation Ordnance Test Station between 1946 and 1959. In June 1959, the U.S. Navy ceased training and flight operations and the WFF, including the Boat Basin, Visitors Information Center MRS, was declared excess and transferred to the newly formed NASA in 1961.

Figure 2-1 Boat Basin, Visitors Information Center MRS

2.4 ANTICIPATED PHASES OF WORK

Table 2-1 presents the anticipated activities at the Boat Basin, Visitors Information Center MRS.

Table 2-1 Anticipated Phases of Work

Work Phase	Work Description	PPE Level
Activity 1: Mobilization/ Demobilization	Mobilize/demobilize equipment and personnel to/from the project location.	Level D
Activity 2: Vegetative Clearing and Fence Removal	Vegetative clearing of investigation areas will be completed using hand tools (e.g., pruners) and if necessary brush hog (with protective shielding) and brush cutting equipment (line trimmer with metal brush blade attachment and shielding). It is expected that only vegetation up to 2-inch-diameter will be cleared. Additionally, fencing surrounding the Pyrotechnics Burn Area will be disassembled by hand to facilitate access for geophysical survey, MEC intrusive, and MC and Expanded RI sampling activities. A UXO Technician II will provide anomaly avoidance support.	Level D/ Modified Level D
Activity 3: Ground-Based Reconnaissance and Geophysical Survey Activities	Construct instrument verification strip for geophysical instrument testing. Arrange for a licensed surveyor to locate and establish survey control points, to allow WESTON personnel to mark grid corners/transect end-points with wooden stakes and steel pins (a UXO Technician II to provide anomaly avoidance support). Subsequent to vegetation clearing of investigation areas, perform DGM and mag and dig transect and grid surveys to detect geophysical anomalies and potential MEC within the designated areas of the MRS.	Level D/ Modified Level D (IVS construction)
Activity 4: Land Surveying	Perform land surveying of MRS boundaries, existing structures, and cultural features (e.g., drainage ditches, tree lines, paved areas, etc.) within the MRS and beyond, if necessary, to meet project objectives. In addition, at least one permanent survey control monument shall be established with a horizontal control accuracy of Third Order Class I survey. Additional surveying of the location and elevation of soil borings and temporary and permanent monitoring wells (Activity 10). A UXO Technician II will provide anomaly avoidance support for land surveying activities within the MRS.	Level D/ Modified Level D
Activity 5: Water-Based Geophysical Survey Activities	Perform DGM transect surveys to detect geophysical anomalies and potential MEC along the south bank of the Boat Basin.	Modified Level D
Activity 6: MEC Intrusive and Disposal Activities	Based on geophysical survey results, qualified UXO Technicians will perform intrusive operations at potential MEC locations to make a 100% verification of the nature of the anomaly. If MEC is positively identified, disposal of MEC will be performed. Munitions and explosives of concern (UXO and DMM), MPPEH, MD, and/or other non-munitions-related metal debris will be recovered to evaluate the nature and extent of potential explosives hazards.	Modified Level D or Level C (if appropriate)

Table 2-1 Anticipated Phases of Work (Continued)

Work Phase	Work Description	PPE Level
	All MEC disposal activities will be conducted in accordance with the approved Explosive Site Plan prepared by USACE (see **Appendix L** of the RI Work Plan), and the Explosive Management Plan (see Section 6 of the RI Work Plan). Notification procedures for demolition activities are provided in Subsection 3.8.2 of the RI Work Plan. Subsurface investigation activities include the excavation of detected anomalies using hand tools, demolition activities of recovered MEC and MPPEH, and MD and non-munitions-debris inspection and transport to a certified recycling program. MEC demolition will employ BIP procedures for recovered items, with limited transport of items determined acceptable-to-move to a common detonation area within the MRS (to be determined).	
Activity 7: Decontamination	Decontamination of drilling equipment, heavy machinery, and personnel (as necessary). Decontamination liquids and solids will be collected, segregated, and placed in 55-gallon drums.	Modified Level D or Level C (if appropriate)
Activity 8: Underwater Operations	A qualified subcontractor (VRHabilis) is to perform an underwater investigation to locate anomalies and conduct follow-on intrusive activities (i.e., mag and dig) as needed to recover potential MEC. Refer to Dive Plan (**Appendix G** of RI Work Plan) for a full description of task. WESTON will provide topside support, including oversight, communications, and MEC disposal. The USACE Dive Board will review the Dive Plan.	See Dive Plan (**Appendix G** of RI Work Plan).
Activity 9: MC Sampling	Following MEC investigation and intrusive activities, collection of MC samples by discrete sampling methodology in areas impacted by MEC or a suspected release will be performed. Discrete samples will be collected by hand or by using hand tools following anomaly avoidance surveys by a UXO Technician II or above.	Modified Level D or Level C (if appropriate)
Activity 10: Drilling / Geoprobe Activities	Borehole anomaly avoidance procedures will be completed by UXO personnel prior to all subsurface drilling/Geoprobe™ investigations. It is anticipated all surface MEC items will have been identified and removed prior to mobilization of the drill rig and support trucks to surface cleared areas of the site. As a result, an access survey is not required if borehole are located more than 10 feet laterally from a previously identified geophysical anomaly. Prior to the installation of subsurface borings, borehole anomaly avoidance procedures using the drill rig or hand auger techniques will be conducted at 2-foot increments. Borehole anomaly avoidance procedures will utilize a Foerster API MK 26 Mod 1, UXO detector (nominal diameter of 1.3 inches). Drill rods and augers will be removed from the borehole in order to facilitate borehole anomaly avoidance procedures. If an anomaly is detected, the borehole will be backfilled in accordance with site-specific procedures and a new borehole location must be selected and cleared to the target depth. Any anomalies detected at a borehole location will be prominently	Modified Level D or Level C (if appropriate)

Table 2-1 Anticipated Phases of Work (Continued)

Work Phase	Work Description	PPE Level
	marked with survey flagging or pin flags for avoidance. Identified areas of potential subsurface MEC material in boreholes will be further investigated under another contract, and this investigation is not part of Contract No. W912DR-09-D-0015. At a minimum, the borehole clearance activities will continue until the water table (approximately 15 feet below grade) is reached or 10 feet below grade, whichever is greater. It is not anticipated that burial areas extended below the water table, and based on the MEC items used at the site, none would have penetrated to depths greater than 10 feet below grade. As necessary with loose soils, a polyvinyl chloride (PVC) pipe (minimum 2 inches inner diameter) may be inserted to keep the hole open and to allow for incremental geophysical screening. If nested or an offset borehole is required, the subsequent borehole must be located within a 2-foot radius of the cleared borehole. Direct-push technology (DPT, e.g., Geoprobe) will be used for installation of soil borings to collect soil samples, and installation of temporary monitoring wells to collect groundwater samples. Approximately 15 DPT borings/wells will be completed. Termination depths of each boring will be approximately 3 feet below the water table as determined by a field geologist. Following review of DPT-derived data, an estimated four permanent monitoring wells will be installed using conventional hollow stem auger methodology and borehole anomaly avoidance procedures by UXO personnel.	
Activity 11: Groundwater Sampling	This task includes sampling of groundwater from installed well locations to determine whether MC is present in the groundwater at the site. Temporary monitoring wells will be sampled following stabilization of water quality parameters. Permanent monitoring wells will be developed until stabilization of select water quality parameters occurs. Permanent monitoring well sampling will occur no earlier than 14 days after development and subsequent stabilization of water quality parameters.	Modified Level D or Level C (if appropriate)

Notes:
BIP = blow-in-place
DGM = digital geophysical mapping
DMM = discarded military munitions
DPT = direct push technology
MC = munitions constituents
MD = munitions debris
MEC = munitions and explosives of concern
MPPEH = material potentially presenting an explosive hazard
MRS = munitions response site
PPE = personal protection equipment
RI = Remedial Investigation
USACE = U.S. Army Corps of Engineers
UXO = unexploded ordnance
WESTON = Weston Solutions, Inc.

2.5 CONTRACTOR ACCIDENT EXPERIENCE MODIFICATION RATE

Table 2-2 WESTON's Intrastate Emergency Modification Rate Since 2009

Year	EMR
2013	0.48
2012	0.51
2011	0.54
2010	0.52
2009	0.44

Notes:

* Calculated by measuring the difference between a company's actual past workers' compensation claims as compared to the average expected claims experience for companies performing the same type of work. An Experience Modification Rate (EMR) is calculated using a rolling 3-year period.

3. HEALTH AND SAFETY POLICY

3.1 HEALTH AND SAFETY POLICY

WESTON personnel operate in a culture where safety, health, and protection of personnel and the environment take precedence over expediency. A fundamental premise of our Behavior-Based Safety (BBS) culture is that accidents are preventable through choosing safe, proactive behaviors. WESTON's policy on health and safety emphasizes several important points:

- WESTON has established a goal of working safely 100% of the time (employees and contractors) with the expected outcome being zero incidents that result in injuries, illnesses, property damage, or environmental damage or contamination.
- All managers and workers accept as their responsibility a concerted and sustained effort to achieve a goal of Safety Every Minute of Every Day.
- All managers and workers assume a safety leadership role.
- All managers and workers take action for safety; coach peers in safe practices; and share experiences, successes, and failures.
- Workers are involved in the identification and control of workplace hazards during work planning, work execution, and feedback activities.
- Management is committed to a work environment that allows free and open expression of safety concerns and where workers fear no reprisals or retaliation.
- People are our most important assets to WESTON and are critical resources for establishing, implementing, and observing safe work practices.

3.1.1 100% Safe Work and Stop Work Policy Statement

For each activity and contract under which WESTON performs work, a policy is implemented clearly stating that WESTON employees have the responsibility and right to stop or curtail any work they perceive to be unsafe (a threat to public health, the safety and health of workers, or the environment). Employees must be free to voice concerns about safety and health without fear of reprisal, retaliation, or harassment. This policy is implemented by a clear, straightforward, contract-specific procedure as part of the WESTON Integrated Safety Management System.

To support the WESTON goal of all employees and subcontractors working safely 100% of the time, all managers will use every available resource to maintain safe, hazard-controlled work environments characterized by a vigorous emphasis on accident prevention. Standards, requirements, and best practices will be implemented in a manner that maximizes the prevention of accidents. Managers will ensure that employees are knowledgeable of those standards, requirements, and best practices that pertain to their safety.

WESTON managers and supervisors are held directly accountable for the health and safety of their employees, subcontractor activities, and other resources employed to maintain employee health and safety, and the continual communication of hazards and hazard controls to the workforce.

3.2 PROGRAM GOALS

WESTON has implemented a BBS program in which employees assume a safety leadership role and are responsible for the safety of coworkers, team members, and stakeholders. Employees focus on behaviors and intervention techniques to improve behavioral processes. As part of WESTON's BBS program, employees create high-quality connections with one another, team members, and stakeholders to foster an active, caring culture. Commitment is high, and employees help each other be Safe Every Minute of Every Day to achieve the corporate goal of *Zero Accidents* involving personnel and the environment.

3.3 PROGRAM OBJECTIVES

1. The EHS staff, resources, and procedures are provided as necessary and used in an efficient and cost-effective manner to establish a safe work environment for WESTON employees, subcontractors, clients, and the general public.

2. Compliance with environmental, health, and safety regulations is assured, and risk is managed and minimized for all employees, as well as the corporation.

3. Management involvement is established and maintained within the EHS Program.

4. Clear lines of reporting, authorities, responsibilities, and performance expectations are established.

5. World-class EHS culture is attained at our places of employment, in our homes, and in our communities through the elimination of at-risk behavior.

3.4 ACCIDENT EXPERIENCE GOAL

The accident experience goal for this project, as well as for every WESTON project, is zero. Work shall not be performed in a manner that conflicts with the safety, health, or environmental precautions outlined in the APP or with the Site Safety and Health Plan (SSHP), provided as **Attachment 2**. Site personnel, including any WESTON subcontractors, who have the potential for exposure to site hazards, are subject to the requirements of the APP and SSHP. Personnel violating safety procedures are subject to dismissal and/or removal from the project location.

WESTON gathers information on all incidents in an electronic database that allows assessment of trends and causes of incidents. By learning from our past experience, we can plan to avoid the recurrence of incidents. This information is available to every WESTON employee and is used in training as well as in the development of APPs, SSHPs, and AHAs. The availability of this information assists in achieving WESTON's goal of working safely 100% of the time.

4. RESPONSIBILITIES AND LINES OF AUTHORITY

4.1 STATEMENT OF EMPLOYER'S RESPONSIBILITY

WESTON is ultimately responsible for the implementation of the EHS Program through enforcing the safety and occupational health (SOH) for this project as stated in the APP and SSHP. WESTON's senior management is committed to operating projects in a manner consistent with controlling EHS, legislative, regulatory, and client requirements, and other applicable requirements administered by federal agencies.

4.2 IDENTIFICATION OF PERSONNEL RESPONSIBLE FOR SAFETY

Table 4-1 presents the key project personnel responsible for the EHS Program implementation. Resumes for key WESTON safety personnel are included in **Attachment 3**. Descriptions of each position are provided in the following sections.

Table 4-1 Project Safety Team

Name	Title	Phone No.
Tony Pace	Project Manager	(757) 819-5310 - office (757) 362-2461 - cell
Bill Irwin	Corporate Environmental, Health and Safety Director	(610) 701-3684 (office) (267) 918-8371 (cell)
Larry Werts	East Division EHS Officer	(610) 701-3912 - office (215) 815-6237 - cell
George Crawford	WESTON CIH	(610) 701-3771 (office) (484) 437-5976 (cell)
Chris Baer, Certified Safety Professional (CSP)	Federal Team Health and Safety Officer	(610) 701-3653 – office (484) 239-4249- cell
Brian Grassmyer	SUXOS	(757) 650-3607 - cell
Elizabeth Cunningham	SSHO	(610) 701-3433– office (610) 389-8545- cell
Bill Bounds	SSHO	(757) 819-5307– office (757)-416-2449- cell
Troy Phelps	UXOSO-UXOQCS	(303) 729-6181 - cell
Mark Maguire (VRHabilis, LLC)	Dive Supervisor	(440) 221-2579 - cell

Notes:

CIH =Certified Industrial Hygienist
CSP = Certified Safety Professional
QC = Quality Control
SSHO = Site Safety and Health Officer
SUXOS = Senior Unexploded Ordnance Supervisor
UXOSO = Unexploded Ordnance Safety Officer
UXOQCS = Unexploded Ordnance Quality Control Specialist

*Phone numbers will be confirmed and/or revised prior to field mobilization and revised during the project, as necessary.

4.2.1 Project Manager

Mr. Tony Pace is the Project Manager for activities covered under this Delivery Order (DO). He has overall responsibility for the management and completion of the project, which includes resource allocation, financial reporting, schedule control, and review and approval of deliverables.

The Project Manager is responsible and accountable for project safety and has overall responsibility for ensuring that project personnel (including subcontractor personnel) comply with EHS regulations, program requirements, and procedures. The Project Manager's specific EHS responsibilities are as follows:

- Ensure development and implementation of project SSHPs and indicate concurrence with final plans after required EHS reviews.
- Ensure project personnel meet applicable safety certification requirements, such as medical certifications and training.
- Ensure adequate project support is acquired from appropriately qualified safety personnel such as Corporate EHS Manager, Division EHS Officer, SSHO or UXOSO, and industrial hygienists.
- Ensure project personnel comply with applicable EHS regulations and corporate or client procedures. Halt any project work activities that are determined to represent an imminent hazard.
- Ensure appropriate safety equipment and materials are provided to project personnel.
- Ensure timely and accurate reporting and investigation of incidents, accidents, or injuries involving project personnel, with support from the Risk Management Department, Corporate EHS Manager, and the Division EHS Officer. Ensure corrective actions are implemented completely.
- Ensure proper response and internal notification regarding inspections by regulatory agencies.
- Ensure all project personnel have met the site-specific experience and training requirements.

4.2.2 Division Environmental Health and Safety Officer

The WESTON East Division EHS Officer is Mr. Larry Werts. Mr. Werts will be responsible for the following actions:

- Oversee and maintain the WESTON Corporate EHS Program, the APP, and SSHP.
- Visit or assign designee (Federal Team Health and Safety Officer) to visit the Boat Basin, Visitors Information Center MRS as needed to audit the effectiveness of the APP and SSHP.
- Evaluate and authorize changes to the APP and SSHP based on field, occupational exposure, and air monitoring data as necessary.
- Serve as a technical advisor.

4.2.3 Federal Team Health and Safety Officer

The Federal Team Health and Safety Officer for this project is Mr. Christopher Baer, Certified Safety Professional. He has more than 12 years of industrial hygiene and safety experience. The Federal Team Health and Safety Officer is responsible for the following actions:

- Ensure the implementation of the WESTON Corporate EHS Program.
- Review and provide concurrence on the APP, SSHP, and any amendments.
- Conduct field audits to assess the effectiveness and implementation of the APP and SSHP at the request of the primary auditing entity (Division EHS Officer), the Project Manager, or USACE.
- Evaluate and authorize changes to the APP and SSHP based on field and occupational exposure as necessary.
- Function as a QC staff member.

Accountability for health and safety at all levels flows from the WESTON Chief Executive Officer (CEO) through a matrix system, as indicated on the organizational chart **(Figure 4-1)**.

4.2.4 Site Safety and Health Officer

The SSHO for this first phase of this project (non-intrusive investigation activities) is Ms. Elizabeth Cunningham. Ms. Cunningham will be the SSHO during geophysical investigation activities (surveying and EM61). Mr. Bill Bounds will be the SSHO during the second phase of this project (intrusive activities), which includes MC and associated soil sampling activities and expanded RI (well installation, development, and sampling) activities. The SSHO is responsible for implementing the APP and SSHP by ensuring that all project DGM and drilling contractor personnel follow the requirements of the APP and SSHP.

Ms. Cunningham and Mr. Bounds are approved by the Division EHS Officer and qualify as a competent person as stated in OSHA 29 CFR 1926.32. As required by EM 385-1-1, Mr. Bounds has at least 5 years of applicable safety experience for intrusive activities and has successfully completed the OSHA 30-hour construction safety course. Ms. Cunningham and Mr. Bounds have performed work on sites of similar hazard, risk, and complexity to the task assignment. Ms. Cunningham and Mr. Bounds are certified in first aid and cardiopulmonary resuscitation (CPR).

The SSHO is responsible for conducting morning safety meetings for all site personnel to discuss the day's activities, associated hazards, and site safety. The SSHO is also required to report any incidents that occur on-site to the Project Manager, Program Manager, and Federal Team Health and Safety Manager. The SSHO is required to implement safety corrective actions through training and reinforced awareness.

4.2.5 Unexploded Ordnance Safety Officer – Unexploded Ordnance Quality Control Specialist

The UXOSO - Unexploded Ordnance Quality Control Specialist (UXOQCS) for this project is Mr. Troy Phelps. Mr. Phelps is a graduate of the U.S. Navy Explosive Ordnance Disposal (EOD) School, is UXO certified, and meets training requirements including 40 hours (with 8-hour annual refresher) of OSHA hazardous waste site training, 30 hours of OSHA construction training, and 8 hours of supervisory training. He has 14 years of experience in the UXO and EOD field conducting MEC disposal activities in accordance with safety regulations and over 8 years of supervisory and management responsibilities. Mr. Phelps is responsible for implementing the site health and safety program by ensuring that all project personnel follow the requirements of the APP and SSHP. He reports to the Federal Team Health and Safety Officer, Project Manager, and SUXOS. In addition to overall site safety, he is also responsible for enforcing safety applicable to all MEC operations, including the following:

- Conduct daily safety meetings for all site personnel to discuss the day's activities, associated hazards, and explosives safety.
- Be present during MEC operations to implement the APP.
- Coordinate changes and/or modifications to the APP with the appropriate site personnel and Contracting Officer (KO).

- Conduct or coordinate project-specific training.
- Review site personnel training and experience records to ensure compliance with the APP and SSHP and Department of Defense Explosives Safety Board Technical Paper 18.
- Report any incidents that occur on-site to the SUXOS, Project Manager, Federal Team Health and Safety Officer, East Division EHS Officer, and the Corporate EHS Manager.
- Implement safety corrective actions through training and reinforced awareness.
- Maintain exposure data.
- Exercise stop-work authority for all safety issues.

4.2.6 Senior Unexploded Ordnance Supervisor - Site Manager

Brian Grassmyer, the SUXOS - Site Manager, is the senior subject matter expert in the field during the execution of this RI. Mr. Grassmyer is a graduate of the U.S. Navy EOD Basic School. He has over 22 years of professional experience as an EOD and UXO specialist. He has extensive knowledge of UXO Technician (I, II, and III) duties and requirements in accordance with state and federal regulations. He also has current training in accordance with OSHA hazardous waste sites (40 hours with annual 8-hour refresher), OSHA construction safety (30 hours), and 8 hours of supervisory training. The SUXOS responsibilities include the following:

- Plan, coordinate, and supervise on-site MEC-related activities.
- Implement procedures and guidance for MEC operations (ensure compliance with DoD directives and federal, state, and local statutes and codes).
- Certify material potentially presenting an explosive hazard and/or range scrap as ready for turn-in or disposal.
- Maintain field records for the project.
- Supervise multiple project teams during the RI that are performing MEC and MEC-related activities, such as the following:
  - Providing UXO escort for vegetation clearance, land surveying, and anomaly avoidance.
  - Conducting aerial and underwater operations (ground-based oversight).
  - Performing demolition activities.
  - Transporting explosive material.

The SUXOS reports directly to the WESTON Project Manager and will have an open line of communication with the UXOSO-UXOQCS.

4.3 DIVE SUPERVISOR

Mark Maguire of VRHabilis, LLC, will be the Dive Supervisor and subject matter expert regarding underwater operations in the field during the execution of this RI. Training and qualifications for the Dive Supervisor are provided in **Appendix G** of the RI Work Plan. At a minimum, the Dive Supervisor's responsibilities include the following:

- Provide supervision of Dive Plan implementation for underwater operations.
- Exercise stop-work authority.
- Implement the project APP and SSHP and recommend changes to the Project Manager as needed.
- Assist SUXOS - Site Manager as needed during execution of underwater operations.
- Assist SSHO or UXOSO as needed to communicate safety-related issues to USACE and to conduct morning safety briefings and site-specific training related to diving activities.
- Document and investigate all incidents and/or deviations from planned activities.
- Identify potential safety-related issues, and develop and implement corrective actions in a timely manner.
- Provide updates to SUXOS - Site Manager of real-time anomaly recovery status so that USACE can be adequately informed of progress (e.g., USACE notification at 25, 50, 75, 100 anomalies, etc., up to the Performance Work Statement (PWS) requirements of 200 anomalies).
- Provide subcontractor supervision including, but not limited to the following:
    - Monitor performance of RI activities and conformance with this APP, SSHP, and Dive Plan.
    - Conduct inspections of work practices and personal protective equipment (PPE).
    - Provide review and maintenance of training records of VRHabilis, LLC, staff to verify status and qualification of personnel.
    - Review field documents for underwater operations (e.g., dive logs).
    - Make recommendations of PPE level changes as appropriate based on site conditions and/or hazards.

- Conduct random safety audits (as needed).
- Provide weekly safety-related updates to the SUXOS - Site Manager.
- Make recommendations to the SUXOS - Site Manager and Project Manager regarding VRHabilis, LLC, work practices or personnel (as needed) during diving activities to ensure safety and compliance with the project APP, SSHP, and Dive Plan.

4.4 COMPETENT PERSON

OSHA Regulation 29 CFR 1926.32 defines a Competent Person. Specific OSHA and USACE regulations identify the need for involvement of competent persons. Competent person requirements and regulatory references are listed in **Table 4-2**. Mr. Phelps, the UXOSO, and Ms. Cunningham and Mr. Bounds, the SSHOs, meet the Competent Person requirements applicable to this scope of work and have been approved by WESTON's Corporate EHS Management. **No work shall be performed without a Competent Person on-site.**

Table 4-2 Competent Person Requirements

Competent Person Requirement	Regulatory Reference	Person Designated
SSHO Identification UXOSO Identification	EM 385-1-1 Sec. 01.A.17	Ms. Cunningham, Mr. Bounds or Troy Phelps
Excavation and Trenching	EM 385-1-1 Sec. 25.A.02 29 CFR 1926.651	Troy Phelps or Mr. Bounds
Machinery or Mechanized Equipment Operators	EM 385-1-1 Sec. 18.G.02 & 04 29 CFR 1926.601(b)(14)	Mr. Bounds, Ms. Cunninghamor Troy Phelps
General Inspections of Construction Sites	EM 385-1-1 Sec. 01.A.12 29 CFR 1926.20	Troy Phelps or Ms. Cunningham and Mr. Bounds
Unsanitary Conditions	EM 385-1-1 Sec. 02 29 CFR 1926.27	Troy Phelps or Ms. Cunningham and Mr. Bounds
Hearing Protection	EM 385-1-1 Sec. 05.C 29 CFR 1926.101	Troy Phelps or Ms. Cunningham and Mr. Bounds

Notes:

EM 385-1-1 is U.S. Army Corps of Engineers Health and Safety Requirements Manual; 29 CFR 1926 is Code of Federal Regulations, Occupational Safety and Health Administration, Safety and Health Regulations for Construction.

Both SSHO personnel identified to support RI activities are designated as Competent Persons as stated in OSHA 29 CFR 1926.32. As required by EM 385-1-1, Mr. Bounds and Mr. Phelps have at least 5 years of applicable safety experience and have successfully completed the OSHA 30-hour construction safety course. The SSHOs and UXOSO assigned to this project have performed work on sites of similar hazard, risk, and complexity to the task assignment, and are certified in first aid and cardiopulmonary resuscitation (CPR).

Records of the qualifications of site personnel will be maintained on-site. The certifications and overall qualifications of WESTON personnel are maintained in a database supported by WESTON (see **Attachment 3** for qualifications of site personnel).

4.4.1 Qualified Person

Site personnel will also include a Qualified Person. WESTON will permit only those employees qualified by training or experience to operate equipment and machinery in compliance with OSHA 29 CFR 1926.20(b)(4). According to OSHA 29 CFR 1926.32, "qualified" means one who, by possession of a recognized degree, certificate, or professional standing, or who by extensive knowledge, training, and experience, has successfully demonstrated the ability to solve or resolve problems relating to the subject matter, the work, or the project. **Table 4-3** lists a Qualified Person's requirements.

Records of the qualifications of all site personnel will be maintained on-site. The certifications and overall qualifications of WESTON personnel are maintained in a database supported by WESTON. Records will be maintained and reviewed by the SSHO or UXOSO.

4.5 PRE-TASK HEALTH AND SAFETY ANALYSIS

Pre-Task Safety and Health Analysis for all projects begins for WESTON at the request for proposal phase by using available documentation, prior sampling results, and site visits. The process continues through development of the APP, AHAs, and SSHP. Project Managers or designated SSHO or UXOSOs are responsible for ensuring that a survey is conducted for each work area during mobilization to identify the sources of all types of hazards and to confirm that the APP, AHAs, and SSHP address these hazards. This phase of the Pre-Task Safety and Health Analysis is used to update as needed the AHAs provided in Section 12 of the APP.

WESTON has many years of experience performing similar site work. Information available from work on similar projects will be reviewed as well as additional public documents and data relevant to the work activities. External reviews are conducted when WESTON receives the notice to proceed.

Table 4-3 Qualified Person Requirements

Qualified Person/Organization	Project Applicability	Training Requirement
UXO Technicians (I, II, & III)/WESTON	All ground-based and/or intrusive activities	Meet Department of Defense Explosive Safety Board Technical Paper 18
Boating Operator and Crew - Subcontractor	Water –based geophysical survey activities	Valid USCG licenses for operator and crew
Divers - Subcontractor	Underwater operations and intrusive activities	Meet OSHA Diving Standards and certified in accordance with U.S. Naval regulations (see **Appendix G** of the RI Work Plan)
Blaster - WESTON and/or Dive Subcontractor	Detonations	Certification from Bureau of Alcohol, Tobacco, Firearms, and Explosives and/or Virginia State Blaster's License
Drilling and other Mechanized Equipment Operators	MC sampling and Expanded RI activities	Meet USACE EM 385-1-1, Sec. 18.G.06 and H.02 and OSHA 29 CFR 1926.20(b)(4)

Notes:

Weston Solutions, Inc. (WESTON®) and/or subcontractor blasting and equipment operating personnel have not yet been identified. Qualifications and training records will be included in subsequent Accident Prevention Plan (APP) addendums.

CFR = Code of Federal Regulations
EM = Engineering Manual
MC = munitions constituents
OSHA = Occupational Safety and Health Administration
RI = remedial investigation
UXO = unexploded ordnance
USACE = U.S. Army Corps of Engineers
USCG = U.S. Coast Guard

During the walk-through survey, the Project Manager or the SSHO and UXOSO will determine the level of PPE required for the work areas and specific activities. They will evaluate the potential physical hazards associated with the work areas and specific work activities (e.g., walking and/or working surfaces, electrical installations and/or lines, and noise exposure) and select PPE to mitigate identified hazards and verify before each activity that site personnel performing the activity have no medical conditions limiting their ability to perform the activity. Consideration will be given to biological and climatic conditions and selection of PPE to accommodate the conditions (e.g., cooling units, insulated clothing and/or footwear, snake chaps).

The WESTON management team evaluates safety performance to ensure continuing suitability, adequacy, and effectiveness. The safety performance will be communicated with the SSHO and the SSHO will report to a senior project (or corporate) official on a weekly basis on safety-related activities and procedures.

4.6 LINES OF AUTHORITY

Lines of authority are shown in **Figure 4-1**.

4.7 NONCOMPLIANCE, DISCIPLINARY ACTIONS, AND COMPANY'S SAFETY INCENTIVE PROGRAMS

4.7.1 Noncompliance

Although noncompliance is not expected, Health and Safety Program violations can and will result in disciplinary action up to and including dismissal. All employees understand that safety is of the utmost importance at WESTON. All personnel understand the importance of compliance with all applicable regulations and project requirements.

4.7.2 Disciplinary Actions

Personnel violating safety procedures are subject to dismissal and/or removal from the project location.

4.7.3 Incentive Programs

Project-specific financial and other incentive plans are developed and integrated with safety and health goals as an overriding component.

4.7.3.1 Safety Solutions Program

Safety Solutions is a program that provides WESTON's employees with positive opportunities to become engaged in the Health and Safety Program. Employees are encouraged to use the Safety Solutions Program to report near incidents or to identify workplace hazards and their proposed solutions. The submitted Safety Solutions are evaluated, and the authors of the most highly regarded solutions are eligible for a financial bonus and other rewards.

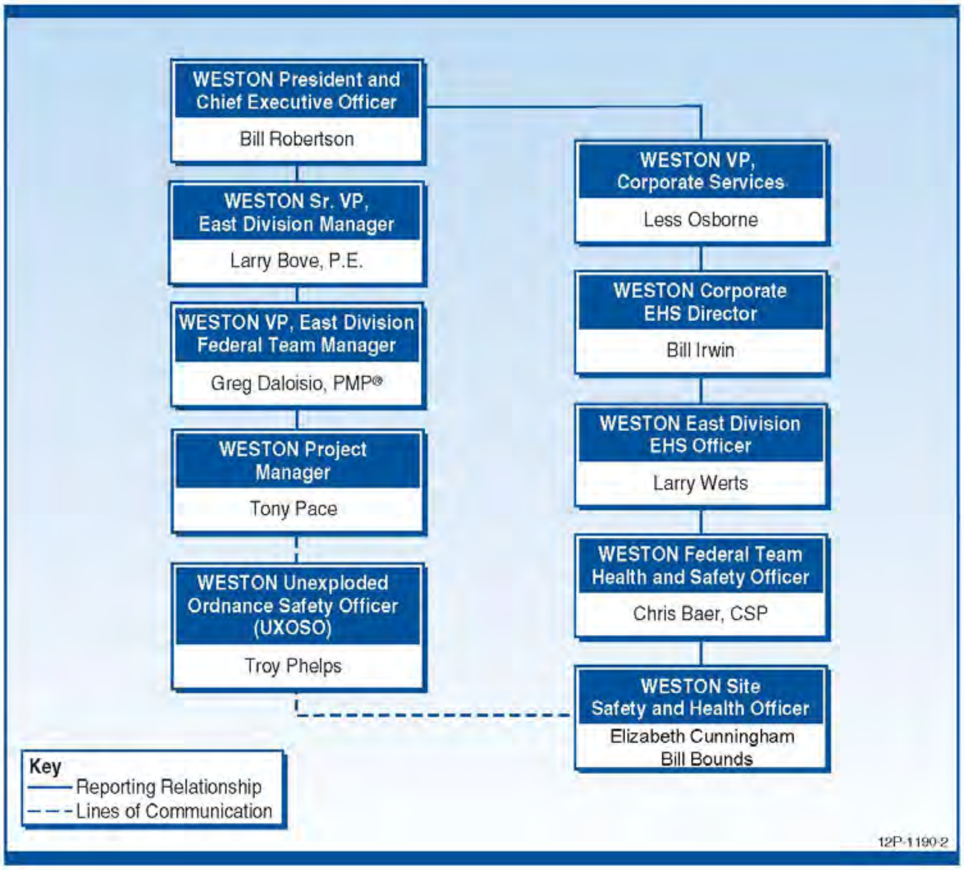


Figure 4-1 Health and Safety Organization Chart and Lines of Authority

4.8 MANAGEMENT ACCOUNTABILITY FOR SAFETY

WESTON managers and supervisors are held directly accountable for the health and safety of their employees, for subcontractor activities, and for the continual communication of hazards and hazard controls to the workforce. The SSHO or UXOSO and the Federal Team Health and Safety Officer assess the health and safety performance of employees.

The accountability of supervisors and managers for the implementation of the Health and Safety Program is ensured through monthly project life cycle reviews with senior management and through annual employee performance reviews.

5. SUBCONTRACTORS AND SUPPLIERS

5.1 IDENTIFICATION OF SUBCONTRACTORS AND SUPPLIERS

Table 5-1 List of Subcontractors

Subcontractor	Activity
VRHabilis, LLC	▪ Conduct underwater operations
Aqua Survey, Inc.	▪ Conduct water-based geophysical surveys
Explosive supplier – To be determined	▪ Supply explosives
CompuChem	▪ Perform primary off-site analytical laboratory services
Meridian Consultant Group	▪ Provide data validation services
Baldwin & Gregg, LTD.	▪ Conduct surveys of anomaly boundaries, individual anomaly locations, and trench locations
Tidewater, Inc.	▪ Provide drilling services
IMS	▪ Provide waste disposal services

5.2 CONTROL AND COORDINATION OF SUBCONTRACTORS AND SUPPLIERS

The subcontractor will assign a Site Safety Representative who will be responsible for coordinating projects and safety responsibilities for their personnel as designated and directed by the WESTON SSHO or UXOSO. WESTON is ultimately responsible for ensuring subcontractor compliance with the APP and SSHP for the Boat Basin, Visitors Information Center MRS. Non-compliance with this plan will result in a stop work order, as determined by the SSHO or UXOSO. The subcontractor conducting underwater activities will additionally be held responsible for compliance with the APP and SSHP for the Boat Basin, Visitors Information Center MRS and with the approved Dive Plan (**Appendix G** of the Work Plan).

5.3 SAFETY RESPONSIBILITIES OF SUBCONTRACTORS AND SUPPLIERS

The Site Safety Representative will interact with the SSHO or UXOSO to ensure compliance with this APP. Subcontractor employees are expected to comply with this APP, USACE EM 385-1-1, and other applicable regulations governing their safety while working on the project. In the event of a conflict, the more stringent requirements will apply.

The Site Safety Representative will perform the following activities:

- Attend health and safety briefings.
- Address worker issues and immediately stop work if unsafe acts and/or conditions exist or if uncertainty exists regarding how a task is to be performed.
- Coordinate corrective action with the SSHO or UXOSO prior to resuming operations.
- Participate in any incident investigations.
- Inspect operations and work areas daily in conjunction with the SSHO or UXOSO.
- Ensure subcontract workers have the proper PPE.
- Control all hazardous material brought on-site.

5.4 SUBCONTRACTOR SAFETY PLANS

For the Boat Basin, Visitors Information Center MRS RI, WESTON subcontractor employees are covered by this APP and will be required to sign the Acknowledgement Form provided as **Attachment 1** indicating that they have read and understand both the APP and SSHP and agree to follow the requirements in these documents. Specialty service subcontractors, including Aqua Survey, Inc. (water-based geophysical activities) and VRHabilis, LLC (underwater operations), are required to submit for WESTON approval a Health and Safety Plan that includes a site-specific task description of hazards, control measures, and an AHA table for specific services required under this DO. VRHabilis, LLC, has prepared a Dive Plan in accordance with EM 385-1-1 requirements to present the accident prevention and health and safety procedures that will be employed during underwater operations. This Dive Plan is included as **Appendix G** to the RI Work Plan and will be reviewed by the USACE Dive Board.

WESTON will obtain and verify the subcontractor personnel training records prior to work commencing.

6. TRAINING

6.1 GENERAL

All personnel assigned to the Boat Basin, Visitors Information Center MRS RI project will have received the required training and provided documentation of training prior to mobilization to the MRS. Records of the required training are maintained in the WESTON Corporate EHS database. Records of required training must also be available on-site at all times and are provided in **Attachment 3**.

6.2 SAFETY INDOCTRINATION

When hired, WESTON staff members are required to complete EHS training appropriate to their role and responsibility level, which often involves hazardous, toxic, and radioactive waste and military munitions response. New hires that have previously completed such training are required to provide documentation of training. All training, including refresher training, is documented in WESTON's corporate recordkeeping software, EHSTrack.

New employees also participate in WESTON's orientation training program. All personnel receive training on WESTON's EHS policies, including environmental aspects, emergency action plans, security plans, ergonomics, incident reporting procedures software, BBS, and site-specific training. Training topics will include the following:

- Accident prevention.
- Accident reporting (how and to whom).
- Anomaly investigation protocol.
- Boating operations associated with water-based geophysical surveys.
- Underwater operations (Dive Plan, **Appendix G** of the RI Work Plan).
- Medical facilities for emergency treatment and/or assistance.
- Evacuation routes.
- Emergency contact information.
- Reporting and correcting unsafe conditions.
- Job hazards and/or hazard control.
- Site-specific biological, physical, chemical, and/or ionizing-nonionizing radiation hazards as listed in the AHAs.

- Company safety policies.
- Site briefings conducted prior to being granted access to the Boat Basin, Visitors Information Center MRS.
- Site layout.
- Hazard control.
- Emergency response and notification.
- Hearing conservation.
- PPE.
- Buddy system.
- Spills.
- Fires.
- Hazard communication.
- Visitor access.
- Public communication guidelines.
- Any specific training required by regulations.

6.3 MANDATORY TRAINING AND CERTIFICATIONS

WESTON will ensure that staff members have the following training and certifications to meet project requirements:

- 40-hour Hazardous Waste Operations and Emergency Response (HAZWOPER).
- 8-hour HAZWOPER Refresher.
- OSHA 30-hour Construction Safety Training – Minimum SSHO or UXOSO.
- UXO Technicians – Graduate of a military EOD school, as a technician or assistant, from the U.S., Canada, Great Britain, Germany or Australia, or from an approved formal UXO training course of instruction as documented in DoD Explosives Safety Board Technical Paper 18.
- Boating personnel - Officers and crew shall be in possession of a current, valid USCG license.
- Divers – Divers will meet OSHA standards and certification in accordance with U.S. Naval regulations (see Dive Plan).

- Blaster -- Certified from the Bureau of Alcohol, Tobacco, Firearms, and Explosives and/or Virginia State Blaster's License – A minimum of one person when conducting demolition operations.
- Dangerous goods shipper -- DOT and International Air Transportation Association function-specific training for shipping hazardous materials.
- First Aid, CPR, Bloodborne Pathogens – A minimum of two persons.

Copies of applicable training records for project personnel will be available on-site and maintained by the SSHO or UXOSO, and are provided in **Attachment 3**. **Table 10-1,** which lists certifications of key personnel, is presented in Subsection 10.6.

6.3.1 OSHA HAZWOPER Training

All general Boat Basin, Visitors Information Center MRS workers will have completed the initial OSHA 40-hour HAZWOPER training course and will have had 3 days of field experience under the direct supervision of a trained experienced supervisor. On-site management personnel (SUXOS and SSHO or UXOSO) will have had an additional 8 hours of specialized supervisory training. Workers will have also received the mandatory 8-hour refresher training within the past 12 months. All training, including project-specific training, will be documented and maintained on-site.

6.3.2 OSHA 30-Hour Construction Safety

In compliance with USACE Health and Safety Requirements Manual (EM 385-1-1), 15 September 2008, all SSHOs or UXOSOs, at a minimum, will have completed the 30-hour OSHA construction safety class or equivalent training, and will complete a minimum of 24 hours of formal safety coursework every 4 years. Training for the OSHA 30-Hour Construction Safety course or equivalent course will include the areas listed below:

- Occupational Safety and Health Act/General Duties Clauses.
- 29 CFR 1904, Recordkeeping.
- Subpart C: General Safety and Health Provisions, Competent Person.
- Subpart D: Occupational Health and Environmental Controls.
- Subpart E: PPE, types and requirements for use.

- Subpart F: Understanding fire protection in the workplace.
- Subpart K: Electrical.
- Subpart M: Fall Protection.
- Rigging, welding, and cutting, scaffolding, excavations, concrete and masonry, demolition; health hazards in construction, materials handling, storage and disposal, hand and power tools, motor vehicles, mechanized equipment, underwater operations, steel erection, stairways and ladders, confined spaces, or any other procedures that are applicable to the work being performed.

6.4 PERIODIC SAFETY AND HEALTH TRAINING

The SSHO or UXOSO will present daily site safety briefings (i.e., tailgate meetings) to on-site personnel prior to the start of the work shift. The purpose of the briefings is to assist personnel in safely conducting the scheduled work activities. The briefings will include the following topics:

- Tasks to be performed and work method and general description of job scope.
- Work location.
- Equipment usage.
- Control of hazards.
- Weather conditions.
- Emergency response review.

The briefings will provide an opportunity for individuals to share observed safety deficiencies and recognitions. Documented attendance at these daily safety briefings will be maintained by the SSHO or UXOSO.

In addition to the daily site safety briefings, a formal safety meeting will be conducted at least monthly for all SSHO or UXOSOs within their respective divisions. A safety manager or designee will be invited to attend this monthly meeting.

6.5 REQUIREMENTS FOR EMERGENCY RESPONSE TRAINING

WESTON provides training by the American Red Cross, or equivalent organization in both Standard First Aid and Adult CPR for all the field staff. At least two WESTON personnel with such training, and also trained in the use of fire extinguishers, will be on-site to provide emergency response. In the event specialized and/or elevated care is necessary, either WESTON or the local emergency medical technician and/or ambulance service will transport the injured person to the appropriate medical facility.

Outside assistance will be requested as detailed in the Emergency Response Plans included in the SSHP.

All WESTON personnel involved with responding to an on-site emergency will be briefed in their roles and responsibilities as part of the initial indoctrination training discussed above. During this training, personnel will be briefed on the Hazard Communication Program, emergency equipment, and first aid procedures, as described in the SSHP. Personnel will also be briefed on emergency response and contingency procedures presented in Sections 10 and 15 of the SSHP, which include the following topics:

- Procedures and tests (e.g., evacuation, fire drills as necessary).
- Spill prevention.
- Firefighting.
- Posting of emergency telephone numbers.
- Medical support.

This training will be documented and will also involve a drill of the emergency response procedures prior to the start of Boat Basin, Visitors Information Center MRS activities. During this training, the route to and location of the evacuation point and the location of medical support will be discussed with each staff member.

6.6 VISITOR TRAINING

The SSHO or UXOSO will provide all visitors with site-specific training on activity hazard awareness, Boat Basin, Visitors Information Center MRS orientation (e.g., exclusion zones, access points, and site facilities), PPE requirements, evacuation routes, and assembly points, at a minimum. Additional training topics may be included based on specific site operations. Site visitors will be escorted throughout the Boat Basin, Visitors Information Center MRS by the SUXOS - Site Manager, who will maintain a log of all visitors to the MRS.

7. SAFETY AND HEALTH INSPECTIONS

7.1 SPECIFIC ASSIGNMENTS OF RESPONSIBILITIES

The SSHO or UXOSO will conduct and document daily safety and health observations on the project log. Daily inspections shall include visual observations including, but not limited to:

- Underwater operations and support systems (twice daily).
- Anomaly reacquisition status.
- Anomaly investigation activities (land- and water-based).
- Anomaly intrusive activities (twice daily).
- Transportation of explosives (during all related activities).
- Excavations (minimum of daily).
- Machinery or other mechanized equipment.
- MEC demolition and/or disposition activities (during all related activities).
- Waste storage areas.
- Work practices and use of PPE.
- Site security and control.

Weekly inspections, including emergency response equipment, will be conducted by the SSHO or UXOSO using the Environmental Health and Safety Inspection Checklist presented in **Attachment 4**. The qualifications and certifications of the inspector (e.g., the SSHO or UXOSO) are provided in **Attachment 3** of this APP. In addition, the UXOQCS, as part of QC responsibilities, will conduct and document daily SOH inspections in daily QC logs.

7.2 INSPECTIONS AND AUDIT FREQUENCY

	Responsible Staff	Daily	Weekly	Monthly
Inspections	SSHO or UXOSO	X	X	
Audits	Federal Team Health and Safety Officer or designee			X

Notes:
SSHO = Site Safety and Health Officer
UXOSO = Unexploded Ordnance Safety Officer

7.3 DEFICIENCY TRACKING

A deficiency tracking form, presented in **Attachment 5**, will be used to document unacceptable work practices. The deficiency tracking form is used to list and facilitate monitoring of the status of safety and health deficiencies in chronological order; display the type and description of the deficiency; the risk rating; code reference; the corrective action taken and the projected resolution date; date resolved; and the person responsible for the corrective action. The deficiency tracking form will be posted on the safety bulletin board and will be updated daily. In most cases, discrepancies of greater severity are corrected immediately, or within 24 hours if they are of lower severity.

When a deficiency is identified, the SSHO or UXOSO will follow up by updating the deficiency tracking form to indicate the specific corrective action, the person(s) responsible for the corrections, and the date by which the action needs to be accomplished. The SSHO or UXOSO will also follow up by ensuring that the corrective action is accomplished in the timeframe indicated. During health and safety audits, the deficiency log is reviewed to ensure that the corrective action process has been implemented. The information from the deficiency tracking form is presented in daily safety and monthly supervisor meetings so that lessons learned are disseminated.

7.4 EXTERNAL INSPECTIONS AND CERTIFICATIONS

Although no external inspection is expected, regulatory agencies do conduct inspections from time to time. An inspector should be treated as a professional and with courtesy. The regulatory agency inspector should introduce himself or herself to the manager in charge of the operation and present credentials to verify that he or she is representing a recognized regulatory agency, such as OSHA or DOT. Personnel who cannot demonstrate their affiliation with a recognized regulatory agency should not be allowed access to the project location or office.

Any pre-inspection conference will be attended by the SUXOS and SSHO or UXOSO, at a minimum. At that time, the scope of the inspection should clearly be described by the inspector. If the inspector has not described the scope of the inspection during the pre-inspection conference, ask the inspector to provide such a description.

Prior to taking the inspector on-site or into the office, it is necessary to contact the Project Manager, USACE, and either the Division EHS Officer or Federal Team Health and Safety Officer. The inspector will perform the inspection, which may include a walk-through inspection of the work site or a targeted file and/or records review. The site or office inspection typically ends with a close-out conference during which the inspector may provide tentative findings. In some cases, the inspector may forego the close-out conference and issue a written citation after leaving the Boat Basin, Visitors Information Center MRS. On occasion, inspections may require more than 1 day.

Regulatory agency inspectors seldom issue citations during the inspection; however, if an OSHA or EPA inspector observes an imminent hazard, he or she can order a work stoppage.

It is WESTON's practice to cooperate with investigations. Information that is requested should be provided; however, requests for copies of documents, health and safety plans, and training records should not be provided without first obtaining approval from WESTON's Law Department. Under no circumstances should any attempt be made to mislead the inspector.

Coordination of any regulatory agency inspection is the responsibility of the SSHO or UXOSO, who will accompany the inspector during all stages of the inspection.

8. ACCIDENT REPORTING

8.1 EXPOSURE DATA (MAN-HOURS WORKED)

The SSHO or UXOSO and Project Manager will track exposure hours. The hours will be presented as a spreadsheet compilation of WESTON and subcontractor hours worked and any reportable accidents that occurred during the month and also those that have occurred since the start of the project. WESTON's Risk Management Administrators compile weekly corporate totals that are distributed to the Division Safety Officers for posting. The Project Manager will provide the Monthly Record of Work-Related Injuries and/or Illnesses and Exposure Hours document to the USACE Contracting Officer's Representative (COR) by the 10th of the following month.

8.2 ACCIDENT INVESTIGATIONS, REPORTS, AND LOGS

All incidents, near incidents, spills, thefts, or other Boat Basin, Visitors Information Center MRS issues will be reported to the WESTON Mid-Atlantic Division EHS Officer or the Federal Team Health and Safety Officer within 1 hour of the occurrence or as soon as physically possible. The USACE ENG Form 3394 Accident Investigation Report, provided in **Attachment 6**, and the WESTON electronic incident reporting and notification process (Notice of Incident (NOI) Track) must be submitted to the Division EHS Officer and Federal Team Health and Safety Officer within 24 hours of the incident. Except for the 1 hour immediate notification requirements addressed below, all incidents will be reported to KO/COR verbally within 24 hours and using USACE ENG Form 3394 as soon as possible, but not more than 5 days after the incident.

All accidents involving contractor personnel meeting the reporting requirements of 29 CFR 1904 and/or property damage in an amount greater than $2,000 will be reported to the Government Designated Authority (GDA) within 24 hours. Serious accidents meeting the requirements of EM 385-1-1, Section 01.D.02 shall be reported immediately to the GDA. The contractor shall maintain a First Aid Log for all accidents where first aid is administered but the incident does not meet the reporting requirements for 29 CFR 1904. All reportable accidents will be investigated by the contractor and an ENG Form 3394 submitted to the GDA within 5 calendar days of the accident date.

WESTON's NOITrack is used to document all incidents, corrective action plans, and investigations involving WESTON-managed work. Incidents meeting the OSHA definitions of recordable incidents are logged on the WESTON 300 logs, and the SSHO also logs these incidents on the Boat Basin, Visitors Information Center MRS OSHA 300 log.

WESTON investigates all incidents, including near incidents or "near misses." Investigation findings, along with appropriate corrective actions, will be reported to the KO/COR in the prescribed format as soon as possible but no later than 5 working days following the accident. Corrective actions will be implemented as soon as reasonably possible.

8.3 IMMEDIATE ACCIDENT NOTIFICATION

The following incidents require immediate notification, no later than 1 hour, to the KO/COR, or designee:

- Fatalities.
- Permanent total disability.
- Permanent partial disability.
- Hospitalization of three or more people resulting from a single occurrence.
- Property damage of $500,000 or more.

The written follow-up will utilize USACE ENG Form 3394 Accident Investigation Report (see **Attachment 6**).

WESTON will notify OSHA within 8 hours of any fatality or single incident that results in hospitalization of three or more persons.

8.4 NOITRACK PROCEDURE

In June 2009, WESTON's Corporate EHS released a new NOI reporting system. The NOITrack system replaces the NOI Form for reporting incidents, although the form may still be used if access to a computer is unavailable. The NOITrack system can be accessed on the WESTON Portal, EHS homepage. The NOITrack information must be completed within 24 hours of the incident, accident, or near incident. The requirement and general procedure for reporting incidents have not changed, only the method of submitting them, as described below has been altered. Anyone involved in the incident can complete an NOI.

The NOI must be used to report ALL incidents and near-incidents. Incidents include the following: employee accidents; injuries; auto accidents; property damage and/or loss; utility damage; information and/or data breaches; security concerns and/or breaches; break-ins; subcontractor injuries, accidents, and/or events; OR any other liability situation or circumstance that could give rise to a claim. For example, spills and/or discharges resulting from the installation of equipment or systems by WESTON or our subcontractors should be reported using the NOITrack system. This system enhances WESTON's ability to record, track, update, and report on all project-related incidents in addition to providing a useful tool for capturing lessons learned.

8.5 ACCIDENT REVIEW

Any accident that occurs while an employee is driving on company business or operating a WESTON-owned, leased, rental, or allowance vehicle at any time will be reviewed and investigated. Drug and/or alcohol testing will be conducted in a timely manner in accordance with WESTON Drug and Alcohol Operating Practice (05-01-010). The accident review is intended to determine whether the accident was "preventable" as defined by the National Safety Council. The investigation will also include consideration of citations issued, if any, and the specifics of the accident to determine appropriate consequences, if any. Investigation may result in outcomes such as recommendation for driver training programs, changes or modifications to vehicle and/or equipment, suspension of driving privileges, or employee termination. Typically, auto accident investigations will be coordinated on a divisional level, following protocols similar to those established by Corporate EHS and divisions for other root-cause investigations. WESTON's Risk Management Department will provide input and guidance and serve as a liaison with insurance carriers, as needed.

9. MEDICAL SUPPORT

9.1 ON-SITE MEDICAL SUPPORT

In the event that on-site medical support is required, WESTON, USACE, and the local Fire and Emergency Medical Service Departments can be notified of emergency situations by using the telephone numbers listed in **Tables 9-1** through **9-3**.

Table 9-1 Emergency Contact Numbers

Organization and/or Point of Contact	Telephone Number
Emergency Service (Ambulance, Fire, Police)	911
Police (non-emergency) Accomack County Sheriff 23323 Wise Court Accomac, VA 23301	(757) 787-1131
Fire (non-emergency) Station 4 Atlantic Fire Company (volunteer fire, no EMS) 10071 Atlantic Road Atlantic, VA 23303	(757) 824-4844
NASA Wallops Flight Facility Fire Department Main Station #25 Wallops Flight Facility, VA	(757) 824-1300
Station 20 Oak Hall Rescue (volunteer fire and full-time EMS)	(757) 824-3370
Hospital Peninsula Regional Medical Center 100 East Carroll Street Salisbury, MD 21801	(410) 546-6400
VA State Police	911
National Response Center	(800) 424-8802

Notes:

*See **Attachment 7** for EMS and/or Rescue Confirmation and Evaluation.

EMS = Emergency Medical Service
NASA = National Aeronautics and Space Administration

A first aid kit will be provided on-site and will be in compliance with the criteria contained in American National Standards Institute (ANSI) Z308.1-2009, and will meet the requirements of EM 385-1-1, November 2008, Section 03.B.

Table 9-2 WESTON and USACE Emergency Contact Numbers

Organization and/or Point of Contact	Telephone Number
USACE Baltimore District Project Manager: Sher Zaman	(410) 962-3134 (office) (410) 428-2318 (fax)
USACE Ordnance and Explosives Safety Specialist: Lowell Martin	(410) 350-9860 (cell)
WFF Safety Office	(757) 824-2518
VDEQ Emergency Response	(804) 698-4159
EPA Region III Emergency Response	(215) 814-3033
WESTON Emergency (24 hour) (West Chester)	(610) 692-3000
WESTON Project Manager: Tony Pace	(757) 819-5310 (office) (757) 362-2461 (cell)
WESTON CIH: George Crawford	(610) 701-3771 (office) (484) 437-5976 (cell)
WESTON East Division EHS Officer: Larry Werts	(610) 701-3912 (office) (215) 815-6237 (cell)
Federal Team Health and Safety Officer: Chris Baer, CSP	(610) 701-3653 (office) (484) 239-4249 (cell)
WESTON Medical Programs Manager: Bill Irwin	(610) 701-3684 (office) (267) 918-8371 (cell)
WESTON Corporate EHS Director: Bill Irwin	(610) 701-3684 (office) (267) 918-8371 (cell)

Notes:

CIH = Certified Industrial Hygienist
CSP = Certified Safety Professional
EHS = Environmental Health and Safety
EPA = U.S. Environmental Protection Agency
USACE = U.S. Army Corps of Engineers
VDEQ = Virginia Department of Environmental Quality
WESTON = Weston Solutions, Inc.
WFF = Wallops Flight Facility

Table 9-3 Other Emergency Contact Numbers

Organization and/or Point of Contact	Telephone Number
Poison Control Center	(800) 962-1253
Spill Response - CHEMTREC	(800) 424-9300
WorkCare WESTON Medical Director Dr. Peter Greaney WorkCare WESTON Program Administrator Heather Lind	From 06:00 to 16:30 Pacific Time, call 800-455-6155 dial 0 or extension 175, Heather Lind to request the on-call clinician
After-Business Hours Contact (Emergency Only)	16:31 to 05:59 Pacific Time and weekends and Holidays, call 800-455-6155 and dial 3 to reach the after-hours answering service. Request that the service connect you with the on-call clinician or the on-call clinician will return your call within 30 minutes.
WESTON Emergency (24 hour) (West Chester)	(610) 701-3720

In case of injury, the following procedures apply:

- For minor injuries, routine first aid procedures will be used.
- For major injuries, an ambulance will be called immediately and the appropriate first aid administered while awaiting the arrival of the ambulance.
- Trained personnel will use approved measures for treatment based on the training they have received; a minimum of two staff members will be on-site at all times that retain current certification in first aid and CPR. **Table 10-1**, which lists certifications of key personnel, is presented in Subsection 10.6.

9.2 OFF-SITE MEDICAL SUPPORT

In the event specialized and/or elevated care is necessary, either WESTON or the local ambulance service will transport the injured person to the Peninsula Regional Medical Center.

WESTON has evaluated the Emergency Medical Services. WESTON's form for evaluation and confirmation of these services is presented in **Attachment 7** of the APP.

Off-site medical emergency contact information for WESTON, USACE, and the local Fire and Emergency Medical Service Departments is provided in **Tables 9-1** through **9-3**.

9.3 DIRECTIONS AND MAP TO NEAREST HOSPITAL

9.3.1 Hospital Route

The appropriate emergency vehicle will travel to the Peninsula Regional Medical Center located in Salisbury, MD, as shown on **Figure 9-1**. Peninsula Regional Medical Center is the closest hospital to the Boat Basin Visitors Information Center MRS. The hospital is approximately 42 miles away with a travel time of approximately 54 minutes.

9.4 FIRST AID AND CPR TRAINING

Table 9-4 presents first aid and CPR training for key personnel.

Table 9-4 First Aid and CPR Training for Key Personnel

Name	First Aid (Expiration Date)	CPR (Expiration Date)	BBP (Expiration Date)
Elizabeth Cunningham	5/28/2015	5/28/2015	4/22/2014
Katie Morrison	4/6/2015	4/6/2015	3/11/2014
Troy Phelps	11/1/2014	11/1/2014	9/18/2014
Bill Bounds	7/20/2014	7/20/2014	5/13/2014

9.5 BLOODBORNE PATHOGENS

WESTON personnel will follow the guidance established in the BBP Exposure Control Plan presented in **Attachment 8**.

9.6 MEDICAL SURVEILLANCE

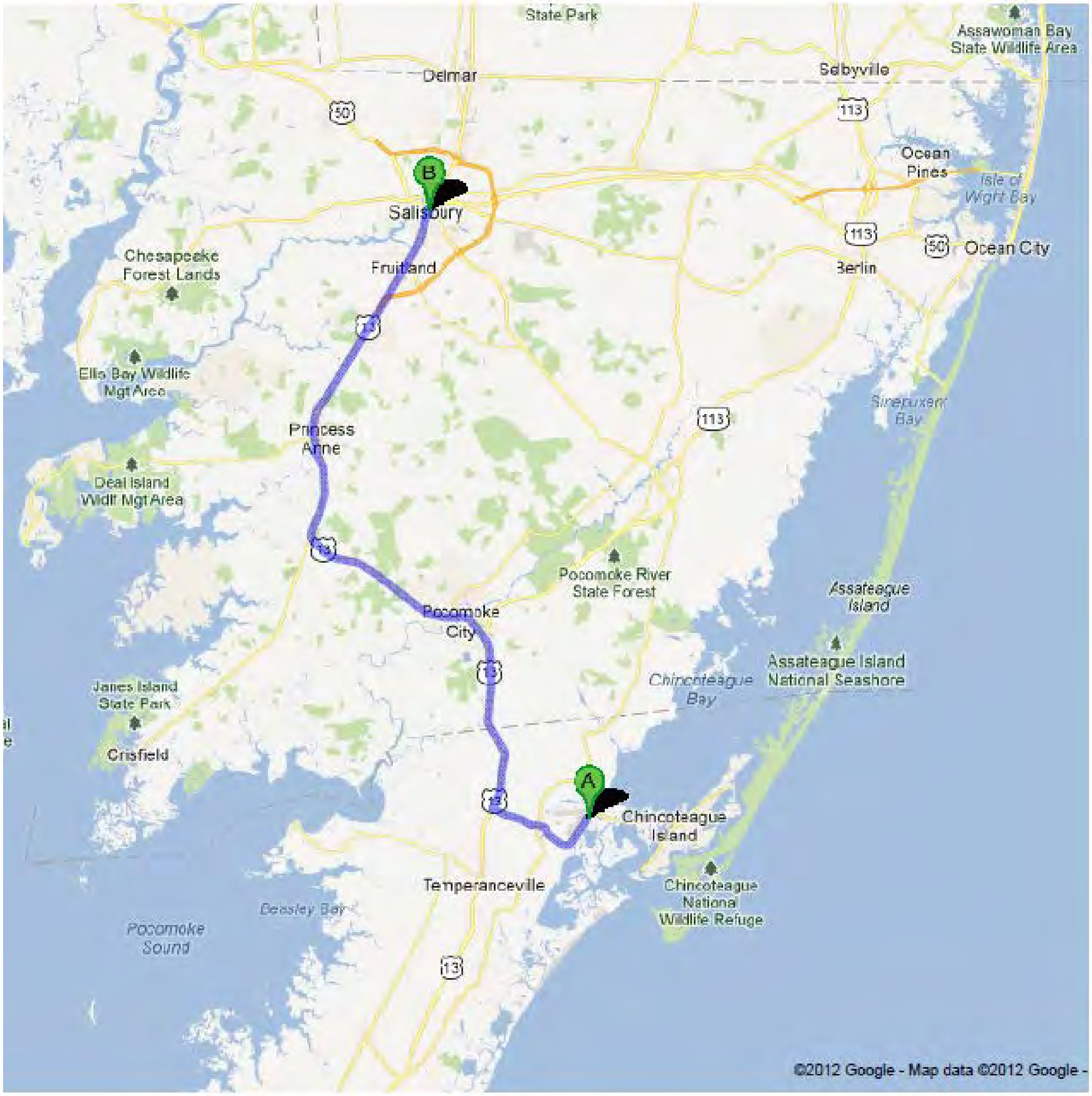
Since 1980, WESTON has used a comprehensive Occupational Health Program (OHP) that complies with all OSHA and USACE requirements. All site personnel and subcontractors who enter the Boat Basin, Visitors Information Center MRS while operations are being conducted must comply with a comparable OHP. Personnel will be required to provide their certifications to the SSHO or UXOSO for review and approval prior to being granted authorization to work. All certifications will be stored and maintained on-site.

9.6.1 Occupational Health Program

To comply with OSHA requirements, WESTON has designated Dr. Peter Greaney of WorkCare to oversee the site-specific medical surveillance and OHP. Dr. Greaney is a board-certified physician in internal and occupational medicine**. Dr. Greaney can be reached during regular business hours at (800) 455-6155.**

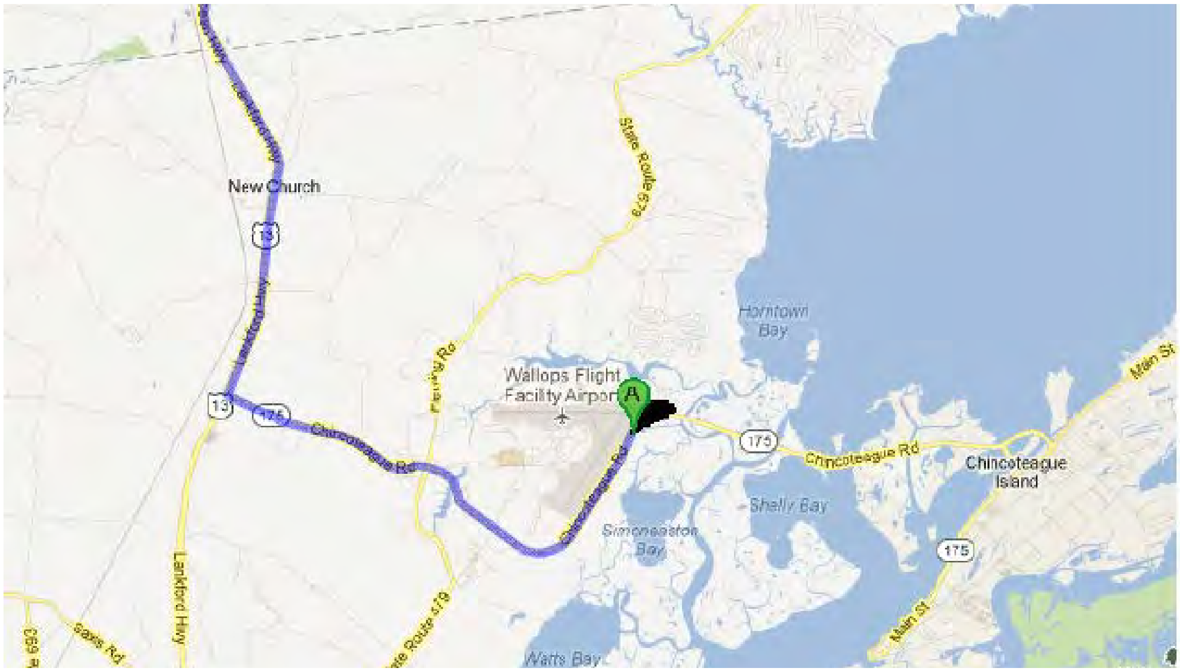
The purpose of the OHP is to ensure suitable job placement of employees, to monitor the health effects of hazards encountered in the workplace, and to maintain and promote good health through preventive measures. Medical examination criteria are established by WorkCare in compliance with 29 CFR 1910.120.

Figure 9-1 Route to Peninsula Regional Medical Center

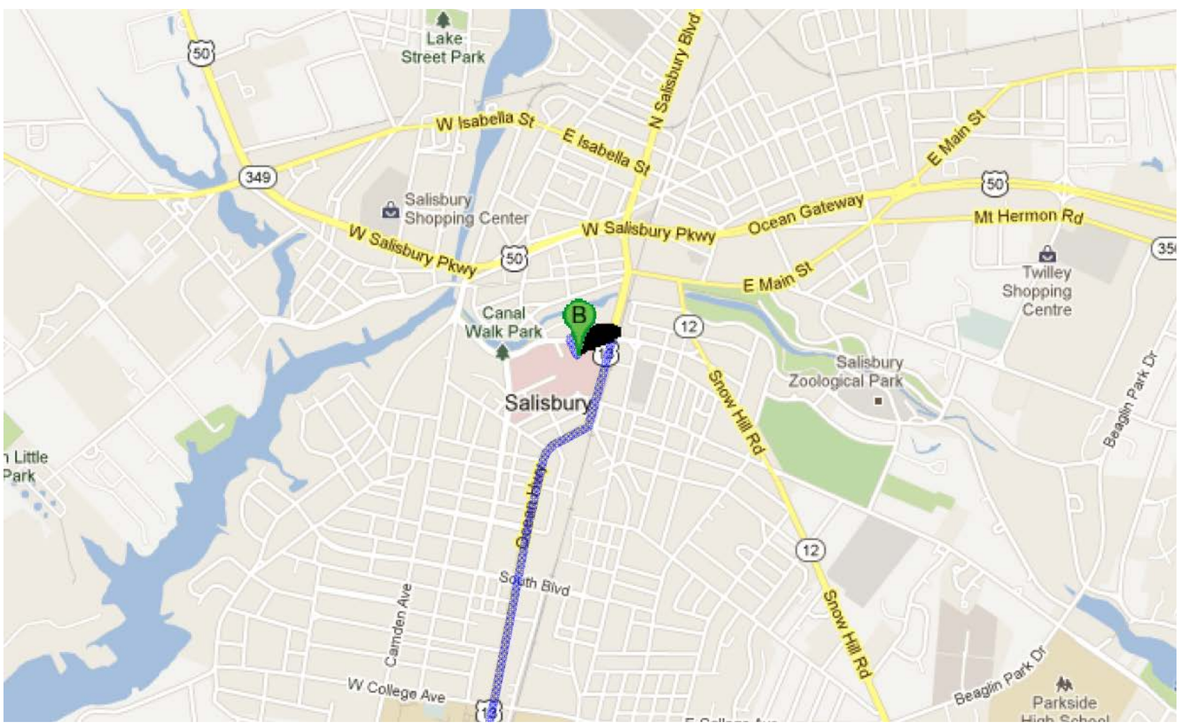


<u>General Overview to Hospital</u>

Note: This map is subject to Google's Terms of Service, and Google is the owner of rights therein.



Wallops Flight Facility Surface Street



Hospital Vicinity Surface Streets

Start Location: NASA Visitor Center, Wallops Island, VA
End Location: 100 East Carroll Street, Salisbury, MD 21801
Total Distance: 42 miles
Total Time: 54 minutes

Directions:

NASA Visitor Center, Wallops Island
NASA Wallops Flight Facility, 2, VA 23337

175	1. Head **southwest** on **VA-175 W/Chincoteague Rd** toward **Wallops Neck Rd** About 8 mins	go 5.8 mi total 5.8 mi
13	2. Turn right onto **US-13 N/Charles M Lankford Jr Memorial Hwy/Lankford Hwy** Continue to follow US-13 N Entering Maryland About 36 mins	go 30.9 mi total 36.7 mi
13	3. Exit onto **US-13 BUS N/S Fruitland Blvd** toward **Fruitland/Salisbury** Continue to follow US-13 BUS N About 9 mins	go 5.2 mi total 42.0 mi
	4. Turn left onto **E Carroll St** About 1 min	go 0.1 mi total 42.1 mi
	5. Turn left to stay on **E Carroll St** Destination will be on the right	go 249 ft total 42.1 mi

100 E Carroll St, Salisbury, MD 21801

These directions are for planning purposes only. You may find that construction projects, traffic, weather, or other events may cause conditions to differ from the map results, and you should plan your route accordingly. You must obey all signs or notices regarding your route.

10. PERSONAL PROTECTIVE EQUIPMENT

The process by which WESTON evaluates hazards and assigns the appropriate level of protection for each task is provided in the following subsections.

10.1 HAZARD ASSESSMENTS

For the Boat Basin, Visitors Information Center MRS RI project, the Federal Team Health and Safety Officer and the SSHO or UXOSO are responsible for overseeing development and implementation of the PPE Program. Once on-site, the SSHO or UXOSO is responsible for ensuring that a survey is conducted for each work area to identify the sources of hazards, including impact, penetration, compression, chemicals, heat, dust, electrical sources, material handling, and light radiation. To assist with this survey, the Hazard Assessment Certification Form is provided in **Attachment 9**.

10.2 IDENTIFYING WHEN HAZARD ASSESSMENTS WILL BE CONDUCTED

Hazard assessments are conducted during the site walk and document review. During the initial PPE decision-making process, the preparer of the APP and SSHP reviewed available site information and established the level of protection to be worn by site personnel for each task. Additional hazard assessments will be conducted periodically and when field activities or site conditions change.

10.3 IDENTIFYING HOW HAZARD ASSESSMENTS WILL BE CONDUCTED

The selection of the most appropriate level of protection depends on the following:

- Hazards, known or potential:
    - Physical hazards.
    - Biological hazards.
    - Chemical hazards.
- Properties such as toxicity, radioactivity, route of exposure, and matrix (i.e., air, soil, water) in which the contaminants are known or suspected.

- Type and measured concentrations of contaminants.
- Potential for exposure based upon task.

During the initial selection of PPE, the SSHO consults with the appropriate safety professionals about the suitability of the PPE selected based on the site activities and anticipated conditions. New or additional PPE will be selected as conditions change to ensure a level that will protect employees from hazards. Care will be taken to recognize the possibility of multiple and simultaneous exposure to a variety of hazards.

The levels of personal protection and the procedures specified in this plan are based on the best information available from reference documents and current Boat Basin, Visitors Information Center MRS data. Therefore, these recommendations represent the minimum safety and health requirements to be observed by all personnel engaged in this project. Unforeseeable site conditions or changes may warrant a reassessment of protection levels and controls stated. All adjustments to the APP must have prior approval by the Federal Team Health and Safety Officer and USACE.

10.4 PERSONAL PROTECTIVE EQUIPMENT TRAINING

In accordance with OSHA 29 CFR 1910, Subpart I (Personal Protective Equipment), PPE will be provided, used, and maintained in a sanitary and reliable condition. The PPE will be of construction, design, and material sufficient to provide employees protection against known or anticipated hazards. The PPE will be selected to properly and appropriately fit the employee. Any concerns regarding the use of appropriate PPE will be brought to the attention of the SSHO or UXOSO, who is directed to contact the Federal Team Health and Safety Officer for assistance in evaluation of PPE as necessary.

As indicated in **Table 2-1**, ground-based operations at the Boat Basin, Visitors Information Center MRS will be completed in Level D, Modified Level D, or Level C (if appropriate based on air monitoring results). Water-based geophysical activities will be conducted in Modified Level D PPE, including the use of personal flotation devices (PFDs). If higher levels of protection are required, an addendum to the APP and SSHP will be prepared and approved. Underwater operations will require PPE in accordance with the requirements presented in **Appendix G** (Dive Plan) of the RI Work Plan.

In accordance with OSHA, any worker required to wear PPE shall receive training in the proper use and care of PPE. Periodic retraining shall be offered by the Corporate EHS Manager or designees to both the employees and the supervisors, as needed. The training shall include, but not necessarily be limited to, the following subjects:

- Situations when it is necessary to wear PPE.
- Type of PPE that is necessary.
- Procedures used to properly don, doff, adjust, and wear PPE.
- Limitations of PPE.
- Proper care, maintenance, useful life, and disposal of PPE.

Typical delivery of training is through formal programs such as HAZWOPER training, refresher training, or specific hazard training. Additional training is offered through routine site training and site-specific training. After the training, the employees shall demonstrate that they understand the components of the PPE program and how to use PPE properly, or they shall be retrained.

10.5 PERSONAL PROTECTIVE EQUIPMENT RETRAINING

Retraining is through formal programs such as those discussed in Section 6.

10.6 WRITTEN CERTIFICATION OF EMPLOYEE PERSONAL PROTECTIVE EQUIPMENT TRAINING

Project personnel will have appropriate training as determined by the Federal Team Health and Safety Officer. All required training and certifications are reviewed as part of the APP and SSHP development internally prior to project commencement. WESTON has an on-line system, EHSTrack, to allow rapid access to personnel training records. WESTON can track current certification status of WESTON personnel assigned to each project. The SSHO or UXOSO uses EHSTrack to update contact information, view EHS personnel training certifications, and view medical clearances. The SSHO or UXOSO will verify each person’s training certification and medical clearance status prior to the start of work and will periodically perform reviews for updates. Key site personnel training and/or certifications are provided in **Table 10-1**.

Table 10-1 Current Key Site Personnel Training and/or Certifications

Personnel	UXO Training	Medical Clearance (expires)	40-Hour HAZWOPER	8-Hour HAZWOPER Refresher (expires)	30-Hour OSHA Construction Safety	First Aid (expires)	CPR (expires)	BBP (expires)	8-Hour Site Safety Supervisor
Elizabeth Cunningham (SSHO – Geophysical Survey)	NA	07/10/2014	07/23/2010	04/22/2014	03/11/2011	5/29/2015	5/29/2015	04/22/2014	12/15/2011
Bill Bounds(SSHO – Intrusive Investigation)	NA	5/16/2015	5/18/2001	5/13/2014	11/16/2012	7/20/2014	7/20/2014	5/13/2014	3/14/2013
Troy Phelps (UXOSO/UXOQCS)	07/01/1997	09/25/2014	10/24/1997	10/31/2013	04/10/2009	11/01/2014	11/01/2014	10/31/2013	04/02/2009
Brian Grassmyer (SUXOS)	12/18/1987	03/28/2014	06/11/2009	10/26/2013	05/18/2010	07/16/2014	07/16/2014	NA	08/10/2009
Katie Morrison (Geophysicist)	NA	05/11/2014	01/04/2012	3/11/2014	NA	04/06/2015	04/06/2015	03/11/2014	04/05/2013
Brian Guthrie (Geophysicist)	NA	01/08/2015	06/23/2000	03/05/2014	09/19/2008	03/27/2015	03/27/2015	--	01/24/2001
UXO Technician I – TBD	TBD	TBD	TBD	TBD	TBD	NA	NA	NA	NA
Casey Faust (UXO Technician II)	5/9/2003	5/31/2015	5/30/2011	12/16/2013	NA	NA	NA	NA	NA
UXO Technician III – TBD	TBD	TBD	TBD	TBD	TBD	NA	NA	NA	NA

Notes:

UXO = unexploded ordnance
SUXOS = Senior UXO Supervisor
UXOSO = UXO Safety Officer
UXOQCS = UXO Quality Control Specialist
SSHO = Site Safety and Health Officer
TBD = To Be Determined
HAZWOPER = Hazardous Waste Operations and Emergency Response
CPR = cardiopulmonary resuscitation
BBP = bloodborne pathogens
OSHA = Occupational Safety and Health Administration
NA = not applicable

All certificates requiring renewal prior to scheduled mobilization date will be obtained, provided to U.S. Army Corps of Engineers, and filed on-site. Personnel will not be authorized to conduct Remedial Investigation activities without providing documentation for medical clearances, training, and/or applicable licenses, as required.

11. PLANS REQUIRED BY EM 385-1-1

Plans, programs, and procedures required by EM 385-1-1 and their disposition in the APP or SSHP are shown in **Table 11-1**.

Table 11-1 Plans Required by EM 385-1-1

Plan, Program or Procedure	Document Location
a. Layout plans (04.A.01)	This project does not involve the construction of any temporary buildings or support systems; therefore, layout plan is not required.
b. Emergency Response Plans	
(1) Procedures and tests (01.E.01)	SSHP Section 15
(2) Spill Plans (01.E.01, 06.A.02)	SSHP Section 10.4
(3) Fire-Fighting Plan (01.E.01, 19.A.04)	SSHP Section 15.8
(4) Posting of Emergency Telephone Numbers (01.E.05)	SSHP Subsection 15.5: **Tables 15-1, 15-2**, and **15-3**
(5) Man overboard/abandon ship (19.A.04)	See Dive Plan (**Appendix G** of the RI Work Plan)
(6) Medical Support (Section 03.A.02; 03.D)	APP Section 9
c. Plan for Prevention of Alcohol and Drug Abuse (01.C.02)	SSHP Subsection 10.7
d. Site Sanitation Plan (Section 02)	SSHP Subsection 10.12
e. Access and Haul Road Plan (4.B)	This plan is not required because no haul road activities are anticipated.
f. Respiratory Protection Plan (05.G)	APP Subsection 11.3.
g. Health Hazard Control Program (06.A)	Health Hazard Control is addressed in the AHAs in Section 12 of the APP and Section 3 of the SSHP.
h. Hazard Communication Program (01.B.01) Provide the location of the Material Safety Data Sheet (MSDS), records of contractor employee training, and inventory of hazardous materials (including approximate quantities and a site map) that will be brought onto government project by the contractor and subcontractor.	Will be maintained at the site by the SSHO. SSHP Subsection 2.3 and SSHP **Attachment A**.
i. Process Safety Management Plan (06.B.04)	This plan is not required because no highly hazardous chemicals are associated with the work plan.
j. Lead Abatement Plan (06.B.05 and specifications)	This plan is not required because no lead abatement activities are anticipated.
k. Asbestos Abatement Plan (06.B.05 and specifications)	This plan is not required because no asbestos abatement activities are anticipated.
l. Radiation Safety Program (06.E.03.a)	Encountering ionizing radiation above background is not anticipated.
m. Abrasive Blasting (06.H.01)	This plan is not required because no abrasive-blasting activities are anticipated.

Table 11 – 1 Plans Required by EM 385-1-1 (Continued)

Plan, Program or Procedure	Document Location
n. Heat/Cold Stress Monitoring Plan (06.I.02)	SSHP Section 9
o. Crystalline Silica Monitoring Plan (Assessment) (06.M)	This plan is not required because no work is anticipated to result in exposure to silica.
p. Night Operations Lighting Plan (07.A.08)	This plan is not required because no night operations will occur.
q. Fire Prevention Plan (09.A)	SSHP Subsection 15.8
r. Wild Fire Management Plan (09.K.01)	SSHP Subsection 15.8.1
s. Hazardous Energy Control Plan (12.A.01)	This plan is not required because no stored hazardous energy activities are anticipated.
t. Critical Lift Procedures (16.H)	This plan is not required because no critical lift is required.
u. Floating Plant Contingency Plan for Severe Weather (19.A.03)	A contingency plan for severe weather is included in Section 11.1.
v. Float Plan (19.F.04)	A float plan for geophysical operations is presented in Section 11.2.
w. Fall Protection Plan (Section 21.C)	This plan is not required because no work at elevation requiring a Fall Protection Plan is anticipated.
x. Demolition Plan (engineering surveys) (23.A.01)	This plan is not required because no building demolition activities are anticipated.
y. Excavation/Trenching Plan (25.A.01)	SSHP Subsection 10.13.
z. Emergency Rescue (tunneling) (26.A)	This plan is not required because no tunneling activities are anticipated.
aa. Underground Construction Fire Prevention and Protection Plan (26.D.01)	This plan is not required because no underground construction work will be done.
bb. Compressed Air Plan (26.I.01)	This plan is not required because no work under compressed air is anticipated.
cc. Formwork and Shoring Erection and Removal Plans (27.C)	This plan is not required because no shoring activities are anticipated. Benching may be performed if test pit excavation is anticipated to extend deeper than 4 feet.
dd. Pre-Cast Concrete Plan (27.D)	This plan is not required because no pre-cast concrete work is anticipated.
ee. Lift Slab Plans (27.E)	This plan is not required because no lift slab activities are anticipated.
ff. Steel Erection Plan (27.E.01)	This plan is not required because no steel erection activities are anticipated.
gg. Safety and Health Plan	**Attachment 2** of the APP.

Table 11 – 1 Plans Required by EM 385-1-1 (Continued)

Plan, Program or Procedure	Document Location
hh. Blasting Plan (29.A.01)	No blasting as covered by Section 29 EM 385-1-1. Demolition of UXO is addressed in Section 3 of the RI Work Plan, and the ESP (provided as **Appendix K** to the RI Work Plan).
ii. Diving Plan (30.A.13)	See Dive Plan (**Appendix G** of Work Plan).
jj. Confined Space (34.A)	This plan is not required because no confined space work will be conducted.
kk. Temporary Heating Plan (09.D.01)	This plan is not required because no temporary heating activities are anticipated.

Notes:

AHA = Activity Hazard Analysis
APP = Accident Prevention Plan
SSHP = Site Safety and Health Plan
SSHO = Site Safety and Health Officer
UXO = unexploded ordnance
RI = Remedial Investigation
ESP = Explosives Site Plan

11.1 FLOATING PLANT CONTINGENCY PLAN FOR SEVERE WEATHER

The WFF Boat Basin area is vulnerable to hurricanes, tornadoes, and thunderstorms with heavy lightning and gusty winds, especially during the summer months. These local occurrences may create hazardous conditions (e.g., waves) for vessels underway or moored in the Boat Basin. Where vessels may be endangered by severe weather (heavy rains, damaging winds, tornadoes, hurricanes, floods, lightning, etc.), weather conditions shall be monitored with a National Weather Service (NWS), an organization within National Oceanic and Atmospheric Administration (NOAA), weather radio, and appropriate precautions will be taken to protect personnel and property from the effects of the severe weather. Severe weather precautions for all site activities other than boating are included in Section 9.1 of the SSHP. Specific severe weather precautions for floating vessels are discussed below.

The floating vessel used for the underwater geophysical investigations of the Boat Basin is self-propelled and will be restricted to movement only within the Boat Basin and channel leading to Mosquito Creek and the surrounding bays. As a result, the floating vessel is located in a safe harbor (safe location), will not be exposed to severe wave action, and will be located within 5 minutes of travel from the mooring location. There are no known structures in the Boat Basin other than other floating vessels and docks that will need to be avoided while moving to a safe location. Any threats of severe weather (other than hurricanes) at the Boat Basin will require work to stop and the vessel to return to shore. The following actions will be taken:

- Once on shore, seek shelter in a vehicle or building (as necessary).
- Account for personnel to assure that they are in healthy physical condition.
- Assess and report any damage to equipment.
- The SSHO will continue to monitor NWS/NOAA marine broadcasts/local marine broadcasts for a minimum of 30 minutes from the last weather threat in the immediate area prior to resuming activities.

If threats of a hurricane or hurricane-related impacts are anticipated to affect the Boat Basin operations, the floating vessel and operations will immediately cease and preparations will be made to demobilize from the Boat Basin within 24 hours of the earliest possible impact. Daily monitoring of impacts will be completed through use of the National Hurricane Center website (http://www.nhc.noaa.gov).

11.2 FLOAT PLAN

In accordance with EM 385-1-1 19F.04, a daily float plan will be completed by the operator of a launch or motorboat when engaged in surveying, patrolling, or inspection activities that are remote and are expected to take longer than 4 hours, or when the operator is traveling alone. The Float Plan form provided in **Figure 11-1** must be completed in its entirety and filed with the UXOSO or SSHO and the Division EHS Officer.

FLOAT PLAN

Complete this form before going boating and leave it with a reliable person who can be depended upon to notify the Coast Guard or other rescue organization, should you not return as scheduled. Do not file this plan with the Coast Guard.

1. Person Reporting Overdue

Name: ______________________ Phone: ____________

Address: ______________________________

____

2. Description of Boat

Registration/Documentation No.: ____________________

Length: ________ Make: ____________ Type: ________

Hull Color: ______________ Trim Color: ______________

Fuel Capacity: ______ Engine Type: ________ No. of Engines: ________

Distinguishing Features: ____________________

3. Operator of Boat

Name: ______________________ Age: ____________

Health: ______________________ Phone: ____________

Address:

____

Operator's Experience: ____________________

____

4. Survival Equipment (Check as Appropriate)

☐ # PFDs: ____ ☐ Flares ☐ Mirror

☐ Smoke Signals ☐ Water ☐ Anchor

☐ Raft or Dinghy ☐ EPIRB ☐ **Horn** ☐ **Whistle**

☐ Others ____________________

5. Marine Radio

☐ Yes ☐ No

Type: ______________ Freqs.: ______________

Figure 11-1 Boat Basin, Visitors Information Center Float Plan

6. Trip Expectations

Depart From: ______________________________

Departure Date: ______________ Time: ______________

Going To: ______________________________

Arrival Date: ______________ Time: ______________

If Operator has not arrived/returned by: Date: __________ Time: __________

Call the Coast Guard or Local Authority at the following number:

____

____

7. Vehicle Description

License No.: ______________ Make: ______________

Model: ______________ Color: ______________

Where is vehicle parked? ______________________________

8. Persons on Board

Name	Age	Phone	Medical Conditions

9. Remarks

____

____

____

____

Figure 11-1 Boat Basin, Visitors Information Center Float Plan (Continued)

11.3 RESPIRATORY PROTECTION PLAN

The following Respiratory Protection Plan (RPP) has been developed based on site history and characterization data and follows the standards established by OSHA and the WESTON Corporate RPP.

11.3.1 RPP Notifications

Safety procedures and PPE for the specific field activities to be conducted will be reviewed prior to work being conducted.

Review of the RPP will occur daily. If an upgrade/downgrade of the RPP is required due to environmental or hazardous conditions, the Federal Team Health and Safety Manager or Division EHS will be notified. The APP and SSHP will be amended based upon new site conditions.

11.3.2 Respirator Selection

The respiratory protection selected by the CIH for this project is described below.

Full-Face, Negative-Pressure Respirators—A full-face, negative-pressure air-purifying respirator (APR) will be used under the following conditions:

- When Action Levels (ALs) for airborne contaminant or particulate are exceeded.

Manufacturers' literature or technical services will be consulted to assist in selecting the appropriate filter media to protect against the known or anticipated contaminants.

11.3.2.1 Cartridge Change Schedule

The respirator cartridges in use will be changed in accordance with manufacturer's recommendations and at the end of each work shift.

11.3.2.2 Upgrade in Respirator Selection

An upgrade of respiratory protection requires implementation of the WESTON Respiratory Protection Program. Working under WESTON's respiratory protection program will include the following:

- Current medical evaluations for respirator users approving their use of respirators.
- Selection of appropriate respirators by the SSHO.
- Fit-testing performed within the last year to determine an employee's respirator is adequately tight-fitting and protective.
- Respirators used in accordance with the manufacturer's instructions and regulatory requirements.
- Cartridge service life/change-out schedules and procedures documented relevant to the work at the site.
- Employees trained within the last year on inspection, care, use, cleaning, disinfecting, storage, and operation of the respirators.
- Fit-checking performed upon donning a respirator.

Current records of medical surveillance, fit testing, and training kept on file for each respirator user.

12. RISK MANAGEMENT PROCESSES

The AHAs presented below define the activities to be performed at the Boat Basin, Visitors Information Center MRS and identify the sequence of work, the specific hazards anticipated, site-specific conditions, equipment and materials, and the control measures to be implemented to eliminate or reduce each hazard to an acceptable level of risk. Reviews of the project-associated hazards will occur periodically and when field activities change. The following is a summary of the activities associated with each AHA presented in **Table 12-1**.

Summary of Activity Hazard Analysis (AHA) Activities

Work Phase	Work Description
Activity 1: Mobilization/ Demobilization	Mobilize/demobilize equipment and personnel to/from the project site.
Activity 2: Vegetative Clearing and Fence Removal	Vegetative clearing of investigation areas will be completed using hand tools (e.g., pruners) and if necessary brush hog (with protective shielding) and brush cutting equipment (line trimmer with metal brush blade attachment and shielding). It is expected that only vegetation up to 2-inch-diameter will be cleared. Additionally, fencing surrounding the Pyrotechnics Burn Area will be disassembled by hand to facilitate access for geophysical survey, MEC intrusive, and MC and Expanded RI sampling activities. A UXO Technician II will provide anomaly avoidance support.
Activity 3: Ground-Based Reconnaissance and Geophysical Survey Activities	Construct instrument verification strip for geophysical instrument testing. Arrange for a licensed surveyor to locate and establish site survey control points to allow WESTON personnel to mark grid corners/transect end-points with wooden stakes and steel pins (a UXO Technician II to provide anomaly avoidance support). Subsequent to vegetation clearing of investigation areas, perform DGM and mag and dig transect and grid surveys to detect geophysical anomalies and potential MEC within the designated areas of the MRS.
Activity 4: Land Surveying	Perform land surveying of MRS boundaries, existing structures, and cultural features (e.g., drainage ditches, tree lines, paved areas, etc.) within the MRS and beyond, if necessary, to meet project objectives. In addition, at least one permanent survey control monument shall be established with a horizontal control accuracy of Third Order Class I survey. Additional surveying of the location and elevation of soil borings and temporary and permanent monitoring wells (Activity 10). A UXO Technician II will provide anomaly avoidance support for land surveying activities within the MRS.
Activity 5: Water-Based Geophysical Survey Activities	Perform DGM transect surveys to detect geophysical anomalies and potential MEC along the south bank of the Boat Basin.
Activity 6: MEC Intrusive and Disposal Activities	Based on geophysical survey results, qualified UXO Technicians will perform intrusive operations at potential MEC locations to make a 100% verification of the

Summary of Activity Hazard Analysis (AHA) Activities (Continued)

Work Phase	Work Description
	nature of the anomaly. If MEC is positively identified, disposal of MEC will be performed. Munitions and explosives of concern (UXO and DMM), MPPEH, MD, and/or other non-munitions-related metal debris will be recovered to evaluate the nature and extent of potential explosives hazards. All MEC disposal activities will be conducted in accordance with the approved Explosives Site Plan prepared by USACE (see **Appendix K** of the RI Work Plan), and the Explosive Management Plan (see Section 6 of the RI Work Plan). Notification procedures for demolition activities are provided in Subsection 3.8.2 of the RI Work Plan. Subsurface investigation activities include the excavation of detected anomalies using hand tools, demolition activities of recovered MEC and MPPEH, and MD and non-munitions-debris inspection and transport to a certified recycling program. MEC demolition will employ BIP procedures for recovered items, with limited transport of items determined acceptable-to-move to a common detonation area within the MRS (to be determined).
Activity 7: Decontamination	Decontamination of drilling equipment, heavy machinery, and personnel (as necessary). Decontamination liquids and solids will be collected, segregated, and placed in 55-gallon drums.
Activity 8: Underwater Operations	A qualified subcontractor (VRHabilis) is to perform an underwater investigation to locate anomalies and conduct follow-on intrusive activities (i.e., mag and dig) as needed to recover potential MEC. Refer to Dive Plan (**Appendix G** of RI Work Plan) for a full description of task. WESTON will provide topside support, including oversight, communications, and MEC disposal. The USACE Dive Board will review the Dive Plan.
Activity 9: MC Sampling	Following MEC investigation and intrusive activities, collection of MC samples by discrete sampling methodology in areas impacted by MEC or a suspected release will be performed. Discrete samples will be collected by hand or by using hand tools following anomaly avoidance surveys by a UXO Technician II or above.
Activity 10: Drilling/Geoprobe Activities	Borehole anomaly avoidance procedures will be completed by UXO personnel prior to all subsurface drilling/geoprobe investigations. It is anticipated all surface MEC items will have been identified and removed prior to mobilization of the drill rig and support trucks to surface cleared areas of the site. As a result, an access survey is not required if borehole are located more than 10 feet laterally from a previously identified geophysical anomaly. Prior to the installation of subsurface borings, borehole anomaly avoidance procedures using the drill rig or hand auger techniques will be conducted at 2-foot increments. Borehole anomaly avoidance procedures will utilize a Foerster API MK 26 Mod 1, UXO detector (nominal diameter of 1.3 inches). Drill rods and augers will be removed from the borehole in order to facilitate borehole anomaly avoidance procedures. If an anomaly is detected, the borehole will be backfilled in accordance with site-specific procedures and a new borehole location must be selected and cleared to the target depth. Any anomalies detected at a borehole location will be prominently marked with survey flagging or pin flags for avoidance. Identified areas of potential subsurface MEC material in boreholes will be further investigated under another contract, and this investigation is not part of

Summary of Activity Hazard Analysis (AHA) Activities (Continued)

Work Phase	Work Description
	Contract No. W912DR-09-D-0015. At a minimum, the borehole clearance activities will continue until the water table (approximately 15 feet below grade) is reached or 10 feet below grade, whichever is greater. It is not anticipated that burial areas extended below the water table, and based on the MEC items used at the site, none would have penetrated to depths greater than 10 feet below grade. As necessary with loose soils, a polyvinyl chloride (PVC) pipe (minimum 2 inches inner diameter) may be inserted to keep the hole open and to allow for incremental geophysical screening. If nested or an offset borehole is required, the subsequent borehole must be located within a 2-foot radius of the cleared borehole. Direct-push technology (DPT, e.g., Geoprobe) will be used for installation of soil borings to collect soil samples, and installation of temporary monitoring wells to collect groundwater samples. Approximately 15 DPT borings/wells will be completed. Termination depths of each boring will be approximately 3 feet below the water table as determined by a field geologist. Following review of DPT-derived data, an estimated four permanent monitoring wells will be installed using conventional hollow stem auger methodology and borehole anomaly avoidance procedures by UXO personnel.
Activity 11: Groundwater Sampling	This task includes sampling of groundwater from installed well locations to determine whether MC is present in the groundwater at the site. Temporary monitoring wells will be sampled following stabilization of water quality parameters. Permanent monitoring wells will be developed until stabilization of select water quality parameters occurs. Permanent monitoring well sampling will occur no earlier than 14 days after development and subsequent stabilization of water quality parameters.

Notes:

BIP = blow-in-place
DGM = digital geophysical mapping
DMM = discarded military munitions
DPT = Direct Push Technology
MC = munitions constituents
MD = munitions debris
MEC = munitions and explosives of concern
MPPEH = material potentially presenting an explosive hazard
MRS = munitions response site
PPE = personal protection equipment
RI = Remedial Investigation
USACE = U.S. Army Corps of Engineers
UXO = unexploded ordnance
WESTON = Weston Solutions, Inc.

Table 12-1 Activity Hazard Analysis

Date Prepared: October 2013

Prepared By: Craig LaCosse

Reviewed By: Chris Baer

***Overall Risk Assessment Code (RAC): M**

RAC Matrix

Hazard Severity	Accident Probability A	B	C	D	E
I	E	E	H	H	M
II	E	H	H	M	L
III	H	M	M	L	L
IV	M	L	L	L	L

Activity 1: Mobilization/Demobilization

Task	Hazards	Hazard Control	RAC*
Mobilize/demobilize equipment and personnel to/from the project site. Establish a common location for out-of-place munitions and explosives of concern (MEC) demolition activities (locations of site facilities to be determined in concert with U.S. Army Corps of Engineers (USACE)). Establish an explosive storage magazine to store donor charges used to support intrusive activities	**Chemical Hazards:**	A low risk of chemical hazards is associated with this activity and with potential site contamination. Contaminant levels are low based on previous Site Inspection results. Proper use of modified Level D personal protection equipment (PPE), including nitrile gloves, will mitigate risk for exposure. Monitoring in accordance with the Site Safety and Health Plan (SSHP) will be conducted. There is minimal risk of exposure to petroleum fuels and lubricants. Vehicles will not be overfilled. Caution will be used when refueling. Refueling will not be conducted within 100 feet of an open flame or ignition source.	L
	MEC Avoidance:	Anomaly avoidance will be provided by an Unexploded Ordnance (UXO) Technician (Level II or above) for any movement into the Boat Basin, Visitors Information Center Munitions Response Site (MRS) and installation of signage or disassembly of fencing that involves digging. Any ordnance items will be positively identified. The Global Positioning System (GPS) coordinates will be taken of the item, and it will be left in place.	L
	Biological Hazards: Possibility of stinging and biting insects (Black Widow spiders). Encountering large animals (bears) and rabid animals.	Use appropriate insect repellents. Training to avoid poisonous plants and avoid contact. Training on symptoms of rabies and avoidance of animals.	L

Activity 1: Mobilization/Demobilization (Continued)

Task	Hazards	Hazard Control	RAC*
Install signage for public information and awareness.	**Radiation Hazards:** Sun	Use sunblock as appropriate. Avoid extended periods of direct exposure to sun.	L
	Physical Hazards: Slips, trips, falls, tools, terrain, or vegetation; uneven walking surfaces; weather hazards, such as snow and ice; and poor visibility.	Slip, trip, and fall hazards shall be either removed or marked and barricaded. Materials will be stored to prevent intrusion into the work areas. Work areas will be kept organized; ice, snow, and mud will be cleared from steps to reduce slip hazards. Work will be completed in adequate natural light or sufficient artificial illumination will be maintained. Site personnel shall conduct an initial walkthrough, and the "buddy system" will be implemented.	M
	Inclement weather	Personnel will be dressed according to weather conditions. Local weather will be monitored on a daily basis or more frequently if storms threaten. The SSHO will determine through visual observations and weather updates (gathered through the radio or cell phone) when it is necessary to halt work and when to re-start field activities. The SSHO will monitor for tornado, lightning, and high wind conditions. In the event of severe weather conditions, the SSHO will advise on appropriate shelter locations.	L
	Heat and cold stress	Workers will be briefed and be cognizant of heat and cold stress symptoms. Electrolyte/fluids replacement will be available to workers as needed. Work/rest periods will be established according to American Conference of Governmental Industrial Hygienists (ACGIH) and National Institute for Occupational Safety and Health (NIOSH) guidelines. Personnel will be monitored.	L
	Manual lifting	Use proper lifting techniques—keep back straight, lift with legs, avoid twisting back, use mechanical equipment, or get help from others whenever possible. Split heavy loads into smaller loads and/or seek assistance. Do not lift a load greater than 25 pounds without mechanical assistance. Verify the path of travel is clear prior to the lift.	M
	Hands or fingers caught between objects; abrasions and lacerations	Personnel shall be made aware of the hazard and asked to coordinate carefully the handling and placement of heavy objects. Materials and objects being handled will be inspected for rough or sharp edges and appropriate precautions shall be taken to avoid contact with rough or sharp edges. Personnel shall wear work	L

Activity 1: Mobilization/Demobilization (Continued)

Task	Hazards	Hazard Control	RAC*
		gloves and avoid placing hands between objects.	
	Hand tools, manual and power	Tools shall be inspected prior to use. Damaged tools will be tagged out of service until repair can be performed by a qualified person. Tools will be used properly and for their intended purpose. All power circuits used for hand tools will be protected by a ground fault circuit interrupter (GFCI). All personnel will be trained on the proper use of all power tools.	L
	Fire	Fire prevention will be a priority through awareness. In the event of a fire, areas where MEC is known to exist will be vacated. Any small fire (non-MEC) may be extinguished using a properly rated extinguisher. All storage, handling, and use of flammables and combustible liquids will be in accordance with National Fire Protection Association (NFPA) 30, 30A. Only labeled/listed containers will be used to store flammables and/or combustibles. Properly rated fire extinguishers will be strategically placed in the work area.	L
	Utilities	All utility locations (above and below ground) will be verified prior to intrusive operations. Underground utility clearance (i.e., DIGSAFE permit) will be obtained prior to and maintained during all intrusive work. Operators will remain cognizant of all ground markings and overhead hazards.	M

Equipment	Personal Protective Equipment	Inspection	Training
▪ Hand and power tools ▪ Vehicles ▪ Heavy equipment used to install site facilities/ signage will require shielding for blast protection.	Safety boots ANSI-labeled hard hat High-visibility safety vest Nitrile/leather/cotton gloves (as needed) Safety glasses Cold-weather clothing	All equipment will be properly stored, inspected, and/or maintained on a daily basis, or according to manufacturer's recommendations. Records of inspection will be maintained on-site. Fire extinguishers and First Aid kits will be inspected monthly by the Site Safety and Health Officer (SSHO) or Unexploded Ordnance Safety Officer (UXOSO).	First aid/cardiopulmonary resuscitation (CPR), BBP, and vehicle training. A minimum of a UXO Technician II will provide anomaly avoidance and MEC awareness training to non-UXO personnel. 40-hour (HAZWOPER). 8-hour HAZWOPER Refresher.

Date Prepared: October 2013

Prepared By: Craig LaCosse

Reviewed By: Chris Baer

***Overall Risk Assessment Code (RAC): M**

RAC Matrix

Hazard Severity	Accident Probability A	B	C	D	E
I	E	E	H	H	M
II	E	H	H	M	L
III	H	M	M	L	L
IV	M	L	L	L	L

Activity 2: Vegetative Clearing and Fence Removal

Task	Hazards	Hazard Control	RAC*
Work sites will be cleared of underbrush and vegetation. Note: Cutting of trees, if necessary, will require prior approval. Remove fencing surrounding Pyrotechnics Burn Area. Fencing to be disassembled by hand.	**Chemical Hazards:**	A low risk of chemical hazards is associated with this activity and with potential site contamination. Contaminant levels are low based on previous Site Inspection results. Proper use of modified Level D personal protection equipment (PPE), including nitrile gloves, will mitigate risk for exposure. Monitoring in accordance with the Site Safety and Health Plan (SSHP) will be conducted. There is minimal risk of exposure to petroleum fuels and lubricants. Vehicles will not be overfilled. Caution will be used when refueling. Refueling will not be conducted within 100 feet of an open flame or ignition source.	L
	MEC Avoidance:	Vegetative clearing and fence removal activities will be conducted with an escort to provide MEC avoidance.	M
	Biological Hazards: Possibility of stinging and biting insects (Black Widow spiders). Encountering large animals (bears) and rabid animals.	Use appropriate insect repellents. Training to avoid poisonous plants and avoid contact. Training on symptoms of rabies and avoidance of animals.	L
	Radiation Hazards: Sun	Use sunblock as appropriate. Avoid extended periods of direct exposure to sun.	L
	Physical Hazards: Slips, trips, falls, tools, terrain, or vegetation; uneven walking surfaces; weather hazards, such as snow and ice; and poor visibility.	Slip, trip, and fall hazards shall be either removed or marked and barricaded. Materials will be stored to prevent intrusion into the work areas. Work areas will be kept organized; ice, snow, and mud will be cleared from steps to reduce slip hazards. Work will be completed in adequate natural light or sufficient artificial illumination will be maintained. Site personnel shall conduct an initial walkthrough, and the "buddy system" will be implemented.	M

Activity 2: Vegetative Clearing and Fence Removal (Continued)

Task	Hazards	Hazard Control	RAC*
	Inclement weather	Personnel will be dressed according to weather conditions. Local weather will be monitored on a daily basis or more frequently if storms threaten. The SSHO will determine through visual observations and weather updates (gathered through the radio or cell phone) when it is necessary to halt work and when to re-start field activities. The SSHO will monitor for tornado, lightning, and high wind conditions. In the event of severe weather conditions, the SSHO will advise on appropriate shelter locations.	L
	Heat and cold stress	Workers will be briefed and be cognizant of heat and cold stress symptoms. Electrolyte/fluids replacement will be available to workers as needed. Work/rest periods will be established according to American Conference of Governmental Industrial Hygienists (ACGIH) and National Institute for Occupational Safety and Health (NIOSH) guidelines. Personnel will be monitored.	L
	Manual lifting	Use proper lifting techniques—keep back straight, lift with legs, avoid twisting back, use mechanical equipment, or get help from others whenever possible. Split heavy loads into smaller loads and/or seek assistance. Do not lift a load greater than 25 pounds without mechanical assistance. Verify the path of travel is clear prior to the lift.	M
	Hands or fingers caught between objects; abrasions and lacerations	Personnel shall be made aware of the hazard and asked to coordinate carefully the handling and placement of heavy objects. Materials and objects being handled will be inspected for rough or sharp edges and appropriate precautions shall be taken to avoid contact with rough or sharp edges. Personnel shall wear work gloves and avoid placing hands between objects.	L
	Hand tools, manual and power	Tools shall be inspected prior to use. Damaged tools will be tagged out of service until repair can be performed by a qualified person. Tools will be used properly and for their intended purpose. All power circuits used for hand tools will be protected by a ground fault circuit interrupter (GFCI). All personnel will be trained on the proper use of all power tools.	L
	Fire	Fire prevention will be a priority through awareness. In the event of a fire, areas where MEC is known to exist will be vacated. Any small fire (non-MEC) may be extinguished using a properly rated extinguisher. All storage, handling, and use of flammables and combustible liquids will be in accordance with National Fire Protection Association (NFPA) 30, 30A. Only labeled/listed containers will be used to store flammables and/or combustibles. Properly rated fire extinguishers will be strategically placed in the work area.	L

Activity 2: Vegetative Clearing and Fence Removal (Continued)

Task	Hazards	Hazard Control	RAC*
	Utilities	All utility locations (above and below ground) will be verified prior to intrusive operations. Underground utility clearance (i.e., DIGSAFE permit) will be obtained prior to and maintained during all intrusive work. Operators will remain cognizant of all ground markings and overhead hazards.	M

Equipment	Personal Protective Equipment	Inspection	Training
▪ Hand and power tools ▪ Vehicles ▪ Small equipment (e.g., small excavator) ▪ Brush Hog (with protective shielding) ▪ Brush Cutter (line trimmer with metal blade) ▪ Ballistic chaps for use when clearing brush with brush hog and brush cutter (no chainsaw use during clearing activities) ▪ Face shields for use when clearing brush with mechanized equipment ▪ Gasoline and oil	Safety boots Safety glasses ANSI-labeled hard hat Cold weather clothing Hearing protection High-visibility safety vest Nitrile/leather/cotton gloves (as needed) Leather gloves Ballistic chaps (brush clearing equipment) Face shields (brush clearing equipment) Hearing Protection (brush clearing)	All equipment will be properly stored, inspected, and/or maintained on a daily basis, or according to manufacturer's recommendations. Records of inspection will be maintained on-site. Fire extinguishers and First Aid kits will be inspected monthly by the SSHO or UXOSO.	First aid, CPR, BBP, and vehicle training. A minimum of a UXO Technician II will provide anomaly avoidance during brush clearing activities and MEC awareness training to non-UXO personnel. Excavator and brush clearing operators will be trained in use and maintenance of equipment. 40-hour (HAZWOPER). 8-hour HAZWOPER Refresher

Date Prepared: October 2013

Prepared By: Craig LaCosse

Reviewed By: Chris Baer

***Overall Risk Assessment Code (RAC): M**

RAC Matrix

Hazard Severity	Accident Probability A	B	C	D	E
I	E	E	H	H	M
II	E	H	H	M	L
III	H	M	M	L	L
IV	M	L	L	L	L

Activity 3: Ground-Based Reconnaissance and Geophysical Survey Activities

Task	Hazards	Hazard Control	RAC*
Construct instrument verification strip for geophysical instrument testing. Arrange for a licensed surveyor to locate and establish site survey control points, to allow WESTON personnel to mark grid corners/ transect end-points with wooden stakes and pin flags Perform digital geophysical mapping (EM61) and mag and dig transect and grid surveys to detect geophysical anomalies and potential MEC.	**Chemical Hazards:**	A low risk of chemical hazards is associated with this activity and with potential site contamination. Contaminant levels are low based on previous Site Inspection results. Proper use of modified Level D personal protection equipment (PPE), including nitrile gloves, will mitigate risk for exposure. Monitoring in accordance with the Site Safety and Health Plan (SSHP) will be conducted. There is minimal risk of exposure to petroleum fuels and lubricants. Vehicles will not be overfilled. Caution will be used when refueling. Refueling will not be conducted within 100 feet of an open flame or ignition source. Same as previously provided in the AHA for Activity 1.	L
	MEC Avoidance:	Any ordnance items will be positively identified. The GPS coordinates will be taken of the item, and it will be left in place. A UXO Technician II or higher will escort the geophysical survey crew and conduct a magnetometer-assisted visual survey to screen for potential MEC.	M
	Biological Hazards: Possibility of stinging and biting insects (Black Widow spiders). Encountering large animals (bears) and rabid animals.	Use appropriate insect repellents. Training to avoid poisonous plants and avoid contact. Training on symptoms of rabies and avoidance of animals.	L
	Radiation Hazards: Sun	Use sunblock as appropriate. Avoid extended periods of direct exposure to sun.	L
	Physical Hazards: Slips, trips, falls, tools, terrain, or vegetation;	Slip, trip, and fall hazards shall be either removed or marked and barricaded. Materials will be stored to prevent intrusion into the work areas. Work areas will be kept organized; ice, snow, and mud will be cleared from steps to reduce slip hazards. Work will be completed in adequate natural light or sufficient artificial illumination will be maintained.	M

Activity 3: Ground-Based Reconnaissance and Geophysical Survey Activities (Continued)

Task	Hazards	Hazard Control	RAC*
	uneven walking surfaces; weather hazards, such as snow and ice; and poor visibility.	Site personnel shall conduct an initial walkthrough, and the "buddy system" will be implemented.	
	Inclement weather	Personnel will be dressed according to weather conditions. Local weather will be monitored on a daily basis or more frequently if storms threaten. The SSHO will determine through visual observations and weather updates (gathered through the radio or cell phone) when it is necessary to halt work and when to re-start field activities. The SSHO will monitor for tornado, lightning, and high wind conditions. In the event of severe weather conditions, the SSHO will advise on appropriate shelter locations.	L
	Heat and cold stress	Workers will be briefed and be cognizant of heat and cold stress symptoms. Electrolyte/fluids replacement will be available to workers as needed. Work/rest periods will be established according to American Conference of Governmental Industrial Hygienists (ACGIH) and National Institute for Occupational Safety and Health (NIOSH) guidelines. Personnel will be monitored.	L
	Manual lifting	Use proper lifting techniques—keep back straight, lift with legs, avoid twisting back, use mechanical equipment, or get help from others whenever possible. Split heavy loads into smaller loads and/or seek assistance. Do not lift a load greater than 25 pounds without mechanical assistance. Verify the path of travel is clear prior to the lift.	M
	Hands or fingers caught between objects; abrasions and lacerations	Personnel shall be made aware of the hazard and asked to coordinate carefully the handling and placement of heavy objects. Materials and objects being handled will be inspected for rough or sharp edges and appropriate precautions shall be taken to avoid contact with rough or sharp edges. Personnel shall wear work gloves and avoid placing hands between objects.	L
	Hand tools, manual and power	Tools shall be inspected prior to use. Damaged tools will be tagged out of service until repair can be performed by a qualified person. Tools will be used properly and for their intended purpose. All power circuits used for hand tools will be protected by a ground fault circuit interrupter (GFCI). All personnel will be trained on the proper use of all power tools.	L

Activity 3: Ground-Based Reconnaissance and Geophysical Survey Activities (Continued)

Task	Hazards	Hazard Control	RAC*
	Fire	Fire prevention will be a priority through awareness. In the event of a fire, areas where MEC is known to exist will be vacated. Any small fire (non-MEC) may be extinguished using a properly rated extinguisher. All storage, handling, and use of flammables and combustible liquids will be in accordance with National Fire Protection Association (NFPA) 30, 30A. Only labeled/listed containers will be used to store flammables and/or combustibles. Properly rated fire extinguishers will be strategically placed in the work area.	L
	Utilities	All utility locations (above and below ground) will be verified prior to intrusive operations. Underground utility clearance (i.e., DIGSAFE permit) will be obtained prior to and maintained during all intrusive work. Operators will remain cognizant of all ground markings and overhead hazards.	M

Equipment	Personal Protective Equipment	Inspection	Training
▪ Hand tools ▪ Four-wheel-drive vehicles ▪ Geophysical survey equipment ▪ Hand-held instrumentation (i.e., metal detector) ▪ Hand-held radios	Safety boots High-visibility vests Nitrile/leather/cotton gloves (as needed) Safety glasses Cold-weather clothing	All equipment will be properly stored, inspected, and/or maintained on a daily basis, or according to the manufacturer's recommendations. Records of inspection will be maintained on-site. Fire extinguishers, First Aid kits, and vehicles will be inspected monthly by the SSHO or UXOSO.	First Aid, CPR, BBP, and vehicle training. A minimum of a UXO Technician II will provide anomaly avoidance during survey operations and MEC awareness training to surveyors. 40-hour (HAZWOPER). 8-hour HAZWOPER Refresher.

Date Prepared: October 2013 ***Overall Risk Assessment Code (RAC): L**

Prepared By: Craig LaCosse

Reviewed By: C. Baer

Activity 4: Land Surveying Activities

Task	Hazards	Hazard Control	RAC*
Survey to establish MRS boundaries, existing structures, and cultural features (e.g., drainage ditches, tree lines, paved areas, etc.) within the MRS and beyond, if necessary, to meet project objectives. At least one permanent survey control monument shall be established with a horizontal control accuracy of Third Order Class I survey. Surveying of the location and elevation of soil borings and temporary and permanent monitoring wells.	**Chemical Hazards**	A low risk of chemical hazards is associated with this activity and with potential site contamination. Contaminant levels are low based on previous Site Inspection results. Proper use of modified Level D personal protection equipment (PPE), including nitrile gloves, will mitigate risk for exposure. Monitoring in accordance with the Site Safety and Health Plan (SSHP) will be conducted. There is minimal risk of exposure to petroleum fuels and lubricants. Vehicles will not be overfilled. Caution will be used when refueling. Refueling will not be conducted within 100 feet of an open flame or ignition source.	L
	MEC Avoidance	Anomaly avoidance will be provided by an Unexploded Ordnance (UXO) Technician (Level II or above) for any movement into the Boat Basin, Visitors Information Center Munitions Response Site (MRS) and installation of signage or disassembly of fencing that involves digging. Any ordnance items will be positively identified. The Global Positioning System (GPS) coordinates will be taken of the item, and it will be left in place.	L
	Biological Hazards:		
	Possibility of stinging and biting insects (Black Widow spiders). Encountering large animals (bears) and rabid animals.	Use appropriate insect repellents. Training to avoid poisonous plants and avoid contact. Training on symptoms of rabies and avoidance of animals.	L
	Radiation Hazards: Sun	Use sunblock as appropriate. Avoid extended periods of direct exposure to sun.	L
	Physical Hazards:	Slip, trip, and fall hazards shall be either removed or marked and barricaded.	L

Activity 4: Land Surveying Activities (Continued)

Task	Hazards	Hazard Control	RAC*
	Slips, trips, falls, tools, terrain, or vegetation; uneven walking surfaces; weather hazards, such as snow and ice; and poor visibility.	Materials will be stored to prevent intrusion into the work areas. Work areas will be kept organized; ice, snow, and mud will be cleared from steps to reduce slip hazards. Work will be completed in adequate natural light or sufficient artificial illumination will be maintained. Site personnel shall conduct an initial walkthrough, and the "buddy system" will be implemented.	
	Inclement weather	Personnel will be dressed according to weather conditions. Local weather will be monitored on a daily basis or more frequently if storms threaten. The SSHO will determine through visual observations and weather updates (gathered through the radio or cell phone) when it is necessary to halt work and when to re-start field activities. The SSHO will monitor for tornado, lightning, and high wind conditions. In the event of severe weather conditions, the SSHO will advise on appropriate shelter locations.	L
	Heat and cold stress	Workers will be briefed and be cognizant of heat and cold stress symptoms. Electrolyte/fluids replacement will be available to workers as needed. Work/rest periods will be established according to American Conference of Governmental Industrial Hygienists (ACGIH) and National Institute for Occupational Safety and Health (NIOSH) guidelines. Personnel will be monitored.	L
	Hands or fingers caught between objects; abrasions and lacerations.	Personnel shall be made aware of the hazard and asked to coordinate carefully the handling and placement of heavy objects. Materials and objects being handled will be inspected for rough or sharp edges, and appropriate precautions shall be taken to avoid contact. Personnel shall wear work gloves and avoid placing hands between objects.	L
	Manual lifting	Use proper lifting techniques—keep back straight, lift with legs, avoid twisting back, use mechanical equipment, or get help from others whenever possible. Split heavy loads into smaller loads and/or seek assistance. Do not lift a load greater than 25 pounds without mechanical assistance. Verify the path of travel is clear prior to the lift.	L

Activity 4: Land Surveying Activities (Continued)

Equipment	Personal Protective Equipment	Inspection	Training
▪ Hand tools ▪ Four-wheel-drive vehicles ▪ Land Survey Equipment ▪ Hand-held instrumentation (i.e., metal detector) ▪ Hand-held radios	Safety boots High-visibility vests Nitrile/leather/cotton gloves (as needed) Safety glasses Cold-weather clothing	All equipment will be properly stored, inspected, and/or maintained on a daily basis, or according to the manufacturer's recommendations. Records of inspection will be maintained on-site. Fire extinguishers, First Aid kits, and vehicles will be inspected monthly by the SSHO or UXOSO.	First Aid, CPR, BBP, and vehicle training. A minimum of a UXO Technician II will provide anomaly avoidance during survey operations and MEC awareness training to surveyors.

Date Prepared: October 2013

Prepared By: Craig LaCosse

Reviewed By: Chris Baer

***Overall Risk Assessment Code (RAC): M**

RAC Matrix

Hazard Severity	Accident Probability A	B	C	D	E
I	E	E	H	H	M
II	E	H	H	M	L
III	H	M	M	L	L
IV	M	L	L	L	L

Activity 5: Water-Based Geophysical Survey Activities

Task	Hazards	Hazard Control	RAC*
Qualified subcontractor (Aqua Survey, Inc.) will perform digital geophysical mapping (DGM) transect surveys using boat-mounted side scan sonar and marine magnetometer to detect geophysical anomalies and potential MEC within the South Bank Boat Basin. WESTON to provide support including oversight and communications.	**Chemical Hazards**	A low risk of chemical hazards is associated with this activity and with potential site contamination. Contaminant levels are low based on previous Site Inspection results. Proper use of modified Level D personal protection equipment (PPE), including nitrile gloves, will mitigate risk for exposure. Monitoring in accordance with the Site Safety and Health Plan (SSHP) will be conducted. There is minimal risk of exposure to petroleum fuels and lubricants. Vehicles will not be overfilled. Caution will be used when refueling. Refueling will not be conducted within 100 feet of an open flame or ignition source.	L
	MEC Avoidance	Anomaly avoidance will be provided by an Unexploded Ordnance (UXO) Technician (Level II or above) for any movement into the Boat Basin, Visitors Information Center Munitions Response Site (MRS) and installation of signage or disassembly of fencing that involves digging. Any ordnance items will be positively identified. The Global Positioning System (GPS) coordinates will be taken of the item, and it will be left in place.	L

Activity 5: Water-Based Geophysical Survey Activities (Continued)

	Biological Hazards: Possibility of stinging and biting insects (Black Widow spiders). Encountering large animals (bears) and rabid animals.	Use appropriate insect repellents. Training to avoid poisonous plants and avoid contact. Training on symptoms of rabies and avoidance of animals.	L
	Radiation Hazards: Sun	Use sunblock as appropriate. Avoid extended periods of direct exposure to sun.	L
	Physical Hazards: Slips, trips, falls, tools, terrain, or vegetation; uneven walking surfaces; weather hazards, such as snow and ice; and poor visibility.	Slip, trip, and fall hazards shall be either removed or marked and barricaded. Materials will be stored to prevent intrusion into the work areas. Work areas will be kept organized; ice, snow, and mud will be cleared from steps to reduce slip hazards. Work will be completed in adequate natural light or sufficient artificial illumination will be maintained. Site personnel shall conduct an initial walkthrough, and the "buddy system" will be implemented.	M
	Inclement weather	Personnel will be dressed according to weather conditions. Local weather will be monitored on a daily basis or more frequently if storms threaten. The SSHO will determine through visual observations and weather updates (gathered through the radio or cell phone) when it is necessary to halt work and when to re-start field activities. The SSHO will monitor for tornado, lightning, and high wind conditions. In the event of severe weather conditions, the SSHO will advise on appropriate shelter locations.	L
	Heat and cold stress	Workers will be briefed and be cognizant of heat and cold stress symptoms. Electrolyte/fluids replacement will be available to workers as needed. Work/rest periods will be established according to American Conference of Governmental Industrial Hygienists (ACGIH) and National Institute for Occupational Safety and Health (NIOSH) guidelines. Personnel will be monitored.	L
	Manual lifting	Use proper lifting techniques—keep back straight, lift with legs, avoid twisting back, use mechanical equipment, or get help from others whenever possible. Split heavy loads into smaller loads and/or seek assistance. Do not lift a load greater than 25 pounds without mechanical assistance. Verify the path of travel is clear prior to the lift.	M

Activity 5: Water-Based Geophysical Survey Activities (Continued)

	Hands or fingers caught between objects; abrasions and lacerations	Personnel shall be made aware of the hazard and asked to coordinate carefully the handling and placement of heavy objects. Materials and objects being handled will be inspected for rough or sharp edges and appropriate precautions shall be taken to avoid contact with rough or sharp edges. Personnel shall wear work gloves and avoid placing hands between objects.	L
	Hand tools, manual and power	Tools shall be inspected prior to use. Damaged tools will be tagged out of service until repair can be performed by a qualified person. Tools will be used properly and for their intended purpose. All power circuits used for hand tools will be protected by a ground fault circuit interrupter (GFCI). All personnel will be trained on the proper use of all power tools.	L
	Fire	Fire prevention will be a priority through awareness. In the event of a fire, areas where MEC is known to exist will be vacated. Any small fire (non-MEC) may be extinguished using a properly rated extinguisher. All storage, handling, and use of flammables and combustible liquids will be in accordance with National Fire Protection Association (NFPA) 30, 30A. Only labeled/listed containers will be used to store flammables and/or combustibles. Properly rated fire extinguishers will be strategically placed in the work area.	L
	Utilities	All utility locations (above and below ground) will be verified prior to intrusive operations. Underground utility clearance (i.e., DIGSAFE permit) will be obtained prior to and maintained during all intrusive work. Operators will remain cognizant of all ground markings and overhead hazards.	M

Activity 5: Water-Based Geophysical Survey Activities (Continued)

	Physical Hazards **Boating**	The Float Plan form provided in Figure 11-1 must be completed in its entirety and filed with the Competent Person prior and Division EHS Manager to operation of marine equipment. Only personnel who are trained in the operation of marine equipment (e.g., boats) will be allowed to operate the equipment. All general safety precautions will be adhered to when working over or near water to prevent accidents caused from careless behavior or horseplay. Work shall be halted when significant wave action exists. Flotation devices must be worn and other lifesaving devices must be present. PFDs should be designed to float unconscious or helpless persons face up. Prior to and after each use, PFDs and life preservers shall be inspected for defects that would alter their strength or buoyancy (e.g., rips, tears, holes). All defective units shall be removed from the site and replaced. At no time will defective units be used. The maximum number of passengers and weight that can safely be transported shall be posted on all launches, motorboats, and motorized john boats/skiffs. This number shall not be exceeded and in no case shall the number of passengers (including crew) exceed the number of PFDs aboard. Outboard motors and motorized john boats/skiffs shall meet the minimum flotation requirements of the USCG. A certification tag affixed to the hull is satisfactory evidence of compliance. USCG-approved life rings (rope attachment not required) and ring buoys (rope attachment required) should have attached at least 90 feet of 3/8-inch solid braid polypropylene rope or equal. The life rings or ring buoys shall be readily available for emergency rescue operations. Distance between ring buoys shall not exceed 200 feet. One ring buoy or life ring shall be provided on the john boat/skiff. One additional ring buoy and throw rope shall be maintained on the pier/seawall. An efficient whistle or signal device shall be provided on all powered vessels to give signals required by the navigation rules applicable to the waters on which the vessel is operated.	L
	Drowning	Wear personal flotation device (PFD). Know location and proper use of lifesaving devices (throw ring, throw bag, reach poles, cargo net, ladder).	H

Activity 5: Water-Based Geophysical Survey Activities (Continued)

	Falls Overboard	Wear PFD, know proper rescue procedures, and wear proper footwear to maintain balance and footing. Make sure kill switch is operational and attached to operator and instructor. Pay close attention to all boat operations during all maneuvers.	H
	Damaged/Sinking Boat	Stay with the vessel until rescue. Wear PFD.	M
	Trailering Boat	Drive defensively. Obey traffic laws. Perform and verify vehicle and trailer are properly connected. Verify trailer lights are operational. Do not eat, drink, smoke, use cell phones, or perform others tasks that interfere with driving.	M
	Launching Boat	Establish standard boat checkout procedures, checklists, and "Go Kits." Make sure boat ramp is clear of obstructions. Engage four-wheel drives when necessary. Set parking brake when trailer is lowered to proper launch depth. Lower driver's side window of the tow vehicle. Use spotter if available. Make sure spotter does not stand behind vehicle on boat ramp. Be aware of wet and slippery boat ramp surface from water or algae. Be aware of tension and pinch points on trailer winch when unhooking boat.	M
	Low on fuel	Ensure that enough fuel is on board for the length of the trip, plus extra for emergencies.	L
	Emergency equipment not on board or does not work	Run through a checklist of emergency equipment required for each vessel type and ensure that emergency equipment is in working order and good condition.	L
	Personnel unfamiliar with potential emergencies at sea	Hold a safety orientation to review emergency procedures and drills at the onset of boating operations and weekly thereafter. Review the use of emergency and safety equipment and their location (including, but not limited to, PFDs, flares, first aid kit, locator beacon, or transmitter). Attend regular (yearly) vessel safety training by an accredited or approved safety training organization.	L

Activity 5: Water-Based Geophysical Survey Activities (Continued)

Equipment	Personal Protective Equipment	Inspection	Training
▪ Boat ▪ Side-scan sonar ▪ Marine magnetometer ▪ Miscellaneous boat equipment ▪ Geophysical survey equipment ▪ Hand-held radios	PFDs Nitrile/leather/cotton/marine/boating gloves (as needed) Cold-weather clothing	All equipment will be properly stored, inspected, and/or maintained on a daily basis, or according to the manufacturer's recommendations. Records of inspection will be maintained on-site. Fire extinguishers, First Aid kits, and vehicles will be inspected by the SSHO or UXOSO. PFDs must be inspected, maintained, stowed, and used in accordance with the manufacturer's instructions. PFDs shall not be exposed to excessive moisture, crushing, and extreme heat while stored.	First Aid, CPR, BBP, and vehicle training. Personnel will be trained in proper use and maintenance of all field screening instrumentation Personnel will be trained in boater safety and operation. USCG License (e.g., Boat Captain). 40-hour (HAZWOPER). 8-hour HAZWOPER Refresher.

Date Prepared: October 2013

Prepared By: Craig LaCosse

Reviewed By: Chris Baer

***Overall Risk Assessment Code (RAC): H**

RAC Matrix

Hazard Severity	Accident Probability A	B	C	D	E
I	E	E	H	H	M
II	E	H	H	M	L
III	H	M	M	L	L
IV	M	L	L	L	L

Activity 6: MEC Intrusive and Disposal Activities

Task	Hazards	Hazard Control	RAC*
Based on geophysical survey results, qualified UXO Technicians will perform intrusive operations at potential MEC locations to make a 100% verification of the nature of the anomaly. If MEC is positively identified, disposal of MEC will be performed. Munitions and explosives of concern (UXO and discarded military munitions [DMM]), material potentially presenting an explosive hazard (MPPEH), munitions debris (MD), and/or other non-munitions-related metal debris will be recovered to evaluate the nature and extent of potential explosives hazards.	**Chemical Hazards**	A low risk of chemical hazards is associated with this activity and with potential site contamination. Contaminant levels are low based on previous Site Inspection (SI) results. Proper use of modified Level D (or level C as appropriate) personal protective equipment (PPE), including nitrile gloves, will mitigate risk for exposure. Air monitoring for VOCs and particulates will be conducted in accordance with the SSHP and if action levels are exceeded, engineering controls or upgrade to Level C PPE, including a respirator with an organic vapor and P100 cartridge, will be required. Monitoring in accordance with the Site Safety and Health Plan (SSHP) will be conducted.	L
	Explosives Hazards: Unintentional detonation of MEC during intrusive activities at selected geophysical anomaly locations.	Establish exclusion zones around intrusive work based on minimum separation distances identified in the approved Explosives Site Plan (ESP). Maintain exclusion zones during all intrusive activities at geophysical anomaly locations. Determine whether anomaly source is MEC, MPPEH, MD, or non-munitions-related debris. The MEC operations will be conducted during daylight hours only. If an unknown munitions item is recovered, the USACE Ordnance and Explosives Safety Specialist (OESS) will be notified. The MPPEH will be inspected and classified as material documented as safe prior to initiating further action. The MEC or MPPEH identified as potential chemical rounds will be reported to the USACE OESS, reassessed, and the course of action verified before proceeding.	H

Activity 6: MEC Intrusive and Disposal Activities (Continued)

Task	Hazards	Hazard Control	RAC*
All MEC disposal activities will be conducted in accordance with the approved ESP prepared by USACE (see **Appendix K** of the RI Work Plan), and the Explosive Management Plan (see Section 6 of the RI Work Plan). Notification procedures for demolition activities are provided in Subsection 3.8.2 of the RI Work Plan.		The approved ESP and EM 385-1-97 will be adhered to at all times. The munition with the greatest fragmentation distance (MGFD) is the 37mm high explosive (HE) projectile. The minimum separation distance (MSD) for teams for manual unintentional detonation operations is 18 feet based on K40 of the MGFD. The MSD for nonessential personnel from manual unintentional detonation operations is 118 feet based on the hazardous fragment distance of the MGFD. The MSD for all personnel from intentional detonations is 200 feet (using engineering controls) based on the maximum fragment distance of the MGFD. The MSD for all personnel from intentional detonation is 12.5 feet using optional engineering controls (i.e., double sandbags).	
Munitions and explosives of concern demolition will employ blow-in-place (BIP) procedures for recovered items, with limited transport of items determined acceptable-to-move to a common detonation area within the MRS (to be determined).	**Demolition Operations:** Detonation of MEC	Before any disposal operations commence, all personnel assigned to or working with disposal teams will attend a site-specific orientation. The purpose of the orientation will be to review MEC disposal and emergency response procedures. The topics to be covered during the orientation will include, but are not limited to, review of the ESP, Accident Prevention Plan (APP), and SSHP (as applicable), engineering control/sandbag enclosure requirements, review of demolition firing systems and components, review of donor charge placement, review of explosives, transportation, site munitions brief, type and condition of MEC, exclusion zone requirements and control, emergency response equipment, emergency procedures, two-person rule, and team assignments. Demolition Supervisor will have current Virginia Blasters License for all demolition activities. Demolition notifications will be made in accordance with the RI Work Plan. All recovered MEC and MPPEH identified as material documented as an explosive hazard will be BIP and destroyed the same day found. Only the donor explosives required for demolition will be received. These donor explosives will be delivered to the demolition site by the vendor and stored in an on-site fenced and grounded magazine. Sandbag mitigation will be used for intentional detonations.	H

Activity 6: MEC Intrusive and Disposal Activities (Continued)

Task	Hazards	Hazard Control	RAC*
		An exclusion zone based on the minimum separation distance for the item recovered will be maintained until an all-clear signal is sounded. Only the designated demolition team will be in the area during demolition operations. All MPPEH will be inspected and classified as material documented as safe prior to release to the public.	
	Excavations	Excavation activities will be conducted in compliance with all applicable federal and USACE requirements, including daily inspection by a competent person. Excavations conducted to facilitate MEC intrusive investigations are not to exceed 4 feet in depth to facilitate safe entry by personnel. All intrusive work is anticipated to be short-term duration. Any excavation left open on-site will be appropriately guarded for public safety.	L
	Moving/heavy equipment operations.	Only competent, trained, experienced operators will operate equipment. Equipment will be inspected daily by a competent person. Personnel shall be made aware of the hazard and will coordinate carefully during handling equipment operations. Back up alarms will be functional. Stay out of the swing area of all equipment and from under loads. No personnel will ride on the equipment unless seats are provided. Guards will be kept in place during operation. Maintain safe distance from moving mechanical parts. Equipment will be equipped with blast shielding as determined necessary and in accordance with the ESP.	M
	Biological Hazards: Possibility of stinging and biting insects (Black Widow spiders). Encountering large animals (bears) and rabid animals.	Use appropriate insect repellents. Training to avoid poisonous plants and avoid contact. Training on symptoms of rabies and avoidance of animals.	L
	Radiation Hazards: Sun	Use sunblock as appropriate. Avoid extended periods of direct exposure to sun.	L

Activity 6: MEC Intrusive and Disposal Activities (Continued)

Task	Hazards	Hazard Control	RAC*
	Physical Hazards: Slips, trips, falls, tools, terrain, or vegetation; uneven walking surfaces; weather hazards, such as snow and ice; and poor visibility.	Slip, trip, and fall hazards shall be either removed or marked and barricaded. Materials will be stored to prevent intrusion into the work areas. Work areas will be kept organized; ice, snow, and mud will be cleared from steps to reduce slip hazards. Work will be completed in adequate natural light or sufficient artificial illumination will be maintained. Site personnel shall conduct an initial walkthrough, and the "buddy system" will be implemented.	M
	Inclement weather	Personnel will be dressed according to weather conditions. Local weather will be monitored on a daily basis or more frequently if storms threaten. The SSHO will determine through visual observations and weather updates (gathered through the radio or cell phone) when it is necessary to halt work and when to re-start field activities. The SSHO will monitor for tornado, lightning, and high wind conditions. In the event of severe weather conditions, the SSHO will advise on appropriate shelter locations.	L
	Heat and cold stress	Workers will be briefed and be cognizant of heat and cold stress symptoms. Electrolyte/fluids replacement will be available to workers as needed. Work/rest periods will be established according to American Conference of Governmental Industrial Hygienists (ACGIH) and National Institute for Occupational Safety and Health (NIOSH) guidelines. Personnel will be monitored.	L
	Manual lifting	Use proper lifting techniques—keep back straight, lift with legs, avoid twisting back, use mechanical equipment, or get help from others whenever possible. Split heavy loads into smaller loads and/or seek assistance. Do not lift a load greater than 25 pounds without mechanical assistance. Verify the path of travel is clear prior to the lift.	M
	Hands or fingers caught between objects; abrasions and lacerations	Personnel shall be made aware of the hazard and asked to coordinate carefully the handling and placement of heavy objects. Materials and objects being handled will be inspected for rough or sharp edges and appropriate precautions shall be taken to avoid contact with rough or sharp edges. Personnel shall wear work gloves and avoid placing hands between objects.	L

Activity 6: MEC Intrusive and Disposal Activities (Continued)

Task	Hazards	Hazard Control	RAC*
	Hand tools, manual and power	Tools shall be inspected prior to use. Damaged tools will be tagged out of service until repair can be performed by a qualified person. Tools will be used properly and for their intended purpose. All power circuits used for hand tools will be protected by a ground fault circuit interrupter (GFCI). All personnel will be trained on the proper use of all power tools.	L
	Fire	Fire prevention will be a priority through awareness. In the event of a fire, areas where MEC is known to exist will be vacated. Any small fire (non-MEC) may be extinguished using a properly rated extinguisher. All storage, handling, and use of flammables and combustible liquids will be in accordance with National Fire Protection Association (NFPA) 30, 30A. Only labeled/listed containers will be used to store flammables and/or combustibles. Properly rated fire extinguishers will be strategically placed in the work area.	L
	Utilities	All utility locations (above and below ground) will be verified prior to intrusive operations. Underground utility clearance (i.e., DIGSAFE permit) will be obtained prior to and maintained during all intrusive work. Operators will remain cognizant of all ground markings and overhead hazards.	M

Activity 6: MEC Intrusive and Disposal Activities (Continued)

Equipment	Personal Protective Equipment	Inspection	Training
▪ Hand tools ▪ Donor explosives ▪ Engineering controls (e.g., sandbags) ▪ Remote firing devices ▪ Hand-held radios ▪ Schonstedt magnetometers ▪ Heavy equipment (i.e., backhoe) ▪ Photoionization detector (PID), lower explosive limit (LEL), O2 meters ▪ Portable DataRAM (PDR) for particulate monitoring ▪ Dust suppression equipment (tank and water if required)	Safety boots ANSI-labeled hard hat High-visibility safety vest Nitrile/leather/cotton gloves (as needed) Safety glasses Cold-weather clothing Hearing protection Full face respirator with organic vapor and P100 cartridge (as appropriate)	All equipment will be properly stored, inspected, and/or maintained on a daily basis or according to manufacturer's recommendations. Records of inspection will be maintained on-site. Fire extinguishers and First Aid kits will be inspected monthly by the SSHO or UXOSO.	First Aid, CPR, BBP, and vehicle training. Unexploded ordnance/Explosive Ordnance Disposal certification, qualified in accordance with Department of Defense Explosives Safety Board Technical Paper 18, First Aid/CPR (at least two personnel); Virginia Blaster's License (or equivalent) and vehicle training. Heavy machinery operators will be trained in accordance with EM 385-1-1, Sec. 18.G.02, 18.G.06 and 18.H.02; and OSHA 29 Code of Federal Regulations (CFR) 1926.20(b)(4) and 1926.601(b)(14) 40-hour (HAZWOPER). 8-hour HAZWOPER Refresher.

Date Prepared: October 2013

Prepared By: Craig LaCosse

Reviewed By: C. Baer

***Overall Risk Assessment Code (RAC): M**

RAC Matrix

Hazard Severity	Accident Probability A	B	C	D	E
I	E	E	H	H	M
II	E	H	H	M	L
III	H	M	M	L	L
IV	M	L	L	L	L

Activity 7: Decontamination

Task	Hazards	Hazard Control	RAC*
Decontamination of personnel (if required), sampling equipment, and heavy machinery and equipment used for intrusive activities	**Chemical Hazards**	A low risk of chemical hazards is associated with this activity and with potential site contamination. Appropriate PPE and engineering controls will be utilized to prevent contact with chemical hazards. Air monitoring for VOCs and particulates will be conducted in accordance with the SSHP and if action levels are exceeded, engineering controls or upgrade to Level C PPE, including a respirator with an organic vapor and P100 cartridge, will be required. The drill rig, macrocore (DPT sample core), augers, and equipment exposed to on-site soils will be decontaminated. A gross decontamination of the drill rig equipment will be completed utilizing nylon brushes and the power washer. The sampling equipment (macrocore sampler) will be decontaminated between boring locations (or more often if contamination is encountered) utilizing phosphate-free soap (e.g., Alconox) and deionized water.	L
	Exposure to decontamination solutions.	Competent workers will wear Modified Level D PPE (or Level C as appropriate), including splash protection.	M
	Pressure Washing Equipment	Only competent and trained personnel will operate power washing equipment. Splash/face shields will be worn at all times.	M
	Wet Feet	Change footwear/socks if wet.	M
	Biological Hazards: Possibility of stinging and biting insects (Black Widow spiders). Encountering large animals (bears) and rabid animals.	Use appropriate insect repellents. Training to avoid poisonous plants and avoid contact. Training on symptoms of rabies and avoidance of animals.	L

Activity 7: Decontamination (continued)

Task	Hazards	Hazard Control	RAC*
	Radiation Hazards: Sun	Use sunblock as appropriate. Avoid extended periods of direct exposure to sun.	L
	Physical Hazards: Slips, trips, falls, tools, terrain, or vegetation; uneven walking surfaces; weather hazards, such as snow and ice; and poor visibility.	Slip, trip, and fall hazards shall be either removed or marked and barricaded. Materials will be stored to prevent intrusion into the work areas. Work areas will be kept organized; ice, snow, and mud will be cleared from steps to reduce slip hazards. Work will be completed in adequate natural light or sufficient artificial illumination will be maintained. Site personnel shall conduct an initial walkthrough, and the "buddy system" will be implemented.	M
	Inclement weather	Personnel will be dressed according to weather conditions. Local weather will be monitored on a daily basis or more frequently if storms threaten. The SSHO will determine through visual observations and weather updates (gathered through the radio or cell phone) when it is necessary to halt work and when to re-start field activities. The SSHO will monitor for tornado, lightning, and high wind conditions. In the event of severe weather conditions, the SSHO will advise on appropriate shelter locations.	L
	Heat and cold stress	Workers will be briefed and be cognizant of heat and cold stress symptoms. Electrolyte/fluids replacement will be available to workers as needed. Work/rest periods will be established according to American Conference of Governmental Industrial Hygienists (ACGIH) and National Institute for Occupational Safety and Health (NIOSH) guidelines. Personnel will be monitored.	L
	Manual lifting	Use proper lifting techniques—keep back straight, lift with legs, avoid twisting back, use mechanical equipment, or get help from others whenever possible. Split heavy loads into smaller loads and/or seek assistance. Do not lift a load greater than 25 pounds without mechanical assistance. Verify the path of travel is clear prior to the lift.	M
	Hands or fingers caught between objects; abrasions and lacerations	Personnel shall be made aware of the hazard and asked to coordinate carefully the handling and placement of heavy objects. Materials and objects being handled will be inspected for rough or sharp edges and appropriate precautions shall be taken to avoid contact with rough or sharp edges. Personnel shall wear work gloves and avoid placing hands between objects.	L

Activity 7: Decontamination (continued)

Task	Hazards	Hazard Control	RAC*
	Hand tools, manual and power	Tools shall be inspected prior to use. Damaged tools will be tagged out of service until repair can be performed by a qualified person. Tools will be used properly and for their intended purpose. All power circuits used for hand tools will be protected by a ground fault circuit interrupter (GFCI). All personnel will be trained on the proper use of all power tools.	L
	Fire	Fire prevention will be a priority through awareness. In the event of a fire, areas where MEC is known to exist will be vacated. Any small fire (non-MEC) may be extinguished using a properly rated extinguisher. All storage, handling, and use of flammables and combustible liquids will be in accordance with National Fire Protection Association (NFPA) 30, 30A. Only labeled/listed containers will be used to store flammables and/or combustibles. Properly rated fire extinguishers will be strategically placed in the work area.	L
	Utilities	All utility locations (above and below ground) will be verified prior to intrusive operations. Underground utility clearance (i.e., DIGSAFE permit) will be obtained prior to and maintained during all intrusive work. Operators will remain cognizant of all ground markings and overhead hazards.	M

Activity 7: Decontamination (continued)

Equipment	Personal Protective Equipment	Inspection	Training
▪ Vehicles, tools, PPE, First Aid Kit, Fire Extinguisher ▪ Decontamination solution, brushes, power washer ▪ Heavy equipment ▪ Photoionization detector (PID), lower explosive limit (LEL), O2 meters ▪ Portable DataRAM (PDR) for particulate monitoring ▪ Dust suppression equipment (tank and water if required)	Safety boots High-visibility safety vest Nitrile gloves Safety glasses Cold-weather clothing Hearing protection ANSI-labeled hard hat Safety glasses Face/splash shield (as required) Full face respirator with organic vapor and P100 cartridge (as appropriate)	Contractors and their Subcontractors shall conduct and document site and equipment inspections and necessary maintenance for the equipment daily and in accordance with the manufacturer's recommendations. Inspection of PPE will be conducted prior to use. First Aid Kits and eyewash/safety showers will be inspected weekly, and fire extinguishers will be inspected monthly. The SSHO will routinely perform "Housekeeping" inspections.	First Aid, CPR, BBP, and vehicle training. Daily safety meetings will be conducted before beginning the work to stress the importance of conducting all activities in a safe manner. Safe work practices and good housekeeping will be followed. Personnel will be informed of the contaminants and chemicals at the site and the availability of MSDSs by the SSHO. Training requirements will be met as defined in Section 5 of the SSHP. Equipment will be operated by qualified and experienced personnel. Training requirements will be met as defined in Section 6 of the APP and Section 5 of the SSHP. 40-hour (HAZWOPER). 8-hour HAZWOPER Refresher.

Date Prepared: October 2013

Prepared By: Craig LaCosse

Reviewed By: Chris Baer

***Overall Risk Assessment Code (RAC): H**

RAC Matrix

Hazard Severity	Accident Probability A	B	C	D	E
I	E	E	H	H	M
II	E	H	H	M	L
III	H	M	M	L	L
IV	M	L	L	L	L

Activity 8: Underwater Operations

Task	Hazards	Hazard Control	RAC*
A qualified subcontractor (VRHabilis) is to perform an underwater investigation to locate anomalies and conduct follow-on intrusive activities as needed to recover potential MEC (i.e., mag and dig). Refer to Dive Plan (Appendix G in the RI Work Plan) for a full description of task. WESTON will provide topside support including oversight, communications, and MEC disposal.	**Chemical Hazards**	A low risk of chemical hazards is associated with this activity and with potential site contamination. Contaminant levels are low based on previous Site Inspection results. Proper use of modified Level D personal protection equipment (PPE), including nitrile gloves, will mitigate risk for exposure. Monitoring in accordance with the Site Safety and Health Plan (SSHP) will be conducted. There is minimal risk of exposure to petroleum fuels and lubricants. Vehicles will not be overfilled. Caution will be used when refueling. Refueling will not be conducted within 100 feet of an open flame or ignition source.	L
	MEC Avoidance	Anomaly avoidance will be provided by an Unexploded Ordnance (UXO) Technician (Level II or above) for any movement into the Boat Basin, Visitors Information Center Munitions Response Site (MRS) and installation of signage or disassembly of fencing that involves digging. Any ordnance items will be positively identified. The Global Positioning System (GPS) coordinates will be taken of the item, and it will be left in place.	L
	Biological Hazards: Possibility of stinging and biting insects (Black Widow spiders). Encountering large animals (bears) and rabid animals.	Use appropriate insect repellents. Training to avoid poisonous plants and avoid contact. Training on symptoms of rabies and avoidance of animals.	L
	Radiation Hazards: Sun	Use sunblock as appropriate. Avoid extended periods of direct exposure to sun.	L
	Physical Hazards:	Slip, trip, and fall hazards shall be either removed or marked and barricaded.	M

Activity 8: Underwater Operations (Continued)

Task	Hazards	Hazard Control	RAC*
	Slips, trips, falls, tools, terrain, or vegetation; uneven walking surfaces; weather hazards, such as snow and ice; and poor visibility.	Materials will be stored to prevent intrusion into the work areas. Work areas will be kept organized; ice, snow, and mud will be cleared from steps to reduce slip hazards. Work will be completed in adequate natural light (diving will not be conducted at night) or sufficient artificial illumination will be maintained. Site personnel shall conduct an initial walkthrough, and the "buddy system" will be implemented.	
	Inclement weather	Personnel will be dressed according to weather conditions. Local weather will be monitored on a daily basis or more frequently if storms threaten. The SSHO will determine through visual observations and weather updates (gathered through the radio or cell phone) when it is necessary to halt work and when to re-start field activities. The SSHO will monitor for tornado, lightning, and high wind conditions. In the event of severe weather conditions, the SSHO will advise on appropriate shelter locations.	L
	Heat and cold stress	Workers will be briefed and be cognizant of heat and cold stress symptoms. Electrolyte/fluids replacement will be available to workers as needed. Work/rest periods will be established according to American Conference of Governmental Industrial Hygienists (ACGIH) and National Institute for Occupational Safety and Health (NIOSH) guidelines. Personnel will be monitored.	L
	Manual lifting	Use proper lifting techniques—keep back straight, lift with legs, avoid twisting back, use mechanical equipment, or get help from others whenever possible. Split heavy loads into smaller loads and/or seek assistance. Do not lift a load greater than 25 pounds without mechanical assistance. Verify the path of travel is clear prior to the lift.	M
	Hands or fingers caught between objects; abrasions and lacerations	Personnel shall be made aware of the hazard and asked to coordinate carefully the handling and placement of heavy objects. Materials and objects being handled will be inspected for rough or sharp edges and appropriate precautions shall be taken to avoid contact with rough or sharp edges. Personnel shall wear work gloves and avoid placing hands between objects.	L

Activity 8: Underwater Operations (Continued)

Task	Hazards	Hazard Control	RAC*
	Hand tools, manual and power	Tools shall be inspected prior to use. Damaged tools will be tagged out of service until repair can be performed by a qualified person. Tools will be used properly and for their intended purpose. All power circuits used for hand tools will be protected by a ground fault circuit interrupter (GFCI). All personnel will be trained on the proper use of all power tools.	L
	Fire	Fire prevention will be a priority through awareness. In the event of a fire, areas where MEC is known to exist will be vacated. Any small fire (non-MEC) may be extinguished using a properly rated extinguisher. All storage, handling, and use of flammables and combustible liquids will be in accordance with National Fire Protection Association (NFPA) 30, 30A. Only labeled/listed containers will be used to store flammables and/or combustibles. Properly rated fire extinguishers will be strategically placed in the work area.	L
	Utilities	All utility locations (above and below ground) will be verified prior to intrusive operations. Underground utility clearance (i.e., DIGSAFE permit) will be obtained prior to and maintained during all intrusive work. Operators will remain cognizant of all ground markings and overhead hazards.	M
	Drowning	Wear personal flotation device (PFD). Know location and proper use of lifesaving devices (throw ring, throw bag, reach poles, cargo net, ladder).	H
	Falls Overboard	Wear PFD, know proper rescue procedures, and wear proper footwear to maintain balance and footing. Make sure kill switch is operational and attached to operator and instructor. Pay close attention to all boat operations during all maneuvers.	H
	Damaged/Sinking Boat	Stay with the vessel until rescue. Wear PFD.	M
	Trailering Boat	Drive defensively. Obey traffic laws. Perform and verify vehicle and trailer are properly connected. Verify trailer lights are operational. Do not eat, drink, smoke, use cell phones, or perform others tasks that interfere with driving.	M

Activity 8: Underwater Operations (Continued)

Task	Hazards	Hazard Control	RAC*
	Launching Boat	Establish standard boat checkout procedures, checklists, and "Go Kits." Make sure boat ramp is clear of obstructions. Engage four-wheel drives when necessary. Set parking brake when trailer is lowered to proper launch depth. Lower driver's side window of the tow vehicle. Use spotter if available. Make sure spotter does not stand behind vehicle on boat ramp. Be aware of wet and slippery boat ramp surface from water or algae. Be aware of tension and pinch points on trailer winch when unhooking boat.	M
	Low on fuel	Ensure that enough fuel is on board for the length of the trip, plus extra for emergencies.	L
	Emergency equipment not on board or does not work	Run through a checklist of emergency equipment required for each vessel type and ensure that emergency equipment is in working order and good condition.	L
	Personnel unfamiliar with potential emergencies at sea	Hold a safety orientation to review emergency procedures and drills at the onset of boating operations and weekly thereafter. Review the use of emergency and safety equipment and their location (including, but not limited to, PFDs, flares, first aid kit, locator beacon, or transmitter). Attend regular (yearly) vessel safety training by an accredited or approved safety training organization.	L

Equipment	Personal Protective Equipment	Inspection	Training
▪ Boat ▪ Miscellaneous boat equipment ▪ Hand-held radios	PFDs Nitrile/leather/cotton/marine/boating gloves (as needed) Cold-weather clothing Specialty equipment identified by the subcontractor in Dive Plan included as **Appendix G.**	All equipment will be properly stored, inspected, and/or maintained on a daily basis, or according to the manufacturer's recommendations. Records of inspection will be maintained on-site. Fire extinguishers, First Aid kits, and vehicles will be inspected monthly by the SSHO or UXOSO. PFDs must be inspected, maintained, stowed, and used in accordance with the manufacturer's instructions. PFD shall not be exposed to excessive moisture, crushing, or extreme heat while stored.	First Aid, CPR, BBP, and vehicle training. Personnel will be trained in proper use and maintenance of all field screening instrumentation. Personnel will be trained in boater safety and operation. USCG License 40-hour (HAZWOPER). 8-hour HAZWOPER Refresher

Date Prepared: October 2013

Prepared By: Craig LaCosse

Reviewed By: Chris Baer

***Overall Risk Assessment Code (RAC): M**

RAC Matrix

Hazard Severity	Accident Probability A	B	C	D	E
I	E	E	H	H	M
II	E	H	H	M	L
III	H	M	M	L	L
IV	M	L	L	L	L

Activity 9: Munitions Constituents Sampling

Task	Hazards	Hazard Control	RAC*
Following MEC investigation and intrusive activities, collection of MC samples by discrete sampling methodology in areas impacted by MEC or a suspected release will be performed. Discrete samples will be collected by hand or by using hand tools following anomaly avoidance surveys by a UXO Technician II or above. For subsurface soil and groundwater sampling for MC, see AHAs 10 and 11, respectively.	**Chemical Hazards:**	A low risk of chemical hazards is associated with this activity and with potential site contamination and sample preservatives. Contaminant levels are low based on previous SI results. Proper use of modified Level D PPE (or Level C as appropriate), including nitrile gloves, will mitigate risk for exposure. Air monitoring for VOCs and particulates will be conducted in accordance with the SSHP and if action levels are exceeded, engineering controls or upgrade to Level C PPE, including a respirator with an organic vapor and P100 cartridge, will be required. Sample preservative hazard communication information will be added to **Attachment A** of the SSHP. Monitoring in accordance with the SSHP will be conducted.	L
	Explosive Hazard	This work is being performed following MEC intrusive investigation activities and is not expected to pose an explosive risk to personnel.	L
	Biological Hazards: Possibility of stinging and biting insects (Black Widow spiders). Encountering large animals (bears) and rabid animals.	Use appropriate insect repellents. Training to avoid poisonous plants and avoid contact. Training on symptoms of rabies and avoidance of animals.	L
	Radiation Hazards: Sun	Use sunblock as appropriate. Avoid extended periods of direct exposure to sun.	L

Activity 9: Munitions Constituent Sampling (Continued)

Task	Hazards	Hazard Control	RAC*
	Physical Hazards: Slips, trips, falls, tools, terrain, or vegetation; uneven walking surfaces; weather hazards, such as snow and ice; and poor visibility.	Slip, trip, and fall hazards shall be either removed or marked and barricaded. Materials will be stored to prevent intrusion into the work areas. Work areas will be kept organized; ice, snow, and mud will be cleared from steps to reduce slip hazards. Work will be completed in adequate natural light or sufficient artificial illumination will be maintained. Site personnel shall conduct an initial walkthrough, and the "buddy system" will be implemented.	M
	Inclement weather	Personnel will be dressed according to weather conditions. Local weather will be monitored on a daily basis or more frequently if storms threaten. The SSHO will determine through visual observations and weather updates (gathered through the radio or cell phone) when it is necessary to halt work and when to re-start field activities. The SSHO will monitor for tornado, lightning, and high wind conditions. In the event of severe weather conditions, the SSHO will advise on appropriate shelter locations.	L
	Heat and cold stress	Workers will be briefed and be cognizant of heat and cold stress symptoms. Electrolyte/fluids replacement will be available to workers as needed. Work/rest periods will be established according to American Conference of Governmental Industrial Hygienists (ACGIH) and National Institute for Occupational Safety and Health (NIOSH) guidelines. Personnel will be monitored.	L
	Manual lifting	Use proper lifting techniques—keep back straight, lift with legs, avoid twisting back, use mechanical equipment, or get help from others whenever possible. Split heavy loads into smaller loads and/or seek assistance. Do not lift a load greater than 25 pounds without mechanical assistance. Verify the path of travel is clear prior to the lift.	M
	Hands or fingers caught between objects; abrasions and lacerations	Personnel shall be made aware of the hazard and asked to coordinate carefully the handling and placement of heavy objects. Materials and objects being handled will be inspected for rough or sharp edges and appropriate precautions shall be taken to avoid contact with rough or sharp edges. Personnel shall wear work gloves and avoid placing hands between objects.	L

Activity 9: Munitions Constituent Sampling (Continued)

Task	Hazards	Hazard Control	RAC*
	Hand tools, manual and power	Tools shall be inspected prior to use. Damaged tools will be tagged out of service until repair can be performed by a qualified person. Tools will be used properly and for their intended purpose. All power circuits used for hand tools will be protected by a ground fault circuit interrupter (GFCI). All personnel will be trained on the proper use of all power tools.	L
	Fire	Fire prevention will be a priority through awareness. In the event of a fire, areas where MEC is known to exist will be vacated. Any small fire (non-MEC) may be extinguished using a properly rated extinguisher. All storage, handling, and use of flammables and combustible liquids will be in accordance with National Fire Protection Association (NFPA) 30, 30A. Only labeled/listed containers will be used to store flammables and/or combustibles. Properly rated fire extinguishers will be strategically placed in the work area.	L
	Utilities	All utility locations (above and below ground) will be verified prior to intrusive operations. Underground utility clearance (i.e., DIGSAFE permit) will be obtained prior to and maintained during all intrusive work. Operators will remain cognizant of all ground markings and overhead hazards.	M

Activity 9: Munitions Constituent Sampling (Continued)

Equipment	Personal Protective Equipment	Inspection	Training
▪ Hand tools ▪ Sample containers ▪ Sample documentation equipment ▪ Cooler ▪ Ice ▪ Photoionization detector (PID), lower explosive limit (LEL), O_2 meters ▪ Portable DataRAM (PDR) for particulate monitoring ▪ Dust suppression equipment (tank and water if required)	Safety boots Nitrile gloves Safety glasses Hard hats, as needed Cold-weather clothing, as needed Full face respirator with organic vapor and P100 cartridge (as appropriate)	All equipment will be properly stored, inspected, and/or maintained on a daily basis or according to manufacturer's recommendations. Fire extinguishers, First Aid kits, and vehicles will be inspected monthly by the SSHO or UXOSO.	First aid/CPR, BBP, and vehicle training. Personnel will be trained in proper use and maintenance of all field screening instrumentation. 40-hour (HAZWOPER). 8-hour HAZWOPER Refresher.

Date Prepared: October 2013

Prepared By: Craig LaCosse

Reviewed By: C. Baer

***Overall Risk Assessment Code (RAC): M**

RAC Matrix

Hazard Severity	Accident Probability A	B	C	D	E
I	E	E	H	H	M
II	E	H	H	M	L
III	H	M	M	L	L
IV	M	L	L	L	L

Activity 10: Drilling/Geoprobe Activities

Task	Hazards	Hazard Control	RAC*
Direct push technology (Geoprobe) for collection of subsurface soil samples and installation of temporary groundwater monitoring wells and hollow-stem auger drilling to install permanent monitoring wells. Termination depths of each monitoring well will be approximately 3 feet below the water table as determined by a field geologist. Borehole clearance will be conducted at each subsurface boring.	**Drilling/Geoprobe**	Follow appropriate drilling safety guidelines such as the "Environmental Remediation Drilling Safety Guideline" or equivalent in establishing drilling safety protocols and procedures. The DPT equipment is a hydraulically powered machine that uses static force and percussion to advance sampling and logging tools, such as a 4-foot stainless steel sampler, into the subsurface. Be aware of the potential for failure of high-pressure hydraulic lines and exposure to hydraulic and other fluids associated with the rig. A 15-foot safety zone for nonessential personnel will be maintained during advancing and recovery of sampling and logging tools.	M
	Chemical Hazards	A low risk of chemical hazards is associated with this activity and with potential site contamination. Contaminant levels are anticipated to be low based on previous SI results. Proper use of modified Level D PPE (or Level C as appropriate), including nitrile gloves, will mitigate risk for exposure. Air monitoring for VOCs and particulates will be conducted in accordance with the SSHP and if action levels are exceeded, engineering controls or upgrade to Level C PPE, including a respirator with an organic vapor and P100 cartridge, will be required. Monitoring in accordance with the SSHP will be conducted.	L
	MEC Avoidance	Borehole anomaly avoidance procedures will be completed by UXO personnel prior to all subsurface drilling/Geoprobe investigations. It is anticipated all surface MEC items will have been identified and removed prior to mobilization of the drill rig and support trucks to surface cleared areas of the site. As a result, an access survey is not required if boreholes are located more than 10 feet laterally from a previously identified geophysical anomaly. Prior to the installation of subsurface borings, borehole anomaly avoidance procedures using the drill rig or hand auger techniques will be conducted at 2-foot increments. Borehole anomaly avoidance procedures will utilize a Foerster API MK 26 Mod 1, UXO detector (nominal diameter of 1.3 inches). Drill rods and augers will be removed from the borehole in order to facilitate borehole anomaly avoidance procedures. If an anomaly is detected, the borehole will be backfilled in accordance with site-specific procedures and a new borehole location must be selected and cleared to the target depth. Any	M

Activity 10: Drilling/Geoprobe Activities (continued)

Task	Hazards	Hazard Control	RAC*
		anomalies detected at a borehole location will be prominently marked with survey flagging or pin flags for avoidance. Identified areas of potential subsurface MEC material in boreholes will be further investigated under another contract and is not part of this investigation. At a minimum, the borehole clearance activities will continue until the water table (approximately 15 feet below grade) is reached or 10 feet below grade, whichever is greater. It is not anticipated that burial areas extended below the water table, and based on the MEC items used at the site, none would have penetrated to depths greater than 10 feet below grade. As necessary with loose soils, a polyvinyl chloride (PVC) pipe (minimum 2 inches inner diameter) may be inserted to keep the hole open and to allow for incremental geophysical screening. If nested or an offset borehole is required, the subsequent borehole must be located within a 2-foot radius of the cleared borehole. Direct-push technology (DPT, e.g., Geoprobe) will be used for installation of soil borings to collect soil samples, and installation of temporary monitoring wells to collect groundwater samples. Approximately 15 DPT borings/wells will be completed. Termination depths of each boring will be approximately 3 feet below the water table as determined by a field geologist. Following review of DPT-derived data, an estimated four permanent monitoring wells will be installed using conventional hollow stem auger methodology and borehole anomaly avoidance procedures by UXO personnel.	
	Biological Hazards: Possibility of stinging and biting insects (Black Widow spiders). Encountering large animals (bears) and rabid animals.	Use appropriate insect repellents. Training to avoid poisonous plants and avoid contact. Training on symptoms of rabies and avoidance of animals.	L
	Radiation Hazards: Sun	Use sunblock as appropriate. Avoid extended periods of direct exposure to sun.	L

Activity 10: Drilling/Geoprobe Activities (continued)

Task	Hazards	Hazard Control	RAC*
	Physical Hazards—Slips, trips, falls, tools, terrain, or vegetation; uneven walking surfaces; weather hazards, such as snow and ice; and poor visibility.	Slip, trip, and fall hazards shall be either removed or marked and barricaded. Materials will be stored to prevent intrusion into the work areas. Work areas will be kept organized; ice, snow, and mud will be cleared from steps to reduce slip hazards. Work will be completed in adequate natural light or sufficient artificial illumination will be maintained. Site personnel shall conduct an initial walkthrough, and the "buddy system" will be implemented.	L
	Inclement weather	Personnel will be dressed according to weather conditions. Local weather will be monitored on a daily basis or more frequently if storms threaten. The SSHO will determine through visual observations and weather updates (gathered through the radio or cell phone) when it is necessary to halt work and when to re-start field activities. The SSHO will monitor for tornado, lightning, and high wind conditions. In the event of severe weather conditions, the SSHO will advise on appropriate shelter locations.	L
	Heat and cold stress	Workers will be briefed and be cognizant of heat and cold stress symptoms. Electrolyte/fluids replacement will be available to workers as needed. Work/rest periods will be established according to American Conference of Governmental Industrial Hygienists (ACGIH) and National Institute for Occupational Safety and Health (NIOSH) guidelines. Personnel will be monitored.	L
	Noise exposure	High noise areas will be identified. Hearing protection will be provided as appropriate. The latest ACGIH threshold limit values (TLVs) will be used. Hearing protection will be worn around drilling equipment operations. A noise control and hearing conservation program, which consists of training, use of hearing protection, and sound level pressure monitoring, will be in place.	M
	Moving/heavy equipment operations.	Only competent, trained, experienced operators will operate equipment. Equipment will be inspected daily by a competent person. Personnel shall be made aware of the hazard and will coordinate carefully during handling equipment operations. Personnel access will be restricted in the area of operation. Back-up alarms will be functional. Stay out of the swing area of all equipment and from under loads. No personnel will ride on the equipment unless seats are provided. Guards will be kept in place during operation. Maintain safe distance from moving mechanical parts. The ground spotter will wear high-visibility vests or clothing and an OSHA-approved hard hat. Always use appropriate PPE. Equipment will be equipped with blast shielding as determined necessary and in accordance with the ESP.	M

Activity 10: Drilling/Geoprobe Activities (continued)

Task	Hazards	Hazard Control	RAC*
	Manual lifting	Use proper lifting techniques—keep back straight, lift with legs, avoid twisting back, use mechanical equipment, or get help from others whenever possible. Split heavy loads into smaller loads and/or seek assistance. Do not lift a load greater than 25 pounds without mechanical assistance. Verify the path of travel is clear prior to the lift.	M
	Hands or fingers caught between objects; abrasions and lacerations	Personnel shall be made aware of the hazard and asked to coordinate carefully the handling and placement of heavy objects. Materials and objects being handled will be inspected for rough or sharp edges and appropriate precautions shall be taken to avoid contact with rough or sharp edges. Personnel shall wear work gloves and avoid placing hands between objects.	L
	Hand tools, manual and power	Tools shall be inspected prior to use. Damaged tools will be tagged out of service until repair can be performed by a qualified person. Tools will be used properly and for their intended purpose. All power circuits used for hand tools will be protected by a ground fault circuit interrupter (GFCI). All personnel will be trained on the proper use of all power tools.	L
	Fire	Fire prevention will be a priority through awareness. In the event of a fire, areas where MEC is known to exist will be vacated. Any small fire (non-MEC) may be extinguished using a properly rated extinguisher. All storage, handling, and use of flammables and combustible liquids will be in accordance with National Fire Protection Association (NFPA) 30, 30A. Only labeled/listed containers will be used to store flammables and/or combustibles. Properly rated fire extinguishers will be strategically placed in the work area.	L
	Utilities	All utility locations (above and below ground) will be verified prior to intrusive operations. Underground utility clearance (i.e., DIGSAFE permit) will be obtained prior to and maintained during all intrusive work. Operators will remain cognizant of all ground markings and overhead hazards.	M

Activity 10: Drilling/Geoprobe Activities (continued)

Equipment	Personal Protective Equipment	Inspection	Training
▪ Hand tools ▪ Sample containers ▪ Sample documentation equipment ▪ Cooler ▪ Ice ▪ Drill rig or DPT rig ▪ Water level indicator ▪ Photoionization detector (PID), lower explosive limit (LEL), O_2 meters ▪ Water quality meters (i.e., pH, turbidity, oxidation-reduction potential (ORP), ▪ Portable DataRAM (PDR) for particulate monitoring ▪ Dust suppression equipment (tank and water if dissolved oxygen)	Safety boots Leather gloves Nitrile/leather/cotton gloves (as needed) Safety glasses ANSI-labeled hard hat as needed Cold-weather clothing, as needed High-visibility reflective vests as needed Hearing protection Respirator with organic and P100 cartridge (as appropriate)	All equipment will be properly stored, inspected, and/or maintained on a daily basis or according to manufacturer's recommendations. Fire extinguishers, First Aid kits, and vehicles will be inspected monthly by the SSHO or UXOSO. All excavations will be inspected daily by a competent person. Records of inspection will be maintained on-site. Contractors and their subcontractors shall conduct and document daily site and equipment inspections and necessary maintenance for the equipment by a competent and qualified person. All air monitoring equipment will be properly stored, inspected, maintained, and/or calibrated on a daily basis, as needed by a competent person. Drill rigs will be inspected daily by a competent person.	Unexploded ordnance/Explosive Ordnance Disposal certification, qualified in accordance with Department of Defense Explosives Safety Board Technical Paper 18 Virginia Blaster's License (or equivalent) \ First Aid/CPR, BBP and vehicle training. Personnel will be trained in proper use and maintenance of all field screening instrumentation. Equipment operators will be trained in the use of equipment being used and retain driller's license as appropriate. 40-hour (HAZWOPER). 8-hour HAZWOPER Refresher.

Note: The direct-push technology/Geoprobe equipment is a high quality, hydraulically powered machine that uses both static force and percussion to advance sampling and logging tools such as a 4-foot stainless steel sampler into the subsurface. Be aware of potential noise exposure, the potential for failure of high-pressure hydraulic lines, and exposure to hydraulic and other fluids associated with the rig.

Date Prepared: October 2013

Prepared By: Craig LaCosse

Reviewed By: C. Baer

***Overall Risk Assessment Code (RAC): M**

RAC Matrix

Hazard Severity	Accident Probability A	B	C	D	E
I	E	E	H	H	M
II	E	H	H	M	L
III	H	M	M	L	L
IV	M	L	L	L	L

Activity 11: Groundwater Sampling Activities

Task	Hazards	Hazard Control	RAC*
Groundwater purging, well development, and sampling	**Chemical Hazards**	A low risk of chemical hazards is associated with this activity and with potential site contamination. Contaminant levels are low based on previous SI results. Proper use of modified Level D PPE (or Level C as appropriate), including nitrile gloves, will mitigate risk for exposure. Air monitoring for VOCs and particulates will be conducted in accordance with the SSHP and if action levels are exceeded, engineering controls or upgrade to Level C PPE, including a respirator with an organic vapor and P100 cartridge, will be required. Monitoring in accordance with the SSHP will be conducted. Potential chemicals used on-site during this activity include Alconox (phosphate-free soap), and sample bottle preservatives, including nitric and hydrochloric acids.	L
	Exposure to preservatives (acids/bases).	Appropriate PPE will be used to prevent splash hazards. A portable 15-minute eyewash station will be placed within the immediate work area for emergency use.	M
	Biological Hazards: Possibility of stinging and biting insects (Black Widow spiders). Encountering large animals (bears) and rabid animals.	Use appropriate insect repellents. Training to avoid poisonous plants and avoid contact. Training on symptoms of rabies and avoidance of animals.	L
	Radiation Hazards: Sun	Use sunblock as appropriate. Avoid extended periods of direct exposure to sun.	L
	Physical Hazards: Slips, trips, falls, tools, terrain, or vegetation; uneven walking surfaces; weather hazards, such as snow and ice; and poor visibility.	Slip, trip, and fall hazards shall be either removed or marked and barricaded. Materials will be stored to prevent intrusion into the work areas. Work areas will be kept organized; ice, snow, and mud will be cleared from steps to reduce slip hazards. Work will be completed in adequate natural light or sufficient artificial illumination will be maintained. Site personnel shall conduct an initial walkthrough, and the "buddy system" will be implemented.	M

Activity 11: Groundwater Sampling Activities (Continued)

Task	Hazards	Hazard Control	RAC*
	Inclement weather	Personnel will be dressed according to weather conditions. Local weather will be monitored on a daily basis or more frequently if storms threaten. The SSHO will determine through visual observations and weather updates (gathered through the radio or cell phone) when it is necessary to halt work and when to re-start field activities. The SSHO will monitor for tornado, lightning, and high wind conditions. In the event of severe weather conditions, the SSHO will advise on appropriate shelter locations.	L
	Heat and cold stress	Workers will be briefed and be cognizant of heat and cold stress symptoms. Electrolyte/fluids replacement will be available to workers as needed. Work/rest periods will be established according to American Conference of Governmental Industrial Hygienists (ACGIH) and National Institute for Occupational Safety and Health (NIOSH) guidelines. Personnel will be monitored.	L
	Manual lifting	Use proper lifting techniques—keep back straight, lift with legs, avoid twisting back, use mechanical equipment, or get help from others whenever possible. Split heavy loads into smaller loads and/or seek assistance. Do not lift a load greater than 25 pounds without mechanical assistance. Verify the path of travel is clear prior to the lift.	M
	Hands or fingers caught between objects; abrasions and lacerations	Personnel shall be made aware of the hazard and asked to coordinate carefully the handling and placement of heavy objects. Materials and objects being handled will be inspected for rough or sharp edges and appropriate precautions shall be taken to avoid contact with rough or sharp edges. Personnel shall wear work gloves and avoid placing hands between objects.	L
	Hand tools, manual and power	Tools shall be inspected prior to use. Damaged tools will be tagged out of service until repair can be performed by a qualified person. Tools will be used properly and for their intended purpose. All power circuits used for hand tools will be protected by a ground fault circuit interrupter (GFCI). All personnel will be trained on the proper use of all power tools.	L
	Fire	Fire prevention will be a priority through awareness. In the event of a fire, areas where MEC is known to exist will be vacated. Any small fire (non-MEC) may be extinguished using a properly rated extinguisher. All storage, handling, and use of flammables and combustible liquids will be in accordance with National Fire Protection Association (NFPA) 30, 30A. Only labeled/listed containers will be used to store flammables and/or combustibles. Properly rated fire extinguishers will be strategically placed in the work area.	L

Activity 11: Groundwater Sampling Activities (Continued)

Task	Hazards	Hazard Control	RAC*
	Utilities	All utility locations (above and below ground) will be verified prior to intrusive operations. Underground utility clearance (i.e., DIGSAFE permit) will be obtained prior to and maintained during all intrusive work. Operators will remain cognizant of all ground markings and overhead hazards.	M

Equipment	Personal Protective Equipment	Inspection	Training
▪ Hand tools ▪ Sample containers ▪ Sample documentation equipment ▪ Cooler ▪ Ice ▪ Sheet plastic (as required) ▪ Water level indicator ▪ Photoionization detector (PID), lower explosive limit (LEL)/O_2 meters ▪ Water quality meters (i.e., pH, turbidity, oxidation-reduction potential (ORP), dissolved oxygen)	Safety boots Nitrile gloves Safety glasses ANSI-labeled hard hat, as needed Cold-weather clothing, as needed High-visibility reflective vests Hearing protection Full face respirator with organic vapor and P100 cartridge (as appropriate)	All equipment will be properly stored, inspected, and/or maintained on a daily basis or according to manufacturer's recommendations. Fire extinguishers, First Aid kits, and vehicles will be inspected monthly by the SSHO or UXOSO. Records of inspection will be maintained on-site. Contractors and their subcontractors shall conduct and document daily site and equipment inspections and necessary maintenance for the equipment by a competent and qualified person. All air monitoring equipment will be properly stored, inspected, maintained, and/or calibrated on a daily basis, as needed by a competent person.	First Aid/CPR, BBP, and vehicle training. Personnel will be trained in proper use and maintenance of all field screening instrumentation. Equipment operators will be trained in the use of equipment being used as appropriate. 40-hour (HAZWOPER). 8-hour HAZWOPER Refresher.

ATTACHMENT 1

PROJECT HEALTH AND SAFETY ACKNOWLEDGMENT FORM

ATTACHMENT 1

PROJECT HEALTH AND SAFETY ACKNOWLEDGEMENT FORM

By signing below, the undersigned certify they have had the opportunity to review and ask questions about this Accident Prevention Plan and all appendices/attachments, and that they understand the procedures, equipment, and restrictions of this plan and agree to abide by them.

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ATTACHMENT 1

PROJECT HEALTH AND SAFETY ACKNOWLEDGEMENT FORM (Continued)

By signing below, the undersigned certify they have had the opportunity to review and ask questions about this Accident Prevention Plan and all appendices/attachments, and that they understand the procedures, equipment, and restrictions of this plan and agree to abide by them.

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ATTACHMENT 1

PROJECT HEALTH AND SAFETY ACKNOWLEDGEMENT FORM (Continued)

By signing below, the undersigned certify they have had the opportunity to review and ask questions about this Accident Prevention Plan and all appendices/attachments, and that they understand the procedures, equipment, and restrictions of this plan and agree to abide by them.

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ATTACHMENT 2

SITE SAFETY AND HEALTH PLAN (SSHP)

ATTACHMENT 2

SITE SAFETY AND HEALTH PLAN

ACCIDENT PREVENTION PLAN
ATTACHMENT 2 – SITE SAFETY AND HEALTH PLAN
MILITARY MUNITIONS RESPONSE PROGRAM
BOAT BASIN, VISITORS INFORMATION CENTER
REMEDIAL INVESTIGATION
WALLOPS ISLAND, VIRGINIA

Prepared for:
U.S. Army Corps of Engineers
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Contracted by:
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Prepared by:
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2551 Eltham Avenue, Suite I
Norfolk, VA 23518

October 2013

TABLE OF CONTENTS

Section **Page**

TABLE OF CONTENTS (CONTINUED)

Section **Page**

TABLE OF CONTENTS (CONTINUED)

Section **Page**

TABLE OF CONTENTS (CONTINUED)

Section **Page**

TABLE OF CONTENTS (CONTINUED)

Section **Page**

LIST OF FIGURES

Title **Page**

LIST OF TABLES

LIST OF ACRONYMS

°F	degrees Fahrenheit
%	percent
µg/L	micrograms per kilogram
ABS	dermal absorption
ACGIH	American Conference of Governmental Industrial Hygienists
AHA	Activity Hazard Analysis
ANSI	American National Standards Institute
APP	Accident Prevention Plan
BBP	bloodborne pathogens
BIP	blow-in-place
BP	boiling point
CAS	Chemical Abstracts Service
CFR	Code of Federal Regulations
CIH	Certified Industrial Hygienist
CNAAS	Chincoteague Naval Auxiliary Air Station
CNS	central nervous system
CON	contact
CPR	cardiopulmonary resuscitation
CRZ	contamination reduction zone
CSP	Certified Safety Professional
CWM	chemical warfare material
dBA	A-weighted decibel
DDESB	Department of Defense Explosives Safety Board
DERP	Defense Environmental Restoration Program
DGM	digital geophysical mapping
DHSO	Division Health and Safety Officer
DO	Delivery Order
DoD	Department of Defense
DPT	direct push technology
EC	Emergency Coordinator
EHS	Environmental Health and Safety
EMT	Emergency Medical Technician
EOD	Explosive Ordnance Disposal
EPA	Environmental Protection Agency
ESP	Explosives Site Plan

LIST OF ACRONYMS (Continued)

eV	electron volt
EZ	exclusion zone
FLP	flash point
FM	Factory Mutual Research Corp.
FUDS	formerly used defense site
GW-HHR	Groundwater Human Health Risk
HAZCOM	Hazard Communication
HAZWOPER	Hazardous Waste Operations and Emergency Response
HE	high explosive
HFA	Human Factors Applications, Inc.
HTRW	hazardous, toxic, and/or radioactive waste
IDLH	immediately dangerous to life or health
ING	ingestion
INH	inhalation
IP	ignitability point
KO	Contracting Officer
LEL	lower explosive limit
MC	munitions constituents
MD	munitions debris
MEC	munitions and explosives of concern
mg/kg	milligrams per kilogram
mg/m^3	milligrams per cubic meter
MGFD	munition with the greatest fragmentation distance
mm	millimeter
mmHg	millimeters of mercury
MMRP	Military Munitions Response Program
MPPEH	material potential presenting an explosive hazard
MRS	munitions response sites
MSD	minimum separation distance
MSDS	Material Safety Data Sheet
msl	mean sea level
MW	molecular weight
NA	not applicable
NAOTS	Naval Aviation Ordnance Test Station
NASA	National Aeronautics and Space Administration

LIST OF ACRONYMS (Continued)

NIOSH	National Institute for Occupational Safety and Health
NOI	Notice of Incident
OEL	Occupational Exposure Limits
OHP	Occupational Health Program
OSHA	Occupational Safety and Health Administration
PEL	permissible exposure limits
PPE	personal protective equipment
ppm	parts per million
QAPP	Quality Assurance Project Plan
QC	quality control
QCS	Quality Control Specialist
REL	reference exposure level
RI	Remedial Investigation
SI	Site Inspection
Soil-ER	Soil Ecological Risk
Soil-HHR	Soil Human Health Risk
SpGr	specific gravity
SSHO	Site Safety and Health Officer
SSHP	Site Safety and Health Plan
SUXOS	Senior Unexploded Ordnance Supervisor
TerranearPMC	TerranearPMC, LLC/Human Factors Applications, Inc.
TLV	Threshold Limit Values
TWA	time-weighted average
U.S.	United States
UFP-QAPP	Uniform Federal Policy for Quality Assurance Project Plan
UL	Underwriters Laboratory
UN	United Nations
USACE	U.S. Army Corps of Engineers
UXO	unexploded ordnance
UXOQCS	Unexploded Ordnance Quality Control Specialist
UXOSO	Unexploded Ordnance Safety Officer
VDEQ	Virginia Department of Environmental Quality
VP	vapor pressure
WESTON®	Weston Solutions, Inc.
WFF	Wallops Flight Facility

1. INTRODUCTION

This Site Safety and Health Plan (SSHP) provides detailed project-specific health and safety information for the Military Munitions Response Program (MMRP) Remedial Investigation (RI) being performed at the Boat Basin, Visitors Information Center Munitions Response Site (MRS) located at the Wallops Flight Facility (WFF), Virginia. The SSHP is written in accordance with applicable Army, federal, state, and local health and safety requirements and presents the minimum requirements for safety and health that must be met by site personnel engaged in RI activity operations. The SSHP does not in any way relieve Weston Solutions, Inc. (WESTON®) site personnel or WESTON subcontractors from responsibility for the safety and health of their personnel. Visitors to the Boat Basin, Visitors Information Center MRS will receive a safety briefing by the Site Safety and Health Officer (SSHO) and Unexploded Ordnance Safety Officer (UXOSO) prior to gaining entry to the work area. The Senior Unexploded Ordnance Supervisor (SUXOS)/Site Manager will provide all visitors with appropriate personal protective equipment (PPE) and an escort while on-site and will maintain an on-site visitor log.

Changes and modifications to the SSHP are permitted and shall be made in writing with the knowledge and concurrence of the Corporate Environmental Health and Safety (EHS) Manager and acceptance by the United States Army Corps of Engineers (USACE) Project Manager.

1.1 PROJECT DESCRIPTION

The purpose of this MMRP RI of the Boat Basin, Visitors Information Center MRS is to perform an investigation to identify the presence of, and determine the nature and extent of, munitions and explosives of concern (MEC) and munitions constituents (MC) at the ground surface, and in the subsurface, surface waters, and submerged ground. The Boat Basin, Visitors Information Center MRS encompasses approximately 1.53 acres of land that include four areas: Pyrotechnics Burn Area, Gun Butt No. 1 and No. 2, and South Bank Boat Basin.

Historical investigations include an unexploded ordnance (UXO) clearance conducted in January 2006 and most recently a Site Inspection (SI) conducted in December 2011. The SI was conducted at the Boat Basin, Visitors Information Center MRS by Human Factors Applications

(HFA), a wholly owned subsidiary of TerranearPMC, LLC (TerranearPMC), Inc. Based on historical evidence and the results from the SI, it was concluded that evidence of MEC and MC is present at the Boat Basin, Visitors Information Center MRS. Therefore, an RI was recommended to address the presence of MEC and MC at the Boat Basin, Visitors Information Center MRS.

To determine the nature and extent of MEC, geophysical surveys will be performed over land and water. Geophysical activities will include conducting surveys of transects and/or grids established over four areas using an EM61-MK2 (all-metals detector) and performing analog surveys with Schonstedt magnetometers.

The digital geophysical mapping (DGM) results will be employed to develop follow-on intrusive activities to recover potential MEC anomalies. Anomalies detected during ground-based geophysical surveys will be investigated to determine whether MEC is present at that location. Recovered MEC will be demolished using a blow-in-place (BIP) approach as the primary method of destruction. When necessary, recovered MEC may be transported by qualified personnel to a common detonation area.

Environmental sampling in accordance with the Uniform Federal Policy for Quality Assurance Project Plan developed for the RI activities includes discrete sampling of surface soil for MC where MEC is detected and where MC is suspected to be present based on the identification of a potential release (e.g., broken munitions, soil staining). If MEC is identified, then MC sampling will be conducted at discrete locations, as deemed necessary. An anticipated 100 total environmental samples (including 15% quality control (QC) samples) will be collected from surface soil, subsurface soil, sediment, surface water, and groundwater to support the characterization of the Boat Basin, Visitors Information Center MRS.

The surface water areas (South Bank Boat Basin) will be investigated by means of a magnetometer survey with subsequent reconnaissance of detected anomalies (i.e., mag and dig). Transects that will be investigated by dive personnel will vary in length. In accordance with

Section 30.A.15 of EM 385-1-1, a separate Dive Plan has been prepared and is provided in **Appendix G** of the RI Work Plan to govern underwater operations conducted as part of the RI.

The RI activities are being performed in cooperation with USACE, the National Aeronautics and Space Administration (NASA), Region III U.S. Environmental Protection Agency (EPA), and the Commonwealth of Virginia Department of Environmental Quality (VDEQ). Investigations conducted at the WFF are part of the ongoing Defense Environmental Restoration Program (DERP) - Formerly Used Defense Site (FUDS) Program to identify hazardous, toxic, and/or radioactive waste (HTRW) and ordnance-related hazards left during prior occupation by the Department of Defense (DoD) and to remediate areas within the FUDS.

Table 1-1 presents the work activities to be conducted at the Boat Basin, Visitors Information Center MRS.

Table 1-1 Anticipated Phases of Work

Work Phase	Work Description	PPE Level
Activity 1: Mobilization/ Demobilization	Mobilize/demobilize equipment and personnel to/from the project location.	Level D
Activity 2: Vegetative Clearing and Fence Removal	Vegetative clearing of investigation areas will be completed using hand tools (e.g., pruners) and if necessary brush hog (with protective shielding) and brush cutting equipment (line trimmer with metal brush blade attachment and shielding). It is expected that only vegetation up to 2-inch-diameter will be cleared. Additionally, fencing surrounding the Pyrotechnics Burn Area will be disassembled by hand to facilitate access for geophysical survey, MEC intrusive, and MC and Expanded RI sampling activities. A UXO Technician II will provide anomaly avoidance support.	Level D/Modified Level D
Activity 3: Ground-Based Reconnaissance and Geophysical Survey Activities	Construct instrument verification strip (IVS) for geophysical instrument testing. Arrange for a licensed surveyor to locate and establish survey control points, to allow WESTON personnel to mark grid corners/transect end-points with wooden stakes and steel pins (a UXO Technician II to provide anomaly avoidance support). Subsequent to vegetation clearing of investigation areas, perform DGM and mag and dig transect and grid surveys to detect geophysical anomalies and potential MEC within the designated areas of the MRS.	Level D/ Modified Level D (IVS construction)
Activity 4: Land Surveying	Perform land surveying of MRS boundaries, existing structures, and cultural features (e.g., drainage ditches, tree lines, paved areas, etc.) within the MRS and beyond, if necessary, to meet project objectives. In addition, at least one permanent survey control monument shall be established with a horizontal control accuracy of Third Order Class I survey. Additional surveying of the location and elevation of soil borings and temporary and permanent monitoring wells (Activity 10). A UXO Technician II will provide anomaly avoidance support for land surveying activities within the MRS.	Level D/ Modified Level D
Activity 5: Water-Based Geophysical Survey Activities	Perform DGM transect surveys to detect geophysical anomalies and potential MEC along the south bank of the Boat Basin.	Modified Level D
Activity 6: MEC Intrusive and Disposal Activities	Based on geophysical survey results, qualified UXO Technicians will perform intrusive operations at potential MEC locations to make a 100% verification of the nature of the anomaly. If MEC is positively identified, disposal of MEC will be performed. Munitions and explosives of concern (UXO and DMM), MPPEH, MD, and/or other non-munitions-related metal debris will be	Modified Level D

Table 1-1 Anticipated Phases of Work (Continued)

Work Phase	Work Description	PPE Level
	recovered to evaluate the nature and extent of potential explosives hazards. All MEC disposal activities will be conducted in accordance with the approved Explosive Site Plan prepared by USACE (see **Appendix K** of the RI Work Plan), and the Explosive Management Plan (see Section 6 of the RI Work Plan). Notification procedures for demolition activities are provided in Subsection 3.8.2 of the RI Work Plan. Subsurface investigation activities include the excavation of detected anomalies using hand tools, demolition activities of recovered MEC and MPPEH, and MD and non-munitions-debris inspection and transport to a certified recycling program. MEC demolition will employ BIP procedures for recovered items, with limited transport of items determined acceptable-to-move to a common detonation area within the MRS (to be determined).	
Activity 7: Decontamination	Decontamination of drilling equipment, heavy machinery, and personnel (as necessary). Decontamination liquids and solids will be collected, segregated, and placed in 55-gallon drums.	Modified Level D or Level C (if appropriate)
Activity 8: Underwater Operations	A qualified subcontractor (VRHabilis) is to perform an underwater investigation to locate anomalies and to conduct follow-on intrusive activities (i.e., mag and dig) as needed to recover potential MEC. Refer to Dive Plan (**Appendix G** of RI Work Plan) for a full description of task. WESTON will provide topside support, including oversight, communications, and MEC disposal. The USACE Dive Board will review the Dive Plan.	See Dive Plan (**Appendix G** of RI Work Plan).
Activity 9: MC Sampling	Following MEC investigation and intrusive activities, collection of MC samples by discrete sampling methodology in areas impacted by MEC or a suspected release will be performed. Discrete samples will be collected by hand or by using hand tools following anomaly avoidance surveys by a UXO Technician II or above.	Modified Level D or Level C (if appropriate)
Activity 10: Drilling / Geoprobe Activities	Borehole anomaly avoidance procedures will be completed by UXO personnel prior to all subsurface drilling/geoprobe investigations. It is anticipated that all surface MEC items will have been identified and removed prior to mobilization of the drill rig and support trucks to surface cleared areas of the site. As a result, an access survey is not required if boreholes are located more than 10 feet laterally from a previously identified geophysical anomaly. Prior to the installation of subsurface borings, borehole anomaly avoidance procedures using the drill rig or hand auger techniques will be conducted at 2-foot increments. Borehole anomaly avoidance procedures will utilize a Foerster API MK 26 Mod 1, UXO detector (nominal diameter of 1.3 inches). Drill rods and augers will be removed from the borehole in order to facilitate borehole anomaly	Modified Level D or Level C (if appropriate)

Table 1-1 Anticipated Phases of Work (Continued)

Work Phase	Work Description	PPE Level
	avoidance procedures. If an anomaly is detected, the borehole will be backfilled in accordance with site-specific procedures, and a new borehole location must be selected and cleared to the target depth. Any anomalies detected at a borehole location will be prominently marked with survey flagging or pin flags for avoidance. Identified areas of potential subsurface MEC material in boreholes will be further investigated under another contract, and this investigation is not part of Contract No. W912DR-09-D-0015. At a minimum, the borehole clearance activities will continue until the water table (approximately 15 feet below grade) is reached or 10 feet below grade, whichever is greater. It is not anticipated that burial areas extended below the water table, and based on the MEC items used at the site, none would have penetrated to depths greater than 10 feet below grade. As necessary with loose soils, a polyvinyl chloride (PVC) pipe (minimum 2 inches inner diameter) may be inserted to keep the hole open and to allow for incremental geophysical screening. If a nested or an offset borehole is required, the subsequent borehole must be located within a 2-foot radius of the cleared borehole. Direct-push technology (DPT, e.g., geoprobe) will be used for installation of soil borings to collect soil samples, and installation of temporary monitoring wells to collect groundwater samples. Approximately 15 DPT borings/wells will be completed. Termination depths of each boring will be approximately 3 feet below the water table as determined by a field geologist. Following review of DPT-derived data, an estimated four permanent monitoring wells will be installed using conventional hollow stem auger methodology and borehole anomaly avoidance procedures by UXO personnel.	
Activity 11: Groundwater Sampling	This task includes sampling of groundwater from installed well locations to determine whether MC is present in the groundwater at the site. Temporary monitoring wells will be sampled following stabilization of water quality parameters. Permanent monitoring wells will be developed until stabilization of select water quality parameters occurs. Permanent monitoring well sampling will occur no earlier than 14 days after development and subsequent stabilization of water quality parameters.	Modified Level D or Level C (if appropriate)

Notes:

BIP = blow-in-place
DGM = digital geophysical mapping
DMM = discarded military munitions
DPT = direct push technology
MC = munitions constituents
MD = munitions debris
MEC = munitions and explosives of concern
MPPEH = material potentially presenting an explosive hazard
MRS = munitions response site
PPE = personal protection equipment
RI = Remedial Investigation
USACE = U.S. Army Corps of Engineers
UXO = unexploded ordnance
WESTON = Weston Solutions, Inc.

2. SITE DESCRIPTION AND CONTAMINATION CHARACTERIZATION

2.1 SITE LOCATION AND DESCRIPTION

The WFF is located in Accomack County, Virginia, near the Atlantic Coast on the Delmarva Peninsula approximately 5 miles south of the Maryland-Virginia border and about 5 miles west of Chincoteague Island (see **Figure 2-1**). The WFF FUDS property consists of the Main Base and Wallops Island. The Boat Basin, Visitors Information Center MRS is located on the Main Base portion of the FUDS property. The Boat Basin, Visitors Information Center MRS encompasses approximately 1.53 acres of land that include the Pyrotechnics Burn Area, Gun Butt No. 1 and No. 2, and South Bank Boat Basin.

The U.S. Government acquired the property in Accomack County in fee in 1942 for use as a naval auxiliary air station. The airfield was commissioned March 5, 1943, and was originally known as Chincoteague Naval Auxiliary Air Station (CNAAS). The airfield was used primarily as a training facility for naval aviation units; however, it was also used for anti-submarine operations. On January 26, 1946, the Bureau of Ordnance established the Naval Aviation Ordnance Test Station (NAOTS) at CNAAS. The NAOTS provided a test range and training for personnel to test, modify, and develop guided missiles, aircraft weapons, and aviation fire control equipment. Naval use commenced in 1946 when NAOTS established a range and constructed support facilities for research and development and to test and evaluate aviation ordnance and related systems and equipment. Based on historical documentation obtained, no known chemical warfare material (CWM) activities were conducted on the WFF property. In June 1959, the U.S. Navy ceased training and flight operations. The CNAAS was declared excess and leased to the newly formed NASA. The Main Base was formally transferred to NASA on 1 December 1961. In 1981, the facility became part of the Goddard Space Flight Center and was renamed WFF.

Figure 2-1 Boat Basin, Visitors Information Center MRS

The Pyrotechnics Burn Area is an approximately 20-foot by 25-foot fenced area used by the Navy to dispose of parachute flares and practice bomb signals using either gasoline or trinitrotoluene. The fencing remains and the Pyrotechnics Burn Area is overgrown with vegetation. Gun Butt No. 1 was constructed in 1952 and used to test and perfect the use of medium caliber (20 millimeter (mm) to 37mm) aviation guns and ammunition. Gun Butt No. 2 was constructed in 1952 and, similar to Gun Butt No. 1, was used to test and perfect the use of medium caliber (20mm to 37mm) aviation guns and ammunition. The South Bank Boat Basin consists of a boat basin and the surrounding bank. Dredging of the Boat Basin and channel was completed on 26 April 1949 by the Navy in order to establish a boat dock and basin to transport rocket testing materials from the Wallops Main Base to the Wallops Island test facilities. The South Bank Boat Basin had no known munitions use; however, numerous munitions items have been observed in this area. The boat basin is still in use occasionally by NASA and the Marine Science Consortium.

Historical investigations at the Boat Basin/Visitors Center MRS include a UXO clearance conducted in January 2006 and an SI conducted in December 2011 by HFA. No confirmed MEC was observed during the SI field event. However, three munitions debris items and seven items that could not be discounted as containing energetic material were observed. Additionally, surface and subsurface soil, sediment, surface water, and groundwater samples were collected at the MRS. Iron was detected above the background concentrations in groundwater collected at Gun Butt No. 1 and No. 2. Antimony, copper, lead, and zinc were detected in surface soil and may present potentially unacceptable risks to ecological receptors. During field activities, samples were not collected within the Pyrotechnics Burn Area as a result of the high concentration of subsurface anomalies (i.e., an anomaly-free sample location could not be identified). Therefore, samples could not be collected from the location most likely to contain the highest MC concentrations.

2.2 SITE PHYSICAL CHARACTERIZATION

The WFF is characterized as primarily developed with wooded and dense brush areas. The terrain is relatively flat with a maximum elevation of 40 feet above mean sea level (msl). The site is located within the Atlantic Coastal Plain physiographic province. The Coastal Plain province is characterized by low relief and surface streams emptying to marshy inlets. The elevation of the Coastal Plain province is commonly less than 100 feet above msl.

The topography of the Boat Basin, Visitors Information Center MRS is generally low and flat with elevations ranging from zero to 5 feet above msl. The former target butts of Gun Butt No. 1 and No. 2 are no longer present, and these areas are currently developed with manicured grass and display rockets associated with the nearby Visitors Information Center. A shallow drainage swale separates the two former gun butt areas, and they are bordered by wetlands to the south and east. The South Bank Boat Basin and Pyrotechnics Burn Area are forested with deciduous or evergreen trees and also contain wetland vegetation (SI Report, 2012, HFA).

The surface and subsurface soils within the Boat Basin, Visitors Center MRS consist of Molena loamy sand (Gun Butt No. 1 and No. 2), Magotha fine sandy loam (Pyrotechnics Burn Area), and Udorthent and Udipsamment soils (Boat Basin) (SI Report, 2012, HFA). The Molena series is deep, rarely flooded, well-drained soils. The Magotha soil series is very deep, frequently flooded, poorly drained, and typically found in salt marshes ranging from 0 to 2 percent (%) slope. The Udorthent and Udipsamment soils are rarely flooded and well drained.

The groundwater at the Boat Basin, Visitors Center MRS generally flows to the southeast toward the nearby Mosquito Creek and wetland areas. The water table at the Main Base ranges from depths of zero to 30 feet below ground surface and is generally recharged by surface waters or infiltration of precipitation.

The total average annual rainfall for the area is 40.8 inches. The majority of precipitation usually occurs from April through September. Frequent steady storms, in the winter, fall, and spring, result in local flooding and severe shoreline erosion. During the summer months, warm sunny days with relatively high humidity prevail (average relative humidity 60%). The average summer temperature is approximately 74 degrees Fahrenheit (°F), with a maximum temperature reaching 101 °F. The average winter temperature is approximately 37 °F. The average seasonal snowfall

Field activities are anticipated to take approximately 4 months, beginning in the fall of 2013.

2.3 CONTAMINATION AND EXPOSURE POTENTIAL

WESTON will ensure compliance with the requirements of EM 385-1-1, OSHA (29 CFR 1910 and 1926), and WESTON policy requirements through formal and site-specific training programs, as well as routine inspections with follow-up compliance. Specific information pertaining to suspected physical, chemical, biological, and radiological hazards associated with the work areas, tasks, and operations is presented in the following subsections. As new data become available, the APP and/or SSHP may need to be modified.

2.3.1 Chemical Hazards

Based on site history and previous studies, the chemicals of concern at the project site include metals and explosives. The main routes of exposure for field personnel include inhalation, ingestion, skin or eye contact, and dermal absorption from soil. Because of the nature of the contaminants and the types of activities planned, it is expected that there is a low potential for exposure to site personnel. Results indicate that levels of chemicals of concern were slightly above the screening criteria. To protect personnel from hazards associated with site chemicals of concern, a Personal Protection Plan, which consists of the Activity Hazard Analyses (AHAs) in Section 12 of the Accident Prevention Plan (APP) and Sections 2, 3, 6, 7, 8, and 10.4, 10.6, 10.12, 11, 12, 13, and 15 of this SSHP will be implemented to control potential chemical exposures. Personal protection requirements, such as respiratory protection, to control chemical exposure for activities where a risk has been assessed are listed in each AHA.

Table 2-1 lists chemicals of concern with exposure limits, exposure routes, and symptoms associated with exposure. In accordance with EM 385-1-1, exposure limits used are the most stringent among the most recently published American Conference of Industrial Hygienists guideline, *Threshold Limit Values and Biological Exposure Indices*, published Army or DoD Occupational Exposure Limits (OEL), or exposure limits published by the Occupational Safety and Health Administration (OSHA). For the purposes of this scope of work, the OEL will be the most stringent of the aforementioned exposure limits.

All hazardous chemicals brought on-site by WESTON personnel or subcontractors will be managed in accordance with 29 Code of Federal Regulations (CFR) 1910.1200, WESTON's

Hazard Communication Program, and Section 01.B.04 of USACE EM 385-1-1. Employees will be informed of how the materials will be used on-site. A chemical inventory will be developed, including information on approximate quantities and storage locations for emergency response purposes. This inventory will be updated as necessary to ensure accuracy.

Table 2-1 Chemicals of Concern

Analytes of Concern and Methods	CAS Number	Project Screening Levels*			Exposure Limits	Characteristics	Routes of Exposure	Symptoms and Effects of Exposure
		Soil - HHR (mg/kg)	Soil - ER (mg/kg)	GW - HHR (µg/L)				
Project-Specific Targets								
Aluminum	7429-90-5	7700	pH < 5.5	50	REL: TWA 5 mg/m^3 IDLH: NA PEL: TWA 5 mg/m^3 TLV: TWA 1.0 mg/m^3 Ca	Silvery-white, malleable, ductile, odorless metal. MW: 27.0 VP: 0 mmHg FL P: NA BP: 4221°F IP: NA Sp Gr: 2.70	INH CON ABS	Eye, skin and respiratory irritant.
Antimony	7440-36-0	3.1	78	0.60	REL: TWA 0.5 mg/m^3 IDLH: 50 mg/m^3 PEL: TWA 0.5 mg/m^3 TLV: TWA 0.5 mg/m^3	Silver-white, lustrous, hard, brittle, solid; scale like crystals; or a dark gray, lustrous powder MW: 121.8 VP: 0 mmHg FL P: NA BP: 2975°F IP: NA Sp Gr: 6.69	INH ING CON ABS	Eye, skin, nose, throat, mouth irritant. Dizz; nausea, vomiting, stomach cramps, insom, diarr
Iron	7439-89-6	5500	--	1100	REL: TWA 0.5 mg/m^3 IDLH: 2,500 mg/m^3 PEL: TWA 10 mg/m^3 TLV: TWA 5 mg/m^3 Ca	Reddish-brown solid. MW: 159.7 VP: 0 mmHg FL P: NA BP: NA IP: NA Sp Gr: 5.24	INH CON ABS	Irrit eyes, skin, resp sys
Lead**	7439-92-1	270	56	15	REL: TWA 0.050 mg/m^3 IDLH: 100 mg/m^3 PEL: TWA 0.050 mg/m^3 TLV: TWA 0.050 mg/m^3	A heavy, ductile, soft, gray solid. MW: 207.2 VP: 0 mmHg FL P: NA BP: 3164°F IP: NA Sp Gr: 11.34	INH ING CON ABS	Lassitude (weakness, exhaustion), insomnia; facial pallor; anorexia, weight loss, malnutrition; constipation, abdominal pain, colic; anemia; gingival lead line; tremor; paralysis wrist, ankles; encephalopathy; kidney disease; irritation eyes; hypertension

Table 2-1 Chemicals of Concern (Continued)

Analytes of Concern and Methods	CAS Number	Project Screening Levels*			Exposure Limits	Characteristics	Routes of Exposure	Symptoms and Effects of Exposure
		Soil - HHR (mg/kg)	Soil - ER (mg/kg)	GW - HHR (µg/L)				
Project-Specific Targets								
Benzene**	71-43-2	1.1	--	0.39	REL: TWA 0.1 ppm IDLH: 500 ppm PEL: TWA 1 ppm TLV: TWA 0.5 ppm	Colorless to light-yellow liquid with an aromatic odor MW: 78.1 VP: 75 mmHg FL P: 12ºF BP: 176°F IP: 9.24 Sp Gr: 0.88	INH CON	Eye, nose, skin, and respiratory irritation; headache; nausea; dermatitis; fatigue; giddiness; staggered gait; bone marrow depression
Ethylbenzene**	100-41-4	5.4	--	1.3	REL: TWA 100 ppm IDLH: 800 ppm PEL: TWA 100 ppm TLV: TWA 20 ppm	Colorless liquid with an aromatic odor. MW: 106.2 VP: 7 mmHg FL P: 55ºF BP: 277°F IP: 8.76 Sp Gr: 0.87	INH CON	Irritation eyes, skin, mucous membrane; headache; dermatitis; narcosis, coma
Toluene**	108-88-3	5000	--	860	REL: TWA 100 ppm IDLH: 500 ppm PEL: TWA 200 ppm TLV: TWA 20 ppm	Colorless liquid with a sweet, pungent, benzene-like odor. MW: 92.1 VP: 21 mmHg FL P: 40ºF BP: 232°F IP: 8.82 Sp Gr: 0.87	INH CON	Eye and nose irritation, fatigue, weakness, confusion, dizziness, headache, dilated pupils, excessive tearing, nervousness, muscle fatigue, paresthesia, dermatitis, liver and kidney damage
Xylenes**	1330-20-7	630	--	190	REL: TWA 100 ppm IDLH: 900 ppm PEL: TWA 100 ppm TLV: TWA 100 ppm	Colorless liquid with an aromatic odor. MW: 106.2 VP: 9 mmHg FL P: 81-90ºF BP: 281°F IP: 8.44-8.56 Sp Gr: 0.86-0.88	INH CON	Irritated eyes, skin, nose, and throat; dizziness; excitement; drowsiness; incoherence; staggering gait; corneal vacuolization; anorexia; nausea; vomiting; abdominal pain; dermatitis

Notes:

* Residential and Industrial Screening Levels were obtained from Oak Ridge National Laboratory (ORNL) Regional Screening Levels (RSLs) for Chemical Contaminants at Superfund Sites Table (April 2012). The RSLs are shown at a target risk of 1.0E-6. The target hazard quotient has been adjusted to 0.1 for non-carcinogens to allow for potential additive toxicity of multiple contaminants.
** Potential COC in the Pyrotechnics Burn Area due to the use of gasoline as an accelerant for disposal of flares.
µg/L = micrograms per liter
ABS = absorption (dermal)
BP = boiling point
CAS = Chemical Abstracts Service
CON = Skin and/or eye contact

Table 2-1 Chemicals of Concern (Continued)

ER = Ecological Risk
Fl. P = flash point
GW-HHR = Groundwater Human Health Risk
HHR = Human Health Risk
IDLH = immediately dangerous to life or health
ING = ingestion
INH = inhalation
IP = ionization potential
mg/kg = milligrams per kilogram
mg/m^3 = milligrams per cubic meter
mmHg = millimeters of mercury
ppm = parts per million
MW = molecular weight
NA = not applicable
PEL = Occupational Safety and Health Administration, Permissible Exposure Limit for an 8-hour, time weighted average.
REL = National Institute for Occupational Safety and Health, Recommended Exposure Limit for a 10-hour, time weighted average.
Soil-ER = Soil Ecological Risk
Soil-HHR = Soil Human Health Risk
SpGr = specific gravity
TLV = American Conference of Governmental Industrial Hygienists, Threshold Limit Value for an 8-hour, time weighted average.
TWA = time-weighted average
VP = vapor pressure

Site personnel will comply with the storage, handling, and use requirements stated on the Material Safety Data Sheet (MSDS) for each chemical brought on-site by WESTON or its subcontractors. An inventory of all chemicals brought on-site and an MSDS for each will be maintained at the Boat Basin, Visitors Information Center MRS. Project subcontractors shall inform WESTON of any chemical materials brought on-site, and the location of their MSDSs. A Site-Specific Hazard Communication Plan is presented in **Attachment A**. Chemical products will be properly labeled, including contents, health, flammability, reactivity, PPE requirements, and any special instructions. If products are contained in secondary containers, they will have the appropriate hazardous material identification system labeling affixed.

2.3.2 Physical Hazards

For ground-based activities, exposure to physical hazards may include manual lifting; slips, trips, falls; heat/cold stress; hand tools (manual and power); terrain or vegetation; uneven walking surfaces; weather hazards, such as snow and ice; poor visibility, and working with earth moving and brush clearing equipment. Additional physical hazards common while performing brush removal activities include hands or fingers caught between objects; electric hazards; caught in/between/struck by or against an object; and traffic. Security will be of the utmost priority during all RI activities.

For water-based activities, physical hazards may include those identified for ground-based activities as well as the following additional hazards: falling overboard, drowning, and physical water conditions (e.g., waves, tides).

2.3.3 Munitions and Explosives of Concern Hazards

Every effort will be made to identify a suspect MEC item. The MEC item will be visually examined for markings and other external features such as shape, size, and external fittings. If an unknown UXO item is encountered, the USACE representative will be notified immediately. Under no circumstances will any fused MEC be moved in an attempt to make a definitive identification.

As a general rule, all fused UXO will be detonated in the original position found (BIP). This is the safest method to effect final disposition of munitions. Any item to be BIP will be sandbagged to mitigate blast effects and fragmentation projection. When necessary, recovered MEC may be transported by qualified personnel to a common detonation area within the Boat Basin, Visitors Information Center MRS.

Only UXO-qualified personnel will handle MEC items and only during daylight hours. Personnel who will be handling MEC items will not wear outer or inner garments such as nylon having static-electricity-generating characteristics.

All WESTON and subcontractor personnel engaged in field operations will be thoroughly trained and capable of recognizing the specific hazards associated with MEC items. All field personnel will be under the direct supervision of a UXO Technician III or higher.

General UXO safety guidelines are listed below:

- Consider projectiles containing base-detonating fuses to be armed if the round is fired.
- Secure arming wires and pop out pins on unarmed fuses prior to moving UXO items.
- Do not depress plungers; turn vanes; or rotate spindles, levers, setting rings, or other external fittings on UXO items.
- Do not attempt to remove or dismantle any components of UXO items.
- UXO personnel are not authorized to render inert any UXO items found on-site.
- UXO items will not be taken from the Boat Basin, Visitors Information Center MRS.
- Consider UXO items, which may have been exposed to fire and detonation, as extremely hazardous.
- Do not rely on the color-coding of UXO items for definitive identification.
- Assume that a practice UXO item contains a live charge until investigation proves otherwise.
- Do not approach a smoking munition.

2.3.4 Biological Hazards

Biological hazards include both terrestrial and marine wild animals (raccoons, foxes, snakes, rats, mice, and bats), insect bites and stings (ticks, bees, mosquitoes), and poisonous plants (poison ivy). Site personnel will be instructed to be alert for and avoid wild animals, to wear appropriate PPE/work attire, and to use insect repellent as well as poison-ivy block and cleanser. Any site worker who is knowingly allergic to insect bites will be required to inform the SSHO or UXOSO and to carry an allergy response kit. First Aid providers will also be required to know how to use the response kit.

2.3.5 Radiation

Based on the review of existing information, exposure to pre-existing sources of ionizing radiation is not expected to be encountered.

2.3.5.1 Non-Ionizing Radiation

This project will be conducted over the fall and/or winter months. The most likely exposure to non-ionizing radiation is the sun. Personnel will receive instruction in using appropriate PPE and/or procedures to follow in the event that non-ionizing radiation creates a concern and requires the use of sunscreen and hats.

3. HAZARD AND RISK ASSESSMENT

3.1 ACTIVITY HAZARD ANALYSIS

Hazard analysis tables provide a task-specific evaluation of the known or potential hazards associated with performing individual work phases associated with this project. Each analysis also contains task-specific information related to hazard control and mitigation, including the use of specific engineering control measures, specific standard operating procedures to be implemented, and PPE to be used as required. AHAs are presented in Section 12 of the APP for each phase/activity associated with the project. Health and safety equipment such as PPE is described in Section 6 of this plan.

If site conditions or tasks change, the SSHO or UXOSO will evaluate the new conditions or task and will contact the Federal Team Health and Safety Officer for assistance in developing amendments to the SSHP. Amendments made to the SSHP will be submitted to USACE for concurrence, and all field personnel will be made aware of any changes.

4. STAFF ORGANIZATION, QUALIFICATIONS, AND RESPONSIBILITIES

WESTON is ultimately responsible for the implementation of the health and safety program, APP, and SSHP. Personnel having the potential for exposure to site hazards are subject to the requirements of this SSHP. Work shall not be performed in a manner that conflicts with the health, safety, or environmental precautions outlined in the APP or this SSHP. Personnel violating safety procedures are subject to dismissal from the project site.

Roles and responsibilities for key project safety personnel are detailed in Section 4 of the APP. Copies of resumes and certifications are presented in **Attachment 3** of the APP.

4.1 ROLES AND RESPONSIBILITIES FOR KEY PERSONNEL

Descriptions are presented below for key project personnel responsible for the EHS Program implementation. Resumes for these key WESTON safety personnel are included in APP **Attachment 3**. The UXO Technicians will meet the personnel qualification requirements of the Department of Defense Explosives Safety Board (DDESB) Technical Paper 18. The key project personnel and lines of authority are shown on the organization chart (see **Figure 4-1**).

4.2 PROJECT MANAGER

Mr. Tony Pace is the Project Manager for the activities covered under this delivery order (DO). He has overall responsibility for the management and completion of the project, which includes resource allocation, financial reporting, schedule control, and review and approval of deliverables.

The Project Manager is accountable for project safety and has overall responsibility for ensuring that project personnel (including subcontractor personnel) comply with EHS regulations, program requirements, and procedures.

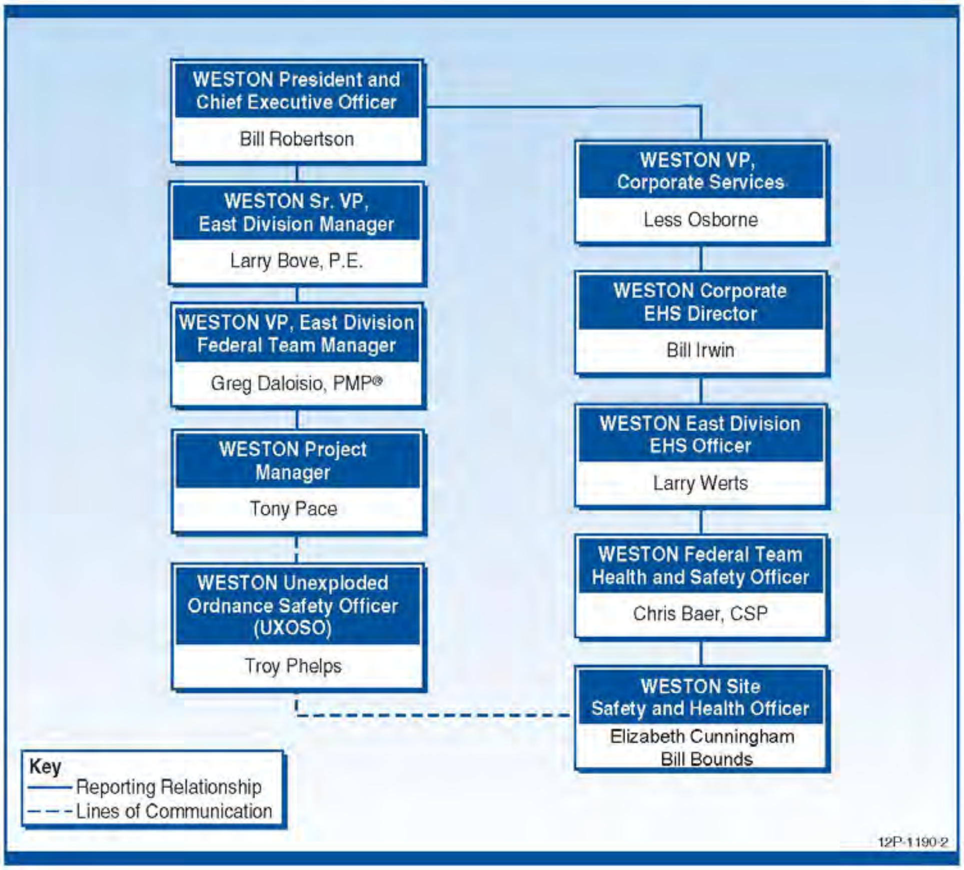

Figure 4-1 Health and Safety Organization Chart and Lines of Authority

4.3 SAFETY AND HEALTH MANAGEMENT

4.3.1 Federal Team Health and Safety Officer

The Federal Team Health and Safety Officer for this project is Mr. Christopher Baer, Certified Safety Professional (CSP). He has more than 11 years of industrial hygiene and safety experience. Mr. Baer is responsible for the following actions:

- Ensure the implementation of the WESTON Corporate EHS Program.
- Review and provide concurrence on the APP, SSHP, and any amendments.
- Conduct field audits to assess the effectiveness and implementation of the APP and SSHP at the request of the primary auditing entity (Division EHS Officer), the Project Manager, or USACE.
- Evaluate and authorize changes to the APP and SSHP based on field and occupational exposure as necessary.
- Function as a QC staff member.

4.3.2 Division Environmental Health and Safety Officer

The WESTON East Division EHS Officer is Mr. Larry Werts. Mr. Werts is responsible for the following actions:

- Oversee and maintain the WESTON Corporate EHS Program, the APP, and SSHP.
- Visit, or assign designee (Federal Team Health and Safety Officer) to visit, the Boat Basin, Visitors Information Center MRS as needed to audit the effectiveness of the APP and SSHP.
- Evaluate and authorize changes to the APP and SSHP based on field, occupational exposure, and air monitoring data as necessary.
- Serve as a technical advisor.

4.3.3 Site Safety and Health Officer

The SSHO for this first phase of this project (non-intrusive investigation activities) project is Mrs. Elizabeth Cunningham. Ms. Cunningham will be the SSHO during geophysical investigation activities (surveying and EM61). Mr. Bill Bounds will be the SSHO during the second phase of this project (intrusive activities) which includes, MC and associated soil sampling activities, and expanded RI (well installation, development, and sampling) activities. The SSHO is responsible for implementing the APP and SSHP by ensuring that all project DGM and drilling contractor personnel follow the requirements of the APP and SSHP.

Ms. Cunningham and Mr. Bounds are approved by the Division EHS Officer and qualify as a competent person as stated in OSHA 29 CFR 1926.32. As required by EM 385-1-1, Mr. Hikel Bounds has at least 5 years of applicable safety experience for intrusive activities and has successfully completed the OSHA 30-hour construction safety course. Ms. Cunningham and Mr. Hikel Bounds has have performed work on sites of similar hazard, risk, and complexity to the task assignment. Ms. Cunningham and Mr. Bounds are certified in first aid and cardiopulmonary resuscitation (CPR).

The SSHO is responsible for conducting morning safety meetings for all site personnel to discuss the day's activities, associated hazards, and site safety. The SSHO is also required to report any incidents that occur on-site to the Project Manager, Program Manager, and Federal Team Health and Safety Officer. The SSHO is required to implement safety corrective actions through training and reinforced awareness.

4.3.4 Unexploded Ordnance Safety Officer—Unexploded Ordnance Quality Control Specialist

The UXOSO - Unexploded Ordnance Quality Control Specialist (UXOQCS) for this project is Mr. Troy Phelps. Mr. Phelps is a graduate of the U.S. Navy Explosive Ordnance Disposal (EOD) School, is UXO-certified, and meets training requirements, including 40 hours (with 8-hour annual refresher) of OSHA hazardous waste site training, 30 hours of OSHA construction training, and 8 hours of supervisory training. He has 14 years of experience in the UXO/EOD field conducting MEC disposal activities in accordance with safety regulations and over 8 years performing supervisory and management responsibilities. Mr. Phelps is responsible for implementing the site health and safety program by ensuring that all project personnel follow the requirements of the APP and SSHP. He reports to the Federal Team Health and Safety Officer, Project Manager, and SUXOS. In addition to overall site safety, he is also responsible for enforcing safety applicable to all MEC operations, including the following:

- Conduct daily safety meetings for all site personnel to discuss the day's activities, associated hazards, and explosives safety.
- Be present during MEC operations to implement the APP.
- Coordinate changes/modifications to the APP with the appropriate site personnel and Contracting Officer (KO).
- Conduct or coordinate project-specific training.
- Review site personnel training and experience records to ensure compliance with the APP and SSHP and DDESB Technical Paper 18.
- Report any incidents that occur on-site to the SUXOS, Project Manager, Federal Team Health and Safety Officer, East Division EHS Officer, and the Corporate EHS Director.
- Implement safety corrective actions through training and reinforced awareness.
- Maintain exposure data.
- Have stop-work authority for all safety issues.

4.3.5 Senior Unexploded Ordnance Supervisor - Site Manager

Brian Grassmyer, the SUXOS – Site Manager, is the senior subject matter expert in the field during the execution of this RI. Mr. Grassmyer is a graduate of the U.S. Navy EOD Basic School. He has over 22 years of professional experience as an EOD and UXO specialist. He has extensive knowledge of all Technician (I, II, and III) duties and requirements in accordance with all state and federal regulations. He also has current training in accordance with OSHA hazardous waste sites (40 hours with annual 8-hour refresher), OSHA construction safety (30 hours), and 8 hours of supervisory training. The SUXOS responsibilities include the following:

- Plan, coordinate, and supervise on-site MEC-related activities.
- Implement procedures and guidance for MEC operations (ensure compliance with DoD directives and federal, state, and local statutes and codes).
- Certify material potentially presenting an explosive hazard (MPPEH) and/or range scrap as ready for turn-in or disposal.

- Maintain field records for the project.
- Supervise multiple project teams during the RI that are performing MEC and MEC-related activities, such as:
  - Provide UXO escort for vegetation clearance, land surveying, and anomaly avoidance.
  - Conduct aerial and underwater operations (ground-based oversight).
  - Perform demolition activities.
  - Transport explosive material.

The SUXOS reports directly to the WESTON Project Manager and will have an open line of communication with the UXOSO - UXOQCS.

4.4 DIVE SUPERVISOR

Mark Maguire of VRHabilis, LLC, will be the Dive Supervisor and subject matter expert regarding underwater operations in the field during the execution of this RI. Training and qualifications for the Dive Supervisor are provided in **Appendix G** of the RI Work Plan. At a minimum, the Diver Supervisor responsibilities include the following:

- Provide supervision of Dive Plan implementation for underwater operations.
- Exercise stop-work authority.
- Implement the project APP and SSHP and recommend changes to the Project Manager as needed.
- Assist SUXOS - Site Manager as needed during execution of underwater operations.
- Assist SSHO or UXOSO as needed to communicate safety-related issues to USACE, and to conduct morning safety briefings and site-specific training, related to diving activities.
- Document and investigate all incidents and/or deviations from planned activities.
- Identify potential safety-related issues, and develop and implement corrective actions in a timely manner.
- Provide updates to SUXOS - Site Manager of anomaly recovery status so that USACE can be adequately informed of progress.
- Provide subcontractor supervision including, but not limited to the following:
  - Monitor performance of RI activities and conformance with the Boat Basin, Visitors Information Center MRS APP, SSHP, and Dive Plan.

- Inspect work practices and PPE.
- Provide review and maintenance of training records of VRHabilis, LLC, staff to verify status and qualifications of personnel.
- Review field document for underwater operations (e.g., dive logs).
- Make recommendations of PPE level changes as appropriate based on site conditions/hazards.
- Conduct random safety audits (as needed).
- Provide weekly safety-related updates to the SUXOS - Site Manager.
- Make recommendations to the SUXOS - Site Manager and Project Manager regarding VRHabilis, LLC, work practices or personnel (as needed) during diving activities to ensure safety and compliance with the project APP, SSHP, and Dive Plan.

4.5 COMPETENT PERSON

OSHA Regulation 29 CFR 1926.32, defines a Competent Person. Specific OSHA and USACE regulations identify the need for involvement of competent persons. Competent person requirements and regulatory references are presented in **Table 4-1**. Mr. Phelps, the UXOSO, and Mr. Hikel, the SSHO, meet the Competent Person requirements applicable to this scope of work and have been approved by WESTON's Corporate EHS Management. **No work shall be performed without a Competent Person on-site.**

Table 4-1 Competent Person Requirements

Competent Person Requirement	Regulatory Reference	Person Designated
SSHO Identification UXOSO Identification	EM 385-1-1 Sec. 01.A.17	Ms. Cunningham, Mr. Bounds, or Troy Phelps
Excavation and Trenching	EM 385-1-1 Sec. 25.A.02 29 CFR 1926.651	Troy Phelps or Mr. Bounds
Machinery or Mechanized Equipment Operators	EM 385-1-1 Sec. 18.G.02 & 04 29 CFR 1926.601(b)(14)	Ms. Cunningham, Mr. Bounds, or Troy Phelps
General Inspections of Construction Sites	EM 385-1-1 Sec. 01.A.12 29 CFR 1926.20	Ms. Cunningham, Mr. Bounds, or Troy Phelps
Unsanitary Conditions	EM 385-1-1 Sec. 02 29 CFR 1926.27	Ms. Cunningham, Mr. Bounds, or Troy Phelps
Hearing Protection	EM 385-1-1 Sec. 05.C 29 CFR 1926.101	Ms. Cunningham, Mr. Bounds, or Troy Phelps

Notes:
EM 385-1-1 is U.S. Army Corps of Engineers Health and Safety Requirements Manual; 29 CFR 1926 is Code of Federal Regulations, Occupational Safety and Health Administration, Safety and Health Regulations for Construction.

Both SSHO (and UXOSO) personnel identified to support Phase II RI activities are designated as Competent Person(s) as stated in OSHA 29 CFR 1926.32. As required by EM 385-1-1, Mr. Bounds and Mr. Phelps have at least 5 years of applicable safety experience and have successfully completed the OSHA 30-hour construction safety course. The SSHO and UXOSO personnel assigned to this project have performed work on a site(s) of similar hazard, risk, and complexity to the task assignment, and are certified in First Aid and CPR.

Records of the qualifications of site personnel will be maintained on-site. The certifications and overall qualifications of WESTON personnel are maintained in a database supported by WESTON. Copies of the certifications and resumes listing the qualifications of WESTON personnel are provided in **Attachment 3** of the APP.

4.6 QUALIFIED PERSON

Site personnel will also include a Qualified Person. WESTON will permit only those employees qualified by training or experience to operate equipment and machinery in compliance with OSHA 29 CFR 1926.20(b)(4). According to OSHA 29 CFR 1926.32, “qualified” means one who, by possession of a recognized degree, certificate, or professional standing, or who by extensive knowledge, training, and experience, has successfully demonstrated the ability to solve or resolve problems relating to the subject matter, the work, or the project. **Table 4-2** lists a Qualified Person’s requirements.

Records of the qualifications of site personnel will be maintained on-site. The records of the certifications and overall qualifications of WESTON personnel are maintained in a database supported by WESTON. Records will be maintained and reviewed by the SSHO or UXOSO.

Table 4-2 Qualified Person Requirement

Qualified Person/Organization	Project Applicability	Training Requirement
UXO Technicians (I, II, & III)/WESTON	All ground-based and/or intrusive activities	Meet DDESB Technical Paper 18
Boating Operator and Crew - Subcontractor	Water–based geophysical survey activities	Valid USCG licenses for operator and crew
Divers/Subcontractor	Underwater operations and intrusive activities	Meet OSHA Diving Standards and certified in accordance with U.S. Naval regulations (see **Appendix G** of the RI Work Plan)
Blaster/WESTON and/or Dive Subcontractor	Detonations	Certification from Bureau of Alcohol, Tobacco, Firearms, and Explosives and/or Virginia State Blaster's License
Drilling and other Mechanized Equipment Operators	MC sampling and Expanded RI activities	Meet USACE EM 385-1-1, Sec. 18.G.06 and H.02 and OSHA 29 CFR 1926.20(b)(4)

Notes:
Weston Solutions, Inc. (WESTON®)/subcontractor blasting and equipment operating personnel have not yet been identified. Qualifications and training records will be included in subsequent Accident Prevention Plan (APP) addendums.
CFR = Code of Federal Regulations
DDESB = Department of Defense Explosive Safety Board
EM = Engineering Manual
MC = Munitions Constituents
OSHA = Occupational Safety and Health Administration
RI = Remedial Investigation
USACE = U.S. Army Corps of Engineers
USCG = U.S. Coast Guard
UXO = unexploded ordnance

4.7 WESTON SUBCONTRACTORS

Table 4-3 presents a list of subcontractors who will be engaged in RI activities at the Boat Basin, Visitors Information Center MRS.

Table 4-3 List of Subcontractors

Subcontractor	Activity
VRHabilis, LLC	▪ Conduct underwater operations
Aqua Survey, Inc.	▪ Conduct water-based geophysical surveys
Explosive supplier – To be determined	▪ Supply explosives
CompuChem	▪ Perform primary off-site analytical laboratory services
Meridian Consultant Group	▪ Provide data validation services
Baldwin & Gregg, LTD.	▪ Conduct surveys of anomaly boundaries, individual anomaly locations, and trench locations
Tidewater, Inc.	▪ Provide drilling services
IMS	▪ Provide waste disposal services

4.7.1 Control and Coordination of Subcontractors and Suppliers

WESTON is ultimately responsible for ensuring subcontractor compliance with the health and safety requirements as outlined in the APP and SSHP for the Boat Basin, Visitors Information Center MRS. Non-compliance with the APP and SSHP will result in a stop work order, as determined by the SSHO or UXOSO. The subcontractor conducting underwater activities will additionally be held responsible for compliance with the APP and SSHP and with the approved Dive Plan (**Appendix G** of the RI Work Plan).

4.7.2 Safety Responsibilities of Subcontractors and Suppliers

The Site Safety Representative will interact with the SSHO or UXOSO to ensure compliance with the APP and SSHP. Subcontractor employees are expected to comply with the APP and SSHP, USACE EM 385-1-1, and other applicable regulations governing their safety while on the project. In the event of a conflict, the more stringent requirements will apply.

The Site Safety Representative will perform the following activities:

- Attend health and safety briefings.
- Address worker issues and immediately stop work if unsafe acts/conditions exist or if uncertainty exists regarding how a task is to be performed.
- Coordinate corrective action with the SSHO or UXOSO prior to resuming operations.
- Participate in any incident investigations.
- Inspect operations and work areas daily in conjunction with the SSHO or UXOSO.
- Ensure subcontractor workers have the proper PPE.
- Control all hazardous material brought on-site.

4.7.3 Subcontractor Safety Plans

WESTON subcontractors are covered by the APP and SSHP and will be required to sign the Plan Acknowledgement Form (see **Attachment 1** of the APP) indicating that they have read and have understood both the APP and the SSHP, and agree to follow the requirements in these documents. Additionally, specialty service subcontractors, including Aqua Survey, Inc. (water-based geophysical activities) and VRHabilis, LLC (underwater operations), are required to submit for WESTON approval a Health and Safety Plan that includes a site-specific task description of hazards, control measures, and an AHA table for specific services required under this DO. VRHabilis, LLC, has prepared a Dive Plan in accordance with EM 385-1-1 requirements to present the accident prevention and health and safety procedures that will be employed during underwater operations. The Dive Plan is provided as **Appendix G** to the RI Work Plan and will be reviewed by the USACE Dive Board.

WESTON will obtain and verify the subcontractor personnel training records prior to work commencing.

4.8 PERSONNEL ASSIGNED TO THE PROJECT

All WESTON and subcontractor personnel who will be involved in on-site activities are responsible for the following:

- Taking all reasonable precautions to prevent injury to themselves and to their fellow employees, and being alert to potentially harmful situations.
- Performing only those tasks that they believe they can do safely and have been trained to do.
- Notifying the SSHO or UXOSO of any special medical conditions (i.e., allergies, contact lenses, diabetes).
- Notifying the SSHO or UXOSO of any prescription and/or nonprescription medication, that the worker may be taking, that might cause drowsiness, anxiety, or other unfavorable side effects.
- Preventing spillage and splashing of materials to the greatest extent possible.
- Practicing good housekeeping by keeping the work area neat, clean, and orderly.
- Immediately reporting all injuries to the SSHO or UXOSO.
- Complying with the SSHP and all safety and health recommendations and precautions, and properly using PPE as determined by the SSHP and/or the SSHO or UXOSO.

5. TRAINING

5.1 GENERAL

All personnel assigned to or regularly entering the Boat Basin, Visitors Information Center MRS will have received the required training to perform job functions safely and with proper authorizations as defined in Subsection 6.3 of the APP. A record of this training is maintained in the WESTON Corporate EHS database. Training certificates for key WESTON safety personnel are included in **Attachment 3** of the APP. If training is not current, employees will not be allowed to work or supervise at the Boat Basin, Visitors Information Center MRS until they have successfully completed training requirements.

A daily discussion will be conducted to review activities associated with daily tasks. All field personnel will participate in these documented discussions.

5.2 SAFETY INDOCTRINATION

When hired, WESTON staff complete EHS training appropriate to their roles and responsibilities. All personnel receive training on WESTON's EHS policy, including environmental aspects, emergency action plans, security plans, ergonomics, incident reporting, Behavior-Based Safety, and site-specific training. Personnel are given a minimum of 3 days of field experience under the direction of a trained, experienced supervisor, in addition to the 40 hours of instructional training. Training topics will include the following:

- Accident prevention.
- Accident reporting (how and to whom).
- Anomaly investigation protocol.
- Boating operations associated with water-based geophysical surveys.
- Underwater operations (Dive Plan, **Appendix G** of the RI Work Plan).
- Medical facilities for emergency treatment and/or assistance.
- Evacuation routes.

- Emergency contact information.
- Reporting and correcting unsafe conditions.
- Job hazards and/or hazard control.
- Site-specific biological, physical, chemical, and/or ionizing/non-ionizing radiation hazards as listed in the AHAs.
- Company safety policies.
- Site briefings conducted prior to being granted access to the Boat Basin, Visitors Information Center MRS.
- Site layout.
- Hazard control.
- Emergency response and notification.
- Hearing conservation.
- PPE.
- Buddy system.
- Spills.
- Fires.
- Hazard communication.
- Visitor access.
- Public communication guidelines.
- Any specific training required by regulations.

5.3 MANDATORY TRAINING AND CERTIFICATIONS

Table 5-1 Current Key Site Personnel Training/Certifications

Personnel	UXO Training	Medical Clearance (expires)	40-Hour HAZWOPER	8-Hour HAZWOPER Refresher (expires)	30-Hour OSHA Construction Safety	First Aid (expires)	CPR (expires)	BBP (expires)	8-Hour Site Safety Supervisor
Elizabeth Cunningham (SSHO – Geophysical Survey)	NA	07/10/2014	09/19/2008	01/03/2014	04/10/2009	10/02/2014	10/02/2014	01/03/2014	04/02/2009
Bill Bounds(SSHO – Intrusive Investigation)	NA	5/16/2015	5/18/2001	5/13/2014	11/16/2012	7/20/2014	7/20/2014	5/13/2014	3/14/2013
Troy Phelps (UXOSO/UXOQCS)	07/01/1997	09/25/2014	10/24/1997	10/31/2013	04/10/2009	11/01/2014	11/01/2014	10/31/2013	04/02/2009
Brian Grassmyer (SUXOS)	12/18/1987	03/28/2014	06/11/2009	10/26/2013	05/18/2010	07/16/2014	07/16/2014	NA	08/10/2009
Katie Morrison (Geophysicist)	NA	05/11/2014	01/04/2012	3/11/2014	NA	04/06/2015	04/06/2015	03/11/2014	04/05/2013
Brian Guthrie (Geophysicist)	NA	01/08/2015	06/23/2000	03/05/2014	09/19/2008	03/27/2015	03/27/2015	--	01/24/2001
UXO Technician I – TBD	TBD	TBD	TBD	TBD	TBD	NA	NA	NA	NA
Casey Faust UXO Technician II	5/9/2003	5/31/2015	5/30/2011	12/16/2013	NA	NA	NA	NA	NA
UXO Technician III – TBD	TBD	TBD	TBD	TBD	TBD	NA	NA	NA	NA

Notes:

UXO = unexploded ordnance
SUXOS = Senior UXO Supervisor
UXOSO = UXO Safety Officer
UXOQCS = UXO Quality Control Specialist
SSHO = Site Safety and Health Officer
TBD = To Be Determined
HAZWOPER = Hazardous Waste Operations and Emergency Response
CPR = cardiopulmonary resuscitation
BBP = bloodborne pathogens
OSHA = Occupational Safety and Health Administration
NA = not applicable

All certificates requiring renewal prior to scheduled mobilization date will be obtained, provided to U.S. Army Corps of Engineers, and filed on-site. Personnel will not be authorized to conduct Remedial Investigation activities without providing documentation for medical clearances, training, and/or applicable licenses, as required.

5.3.1 Occupational Safety and Health Administration Hazardous Waste Operations and Emergency Response Training

All general site workers are required to have completed the initial OSHA 40-hour Hazardous Waste Operations and Emergency Response (HAZWOPER) training course and will have had 3 days of field experience under the direct supervision of a trained, experienced supervisor. On-site management personnel (SUXOS and/or SSHO or UXOSO) will have had an additional 8 hours of specialized supervisory training. Where applicable, workers will have also received the mandatory 8-hour refresher training within the past 12 months. All training, including project-specific training, is documented and will be maintained by the SSHO or UXOSO.

5.3.2 Occupational Safety and Health Administration 30-Hour Construction Training

In compliance with USACE Health and Safety Requirements Manual (EM 385-1-1), 15 September 2008, all SSHOs or UXOSOs, at a minimum, will have completed the 30-hour OSHA construction safety class or equivalent training, and will complete a minimum of 24 hours of formal safety coursework every 4 years. Training for the OSHA 30-Hour Construction Safety course or equivalent course will include the areas listed below:

- Occupational Safety and Health (OSH) Act/General Duties Clauses.
- 29 CFR 1904, Recordkeeping.
- Subpart C: General Safety and Health Provisions, Competent Person.
- Subpart D: Occupational Health and Environmental Controls.
- Subpart E: PPE, types and requirements for use.
- Subpart F: Understanding fire protection in the workplace.
- Subpart K: Electrical.
- Subpart M: Fall Protection.
- Rigging, welding, and cutting, scaffolding, excavations, concrete and masonry, demolition; health hazards in construction, materials handling, storage and disposal, hand and power tools, motor vehicles, mechanized equipment, marine operations, steel erection, stairways and ladders, confined spaces, or any others that are applicable to the work being performed.

5.3.3 First Aid and Cardiopulmonary Resuscitation Training

At least two employees or subcontractors at the site will be currently certified in First Aid and CPR. The training shall be equivalent to that provided by the American Red Cross.

5.3.4 Biological Hazard Training

Prior to the start of work, the SSHO or UXOSO will inform site personnel of site-specific blood borne pathogen information, including parasitic, viral, and environmental diseases endemic to the Boat Basin, Visitors Information Center MRS work location. WESTON has identified the following endemic zoonotic diseases for the eastern shore area, and they may be of concern at the Boat Basin, Visitors Information Center MRS work location:

- Lyme, Rocky Mountain Spotted Fever, and Ehrlichiosis tick-borne illnesses may occur in this area.
- Rabies is endemic in wildlife (raccoons, fox, skunks, and occasionally unvaccinated cats or dogs).
- Residents are also exposed to arboviral infections, including West Nile Virus and Eastern Equine Encephalitis.
- Other illnesses may include Vibriosis (water-related exposures), Tetanus (exposure to bacteria-contaminated soil or manure), and Tularemia (normally associated with wild rabbits). Gastrointestinal illnesses associated with Salmonella and Campylobacter exposures increase during the summer/fall months for various reasons such as exposure to animal feces, lack of hand washing, or undercooked or cross-contaminated foods.

5.3.5 Blood Borne Pathogen Training

The SSHO or UXOSO will provide information to site personnel regarding the zoonotic diseases identified above and other potential bloodborne pathogens, including Hepatitis B, Hepatitis C, and HIV/AIDS. The following topics will be discussed with site personnel to address site-specific bloodborne pathogen concerns

- Modes of disease transmission.
- Specific health risks associated with the disease.
- Preventive measures such as available vaccines and PPE (gloves, eye and skin protection, respirator).

- Appropriate work practices to prevent contact with infected agents (e.g., bird/rodent droppings), such as watering areas prior to dust-generating activities.
- Vaccine information, to include information on the effectiveness, risk, and availability.
- Safe removal of source where applicable.
- Symptom recognition and medical referral.
- Post-exposure procedures.
- Procedure labeling and color-coding of infectious waste.

5.4 PERIODIC SAFETY AND HEALTH TRAINING

The SSHO or UXOSO will present daily site safety briefings (i.e., tailgate meetings) to on-site personnel prior to the start of the work shift. The purpose of the briefings is to assist personnel in safely conducting the scheduled work activities. The briefings will include the following topics:

- Tasks to be performed, work method, and general description of job scope.
- Work location.
- Equipment usage.
- Control of hazards.
- Weather conditions.
- Emergency response review.

The briefings provide an opportunity for individuals to share observed safety deficiencies and recognitions. Attendance at these daily safety briefings is mandatory and will be documented by the SSHO or UXOSO.

In addition to the daily site safety briefing, a formal safety meeting will be conducted at least monthly for all SSHO or UXOSO within their respective divisions. A safety manager or designee will be invited to lead this monthly meeting.

5.5 EMERGENCY RESPONSE TRAINING

WESTON provides training by the American Red Cross or equivalent organization in both Standard First Aid and Adult CPR for all the field staff. At least two WESTON personnel with such training and also trained in the use of fire extinguishers will be on-site to provide emergency response. In the event specialized and/or elevated care is necessary, either WESTON or the local Emergency Medical Technician (EMT) and/or ambulance service will transport the injured person to the appropriate medical facility.

Outside assistance will be requested as detailed in the Emergency Response Plans included in the SSHP (see Section 15).

All WESTON personnel involved with responding to an on-site emergency will be briefed in their roles and responsibilities as part of the initial indoctrination training discussed above. During this training, personnel will be briefed on the Hazard Communication (HAZCOM) Program, emergency equipment, and First Aid procedures, as described in the SSHP. Personnel will also be briefed on emergency response and contingency procedures presented in Section 10 of the SSHP, which include the following topics:

- Procedures and tests.
- Spill prevention.
- Firefighting.
- Posting of emergency telephone numbers.
- Medical support.

This training will be documented and will also involve a drill of the emergency response procedures prior to the start of RI activities. During this training, the route to and location of the evacuation point and the location of medical support will be discussed with each staff member.

5.6 HAZARD COMMUNICATION

Personnel will be briefed on the HAZCOM Program. This discussion will include the following topics:

- Potential safety/health effects of exposure to chemicals used (e.g., gasoline and/or diesel fuel).
- Procedures for labeling containers.
- Current inventory of hazardous chemicals.
- Location and/or use of MSDS.
- Procedures to inform employee when new chemical is brought on-site.
- Current quantities of hazardous chemicals.

- Location of chemical on-site.
- Explosive hazards procedures.

Personnel are trained initially and periodically when the use of hazardous or toxic agents is altered or modified to accommodate changing on-site work procedures. Training shall cover the following topics:

- Requirements and use of the HAZCOM program on the project.
- The location of hazardous or toxic agents at the project location.
- Identification and recognition of hazardous or toxic agents on the project.
- Physical and health hazards of the hazardous or toxic agents associated with project activities.
- Protective measures that employees can implement when working with project-specific hazardous or toxic agents.
- Training specific to other sections of EM 385-1-1 or OSHA standards in 29 CFR 1910 and 29 CFR 1926 that are applicable to site operations.

5.7 PROJECT-SPECIFIC TRAINING

Project-specific training will cover each element in the SSHP, including the items listed in the following subsections:

- Site-Specific Chemical and Physical Hazards.
- Hearing Conservation.
- Buddy System.
- Visitor Access.
- PPE.

5.7.1 Chemical and Physical Hazards

Site-specific health and safety training will be conducted prior to field activities at the Boat Basin, Visitors Information Center MRS. In particular, the training will stress emergency response procedures and will cover the chemical and physical hazards of the site and site operations.

The SSHO or UXOSO will be required to document that personnel have read and thoroughly understand the information contained in the AHAs.

5.7.2 Hearing Conservation Training

All site personnel exposed to noise levels exceeding 85 A-weighted decibels (dBA) over an 8-hour time-weighted average will be provided with training, which addresses the following topics:

- Physical and psychological effects of high noise exposure.
- Noise exposure limits.
- Elements of the Hearing Conservation Program.
- Selection, use, and limitations of hearing protection devices.

Sources of noise potentially above 85 dBA at the Boat Basin, Visitors Information Center MRS include chainsaw operations, excavator or heavy machinery operation, generator operation, and MEC demolition activities. Noise hazards and appropriate controls (i.e., hearing protection) are addressed in the AHAs in Section 12 of the APP.

5.7.3 Buddy System Training

All work will be performed using the buddy system. Team members will keep in visual contact with each other at all times. Team members will be made aware of any slip, trip, and lifting hazards along with heat or cold stress and general hazards within their work area.

5.7.4 Visitor Training

Visitors will receive site-specific training to ensure that potential hazards and risks are identified. This training will consist of a safety briefing by the SSHO or UXOSO that will include the following:

- Location and description of potential hazards and risks.
- Required PPE.
- Areas of the Boat Basin, Visitors Information Center MRS that are closed to visitors.
- The site evacuation plan and emergency procedures.
- Other topics as deemed appropriate.

6. PERSONAL PROTECTIVE EQUIPMENT

The PPE to be used for this work is described below. Personnel performing operations on-site shall be required to use the appropriate level of protection. The minimum level of protection required to begin each activity of this project is shown in **Table 6-1**.

Table 6-1 Minimum Level of Protection Requirements

Activity	PPE Level
Activity 1: Mobilization and Demobilization	Level D
Activity 2: Vegetative Clearing	Level D/Modified Level D
Activity 3: Ground-Based Reconnaissance and Geophysical Survey Activities	Level D
Activity 4: Land Surveying	Level D/Modified Level D
Activity 5: Water-Based Geophysical Survey Activities	Modified Level D
Activity 6: MEC Intrusive and Disposal Activities	Level D/Modified Level D or Level C (if applicable)
Activity 7: Decontamination	Level D/Modified Level D or Level C (if applicable)
Activity 8: Underwater Operations	See Dive Plan (**Appendix G** of RI Work Plan).
Activity 9: MC Sampling	Level D/Modified Level D or Level C (if applicable)
Activity 10: Drilling/Geoprobe	Level D/Modified Level D or Level C (if applicable)
Activity 11: Groundwater Sampling	Level D/Modified Level D or Level C (if applicable)

Notes:

PPE = personal protective equipment
MEC = munitions and explosives of concern
MC = munitions constituents
RI = Remedial Investigation

The effectiveness of the PPE Program will be evaluated by the SSHO or UXOSO. If additional hazards are identified requiring a higher level of protection and changes to the program are necessary, the SSHO or UXOSO will inform the Federal Team Health and Safety Officer and amend the PPE requirements.

In accordance with OSHA 29 CFR 1910, Subpart I (Personal Protective Equipment), all PPE will be provided, used, and maintained in a sanitary and reliable condition. All PPE will be of the construction, design, and material to provide employees with protection against known or anticipated hazards. PPE will be selected that properly and appropriately fits the employee. WESTON employees have received OSHA-compliant training. Any concerns regarding the use of appropriate PPE will be brought to the attention of the SSHO or UXOSO, who will contact the Federal Team Health and Safety Officer for assistance in evaluation of PPE as necessary.

Level D, modified Level D, Level C, and Dive Equipment PPE is required for this project based on activity type and associated hazards. The SSHO or UXOSO will review the following criteria with employees:

- Proper selection.
- Situations when PPE is anticipated for use.
- Proper uses and limitations of equipment during temperature extremes, heat/cold stress, and in relation to employee medical conditions.
- Proper donning, doffing, and adjusting.
- Maintenance, cleaning, and storage.
- Inspection procedures.

An upgrade in PPE will be considered based on a change in activity or evaluation of monitoring results collected during task implementation, should conditions warrant a re-evaluation (e.g., elevated monitoring results above action levels).

6.1 LEVEL D PERSONAL PROTECTIVE EQUIPMENT

Level D PPE consists of the following:

- Work clothes such as long pants and shirts with sleeves.
- Work gloves—leather or cotton as necessary for physical hazards.
- American National Standards Institute (ANSI)-compliant safety boots.
- High-visibility safety vests.
- ANSI-compliant safety glasses or safety goggles/splash/face shields (as necessary).
- ANSI-compliant hard hat (as necessary).

- Hearing protection, as necessary (e.g., chainsaw operations).
- ANSI-compliant face shields (as necessary during chainsaw operations).
- Logging boots (as necessary during chainsaw operations).
- Ballistic chaps, as necessary (e.g., chainsaw operations).

6.2 MODIFIED LEVEL D PERSONAL PROTECTION EQUIPMENT

Modified Level D PPE that will be used during all Phase II RI activities that have the potential for personnel to come in contact with MEC and/or MC releases (e.g., sampling, monitoring, and intrusive investigations) consists of the following:

- Work clothes such as long pants and shirts with sleeves.
- Gloves, nitrile chemical-resistant.
- Work gloves—leather or cotton as necessary for physical hazards.
- High visibility safety vests.
- ANSI-compliant hard hat (as necessary).
- ANSI-compliant safety boots.
- ANSI-compliant safety glasses or safety goggles/splash/face shields (as necessary).
- Hearing protection, as necessary (e.g., chainsaw and drilling operations).
- ANSI-compliant face shields (as necessary during chainsaw operations).
- Ballistic chaps, as necessary (e.g., chainsaw operations).
- Logging boots (as necessary during chainsaw operations).
- Personal flotation device (as necessary for work over water/from boat).

6.3 LEVEL C PERSONAL PROTECTIVE EQUIPMENT

Level C PPE will be worn when the concentration(s) and type(s) of airborne substance(s) are known and the criteria for using air purifying respirators are met.

The following constitute Level C equipment; this equipment may be used as appropriate.

- Full-face respirator with organic vapor and P100 cartridges
- Tyvek or Saranex equivalent hooded suit
- Coveralls.
- *Nitrile gloves, outer
- *Nitrile gloves, inner
- Latex boots (outer)
- Steel toe safety boots and puncture resistant soles.
- Hard hat.

*Determination of materials was based on permeation/degradation rates of contaminants of concern.

6.4 UNDERWATER OPERATIONS PERSONAL PROTECTION EQUIPMENT

For PPE requirements for underwater operations, see the Dive Plan (**Appendix G** of the RI Work Plan).

7. MEDICAL SURVEILLANCE

7.1 MEDICAL SUPPORT FUNCTIONS

Since 1980, WESTON has used a comprehensive Occupational Health Program (OHP) that complies with all OSHA and USACE requirements. All site personnel and subcontractors who enter the Boat Basin, Visitors Information Center MRS while operations are being conducted must comply with a comparable OHP. All medical records are maintained in accordance with 29 CFR 1910.1020. If an unforeseen hazard becomes evident during the performance of work, the SSHO or UXOSO will bring such hazard information to the attention of the Federal Team Health and Safety Officer and the Government-Designated Authority both verbally and in writing for resolution as soon as possible. In the interim, the necessary action will be taken to reestablish and maintain safe working conditions. Medical certifications for site personnel are summarized in **Table 7-1** and are included in **Attachment 3** of the APP. Additional copies of personnel certifications will be maintained on-site and available for review.

Table 7-1 Medical Surveillance

Employee Name	Medical Expiration
Brian Grassmyer (SUXOS)	03/28/2014
Troy Phelps (UXOSO/UXOQCS)	09/25/2014
Katie Morrison (Geophysicist)	05/11/2014
Brian Guthrie (Geophysicist)	01/08/2015
Elizabeth Cunningham (SSHO)	07/10/2014
Bill Bounds (SSHO)	5/16/2015
UXO Tech I - TBD	TBD
Casey Faust (UXO Tech II)	5/31/2015
UXO Tech III - TBD	TBD

Notes:
SUXOS = Senior UXO Supervisor
SSHO = Site Safety and Health Officer
Tech = Technician
UXOQCS = Unexploded Ordnance Quality Control Specialist
UXO = unexploded ordnance
UXOSO = Unexploded Ordnance Safety Officer
TBD = To be determined

All certificates requiring renewal prior to scheduled mobilization date will be obtained, provided to U.S. Army Corps of Engineers, and filed on-site. Personnel will not be authorized to conduct Remedial Investigation activities without providing documentation for medical clearances, training, and/or applicable licenses, as required.

7.1.1 Occupational Health Program

To comply with OSHA requirements, WESTON has designated Dr. Peter Greaney of WorkCare® to oversee the site-specific medical surveillance and OHP. Dr. Greaney is a board-certified physician in internal and occupational medicine. Dr. Greaney can be reached during regular business hours at (800) 455-6155.

The purpose of the OHP is to ensure suitable job placement of employees, to monitor the health effects of hazards encountered in the workplace, and to maintain and promote good health through preventive measures. Medical examination criteria are established by WorkCare in compliance with 29 CFR 1910.120.

8. EXPOSURE MONITORING/AIR MONITORING

Based on our hazard/risk assessment of the Boat Basin, Visitors Information Center MRS, the nature of the work, and previous experience performing UXO operations, it is not expected that any airborne contaminants or nuisance dust level exposure limits will be exceeded. Additionally, toxic vapor screening results from previous investigations conducted at WFF did not indicate the presence of airborne contaminants above OELs. However, as there were no previous groundwater investigations conducted at the Pyrotechnics Burn Area of the MRS, it is possible there may be the potential for exposure to gasoline constituents because gasoline was possibly used by the Navy to dispose of parachute flares and practice bomb signals. As a result, air monitoring in accordance with **Table 8-1** will be performed during subsurface soil and groundwater investigations at the Pyrotechnics Burn Area. WESTON will perform required monitoring to evaluate the effectiveness of prescribed PPE and to evaluate potential work exposure. If conditions change, the AHAs and SSHP will be amended. Any amendment to the plan will be reviewed and approved by the Federal Team Health and Safety Officer and USACE.

Table 8-1 Action Levels for Direct-Reading Air Monitoring Instruments

Hazard[a]	Instrument	Action Level	Action
Oxygen Content	O_2 meter	<19.5% O_2	Leave area. Re-enter only with self-contained breathing apparatus (SCBA).
		19.5 to 23% O_2	Work may continue. Investigate changes from 21%.
		>23% O_2	Stop work. Ventilate area before returning.
Explosive Atmosphere (Methane)	Combustible gas indicator (CGI)/lower explosive limit (LEL) meter	< 10% LEL	Continue to work, monitor atmosphere.
		> 10% LEL	Stop work. Evacuate area immediately. Contact CIH, East Division EHS Officer, or Federal Team Health and Safety Officer.

Table 8-1 Action Levels for Direct-Reading Air Monitoring Instruments (Continued)

Hazard[a]	Instrument	Action Level	
Volatile Organic Compounds	PID[b] (ppbRAE required)	Because benzene (potential gasoline component) could be present, the actions listed below will be followed.	
		PID 0 to 100 ppb (isobutylene equivalent benzene action level).	Use ppbRAE 3000 to monitor action levels. If ppbRAE readings in breathing zone are sustained and greater than 100 ppb (benzene action level based on use of ppbRAE with 10.6 eV bulb) and less than 4,700 ppb (ACGIH TLV STEL isobutylene equivalent for benzene and use of 10.6 eV ppbRAE), use Sensidyne™ colorimetric detector tube for benzene (Tube 118SD; Range: 0.1-75 ppm) or equivalent to determine the presence and concentration of benzene. If Sensidyne™ tube measurement is less than 0.1 ppm; proceed with work with intermittent verification of benzene. If benzene is greater than 0.1 ppm (Sensidyne™ tube), discontinue work, then contact CIH, East Division EHS Officer, or Federal Team Health and Safety Officer to discuss entry requirements.
		PID reading > 20,000 ppb or 20 ppm and benzene < 0.5 ppm .	If action levels in breathing zone are sustained and greater than 20,000 ppb and benzene less than 0.5 ppm, use Draeger or equivalent colorimetric tubes (ethylbenzene and toluene) to isolate respective contaminant. If ethylbenzene and/or toluene colorimetric tube concentrations are above respective action levels (both action levels are 20 ppm using Draeger tube), discontinue work, then contact CIH, East Division EHS Officer, or Federal Team Health and Safety Officer to discuss entry requirements. If ethylbenzene or toluene concentrations below respective action levels continue work in Modified Level D.

Table 8-1 Action Levels for Direct-Reading Air Monitoring Instruments (Continued)

		PID reading > 110,000 ppb or 110 ppm (isobutylene equivalent xylene action level) and benzene < 0.5, ethylbenzene < 20 ppm, toluene < 20 ppm	If action levels in breathing zone are sustained and greater than 110,000 ppb or 110 ppm and benzene less than 0.5 ppm, ethylbenzene and toluene less than 20 ppm,, use Draeger or equivalenet colorimetric tube (xylene) to isolate respective contaminant. If xylene colorimetric tube concentration is above 100 ppm, discontinue work, and then contact CIH, East Division EHS Officer, or Federal Team Health and Safety Officer to discuss entry requirements. If xylene concentration below respective action level continue work in Modified Level D.
Particulates	Personal DataRam (PDR)	01.5 mg/m^3 > 01.5 mg/m^3	Level D (Use dust suppression as appropriate to maintain dust levels below action levels). Level C. At a minimum, a P-100 cartridge will be utilized to reduce particulate exposure. If other contaminants (e.g., VOCs) are present, an evaluation will be completed to determine if a full-face respirator and dual cartridge (organic vapor and P100) are appropriate for the anticipated activity.

[a]All air monitoring for employee exposure should be conducted in the worker's breathing zone. Readings on instruments obtained while screening soil cores or with the tip of the PID inside of a well casing or a 55-gallon drum do not represent worker exposure.

[b]Detects and measures concentrations of combustible gases or vapors in the air. These readings will be taken as close to the point of emission as possible.

Air monitoring for benzene will be conducted during subsurface boring and well installations and groundwater sampling at the Pyrotechnics Burn Area. The measurements obtained by these instruments are intended to indicate when the use of respirators is required, to validate the use of air-purifying respirators (APRs), to determine when or if supplied air respirators are required, to alert personnel of potentially explosive conditions, and to ensure sufficient oxygen is available for work.

A ppbRAE will be utilized for monitoring organic contaminants of concern. This photoionization Detector (PID) has an extended range of 1 ppb to 10,000 ppm to ensure action levels are adequately monitored. A PID ionizes contaminants by the use of ultraviolet light. Positively charged particles produce an electrical current that is proportional to the concentration of the contaminant. A photoionization detector detects chemicals that can be ionized by the energy (wavelength) of the lamp (e.g., 10.6 electron volt [eV]).

A personal DataRam will be used to measure particulate in air. The personal DataRAM measures mass concentration of dust, smoke, mists, and fumes in real time, and sounds an audible alarm whenever the user-defined level is exceeded. The calculated site specific combined particulate action level was determined to be at a higher action level (less protective) than the ACGIH of 3 mg/m^3 of air. As a result, the particulate action level is 1.5 mg/m^3.

Where particulate levels are of concern, dust suppression will be utilized to control the hazard. This control will include wetting down the area of activity with water in order to decrease the particulate compound's dust generation. Water cannot be used in the area of the activity if the collection of soil samples is anticipated. If the wetting process is expected to result in potentially contaminated runoff, measures will be taken to contain runoff. In the event that dust suppression measures are not adequate in the opinion of the SSHO, the workers will wear air purifying respirators with HEPA filters.

For toxic volatile organic contaminants, the action level is based on the exposure limit (the lowest of the OSHA PEL or the American Conference of Governmental Industrial Hygienists [ACGIH] TLV), the instrument correction factor, and a safety factor of 2. Specific monitors such as Draeger tubes (or Sensidyne™) or electronic sensors are used to identify or rule out certain contaminants such as benzene. Using benzene, the action level is calculated by dividing the exposure limit (NIOSH REL = .1 ppm) by the correction factor of the instrument (0.53 for 10.6 eV), and dividing by a safety factor of 2 to get an action level of 0.1 ppm or 100 ppb (isobutylene equivalent).

WESTON employees will implement a conservative approach to setting PPE requirements and action levels for PPE upgrades and downgrades based on breathing zone conditions. A worker's breathing zone for this project will be the lowest vertical space where personnel are breathing. This approach is in accordance with industry standards and will account for unanticipated compounds (stressors) that may be encountered during intrusive activities.

9. HEAT AND COLD STRESS/WEATHER

Personnel will be provided information about heat and cold stress symptoms. Weather conditions will be discussed during morning safety briefings.

9.1 HEAT STRESS

One of the most common types of stress that can affect field personnel is heat stress. Heat stress can be a serious hazard to workers at project sites because of the PPE required. The SSHO is responsible for evaluating the conditions, work tasks, and requirements for PPE, and for implementing the emergency response procedures. The following subsections describe the signs and symptoms, monitoring requirements, prevention and treatment procedures for heat rash, heat cramps, heat exhaustion, and heat stroke. These requirements and procedures will be followed at all times.

During hot conditions, cool drinking water will be provided for employees. Employees will be encouraged to drink at least one cup every 20 minutes and take breaks in a cooler, shady location. Personnel not acclimated to the climate or taking medications that might make them sensitive to heat should be allowed additional breaks. When possible, work should be scheduled during cooler periods of the day. Personnel working outside should use sun screen with a high SPF.

9.1.1 Heat Stress Symptoms and Treatment

9.1.1.1 Heat Rash

Heat rash, also known as prickly heat, may occur in hot and humid environments where sweat is not easily removed from the surface of the skin by evaporation, and skin is aggravated by chafing clothes. When extensive or complicated by infection, heat rash can be so uncomfortable that it inhibits sleep and impairs a worker's performance.

- **Symptoms**—Mild red rash, especially on areas of the body that come into contact with protective gear.

- **Treatment**—Decrease amount of time spent working in protective gear and provide body powder to help absorb moisture and decrease chafing. Heat rash can be prevented by showering, resting in a cool place, and allowing the skin to dry.

9.1.1.2 Heat Cramps

Heat cramps are caused by inadequate electrolyte intake. The individual may be receiving adequate water; however, if not combined with an adequate supply of electrolytes, the blood can thin to the point where it seeps into the active muscle tissue, causing cramping.

- **Symptoms**—Acute painful spasms of voluntary muscles, most notably of the abdomen and extremities.

- **Treatment**—Move the victim to a cool area and loosen clothing. Have the victim drink 1 to 2 cups of cool potable water or diluted commercial electrolyte solution (e.g., Gatorade®, Quench®) immediately, and then every 20 minutes thereafter until symptoms subside. Electrolyte supplements can enhance recovery; however, it is best to double the amount of water required by the dry mix package directions or to add supplemental water to the liquid form.

9.1.1.3 Heat Exhaustion

Heat exhaustion is a state of weakness or exhaustion caused by the loss of fluids from the body. Heat exhaustion is not as dangerous as heat stroke, but if not properly managed in the field, it may lead to heat stroke.

- **Symptoms—**Pale, clammy, and moist skin, profuse perspiring, and extreme weakness. Body temperature is normal, pulse is weak and rapid, and breathing is shallow. The person may have a headache, may vomit, may feel dizzy, and may be irritable or confused.

- **Treatment—**Move the victim to a cool, air-conditioned or temperature-controlled area, loosen clothing, place in a position with the head lower than the feet (shock prevention), and allow the victim to rest. Consult a physician. Ensure that the victim is not nauseated or vomiting. If not nauseated or vomiting, give the victim small sips of cool water or diluted electrolyte replenishment solution (1 to 1 dilution with water, or if mixing from powder, double the water added). If this is tolerated, have the victim drink 1 to 2 cups of fluid immediately, and every 20 minutes thereafter until symptoms subside. Seek medical attention at the advice of the consulting physician.

9.1.1.4 Heat Stroke

Heat stroke is an acute and dangerous reaction to heat stress caused by a failure of the body's heat regulating mechanisms, i.e., the individual's temperature control system (sweating) stops working correctly. Body temperature rises so high that brain damage and death may result if the person is not cooled quickly.

- **Symptoms—**Red, hot, dry skin (although the person may have been sweating earlier); nausea, dizziness, confusion, extremely high body temperature (i.e., 104 degrees Fahrenheit [°F] or greater as measured with a tympanic thermometer), rapid respiratory and pulse rate, seizures or convulsions, unconsciousness or coma.

- **Treatment—**Immediately call for emergency medical assistance. Remove the victim from the source of heat and cool the victim quickly. If the body temperature is not brought down quickly, permanent brain damage or death may result. Remove all PPE and as much personal clothing as decency permits. Fan the person while sponging or spraying with cool or tepid water. Apply ice packs (if available) to the back of the neck, armpits, groin area, or behind the knees. Place the victim flat on his or her back or with head and shoulders slightly elevated. If conscious, and not nauseated or vomiting, the victim may be provided sips of cool water. Do not give the victim coffee, tea, or alcoholic beverages. Emergency medical personnel will take over treatment upon arrival.

9.1.2 Heat Stress Prevention

The following measures should be followed to prevent heat stress:

- The most important measure is to prevent heat-related illness through adequate fluid intake.

- Ensure workers drink 1/2 to 1 quart of liquid per hour in high heat conditions. Most of this liquid should be water.

- Provide a shaded area for rest breaks.

- Ensure that adequate shelter is available to protect personnel against heat and direct sunlight. When possible, shade the work area.

- Discourage the intake of caffeinated drinks during working hours.

- Monitor for signs of heat stress.

- Encourage workers to maintain a good diet during these periods. In most cases, a balanced diet and lightly salted foods should help maintain the body's electrolyte balance. Bananas are especially good for maintaining the body's potassium level.

- If using commercial electrolyte mixes, double the amount of water called for in the package directions. Indications are that “full-strength” preparations taken under high heat stress conditions may actually decrease the body’s electrolytes.
- Acclimate workers to site work conditions by slowly increasing workloads (i.e., do not begin work activities with extremely demanding tasks).
- Encourage workers to wear lightweight, light-colored, loose-fitting clothing.
- In extremely hot weather, conduct field activities in the early morning and evening.
- Maintain good hygienic standards through frequent showering and changes of clothing.
- Allow clothing to dry during rest periods.

9.1.3 Heat Stress Monitoring and Work Cycle Management

When strenuous field activities are part of ongoing site work conducted in hot weather, the following guidelines should be used to monitor the body’s physiological response to heat, and to manage the work cycle, even if workers are not wearing impervious clothing. These procedures should be instituted when the temperature exceeds 70 ^{O}F and the tasks and risk analysis indicate an increased risk of heat stress problems. Consult the safety professional (e.g., Division EHS Officer or SSHO) if questions arise as to the need for specific heat stress monitoring. In all cases, the site personnel must be aware of the signs and symptoms of heat stress and be provided adequate rest breaks and proper aid as necessary. The SSHO will conduct heat stress monitoring. The SSHO will use a tympanic thermometer for body temperature and a standard thermometer for ambient temperature.

NOTE: For purposes of this operating practice, a break is defined as a 15-minute period.

A physiological monitoring schedule is determined by following the steps below:

- Measure the air temperature with a standard thermometer.
- Estimate the fraction of sunshine by judging the percentage of time the sun is out (refer to **Table 9-1**).
- Calculate the adjusted temperature based on the following formula:

- *Adjusted Temperature = Actual Temperature + 13 X (where X = sunshine fraction from **Table 9-1**)*

- Using **Table 9-2**, determine the physiological monitoring schedule for fit and acclimated workers for the calculated adjusted temperature.

The length of the work period is governed by the frequency of physiological monitoring (**Table 9-2**). The length of the work period is governed by physiological parameters (heart rate and body temperature). As noted above, the rest period will be set at 15 minutes in duration. To check the heart rate, count the radial pulse for 30 seconds at the beginning of the rest period. If the heart rate exceeds 110 beats per minute, shorten the next work period by one third and maintain the same rest period. Body temperature can be checked with a tympanic thermometer after work but before the employee drinks water. If the body temperature taken exceeds 99.7 °F, shorten the next work cycle by one third. These adjustments of the work period based on heart rate and body temperature were recommended in OSHA Technical Manual TED 01-00-015, January 1999, Section III: Chapter 4, Heat Stress.

Table 9-1 Percent Sunshine Factors—Heat Stress Prevention and Monitoring

Percent Sunshine (%)	Cloud Cover	Sunshine Fraction
100	No cloud cover	1.0
50	50% cloud cover	0.5
0	Full cloud cover	0.0

Table 9-2 Physiological Monitoring Schedule—Heat Stress Prevention and Monitoring

Adjusted Temperature	Level D (Permeable clothing)	Level C, B, or A (Non-permeable clothing)
90 °F (32.2 °C) or above	After each 45 minutes of work	After each 15 minutes of work
87.5 °F (30.8° - 32.2 °C)	After each 60 minutes of work	After each 30 minutes of work
82.5 °F - 87.5 °F (28.1 °C - 32.2 °C)	After each 90 minutes of work	After each 60 minutes of work
77.5 °F - 82.5°F (25.3 °C - 28.1 °C)	After each 120 minutes of work	After each 90 minutes of work
72.5 °F - 77.5 °F (22.5 °C - 25.3 °C)	After each 150 minutes of work	After each 120 minutes of work

9.2 COLD STRESS

In the planning stages of a project, the potential for cold-related hazards are considered during risk assessment. The SSHO must make decisions on the proper safety procedures. The SSHO will be responsible for implementing the program as well as attaining data on cold stress monitoring using a kestrel or other similar device, which measures wind speed, humidity, and ambient temperature. Each worker must evaluate the risk associated with his or her work and be actively alert to these hazards. Any site worker may stop work if safety procedures are not followed or if the risk is too great.

Personnel working outdoors are subject to cold stress at temperatures below 40 °F. Exposure to extreme cold can cause skin injury or death if the core body temperature is unchecked and permitted to drop. Chemical-protective clothing does not provide protection against cold stress and may increase susceptibility. The following subsections describe the signs and symptoms, monitoring requirements, prevention, and treatment procedures for cold stress. These requirements and procedures will be followed at all times.

During cold conditions, employees will be encouraged to take rewarming breaks. Any employee whose clothes become wet will immediately be wrapped in a blanket and will change into dry clothes as soon as possible. Thermally protective gloves should be worn and extremities covered by appropriate clothing. Clothing should allow sufficient ventilation or wick moisture away from the skin. Metal hand-held equipment should have a barrier between the equipment and skin.

9.2.1 Cold Stress Symptoms and Treatment

9.2.1.1 Frostbite

Frostbite is the freezing of tissue and most commonly affects the toes, ears, fingers, and face. Frostbite occurs when an extremity loses heat faster than it can be replaced by the circulating blood. Frostbite may result from direct exposure to extreme cold or to cool, high wind. Damp socks or shoes may contribute to frostbite of the toes.

- **Symptoms**—Cold, tingling, aching, or stinging feeling followed by numbness; skin color is red, purple, white, or very pale and is cold to the touch; blisters may be present (in severe cases).
- **Treatment**—Call for emergency medical assistance. Move the victim indoors and/or away from additional exposure to cold, wet, and wind. Wrap the affected area in a soft, clean cloth (sterile, if available). Give a warm drink (water or juices, not coffee, tea or alcohol). Do not allow the victim to smoke. Do not rub the frostbitten part (this may cause gangrene). Do not use ice, snow, gasoline, or anything cold on the frostbitten area. Do not use heat lamps or hot water bottles to rewarm the frostbitten area. Do not place the frostbitten area near a hot stove. Do not break blisters. After rewarming, elevate the area and protect it from further injury.

9.2.1.2 Hypothermia

Hypothermia means "low heat" and is a potentially serious condition. Systemic hypothermia occurs when body heat loss exceeds body heat gain and the body core temperature falls below the normal 98.6 ºF. Although some hypothermia cases are caused by extremely cold temperatures, most cases develop in air temperatures between 30 ^{O}F and 50 ^{O}F, especially when compounded with water immersion and/or windy conditions. The victim of hypothermia may not know, or may refuse to admit, that he or she is experiencing hypothermia. All personnel must be observant for these signs for themselves and for other team members.

- **Symptoms**—Cool bluish skin; uncontrollable shivering; vague, slow, slurred speech; irritable, irrational, or confused behavior; memory lapses; clumsy movements, fumbling hands; fatigue or drowsiness. Below the critical body core temperature of 95 ºF, the body cannot produce enough heat by itself to recover. At this point, emergency measures must be taken to reverse the drop in core temperature. The victim may slip into unconsciousness and can die in less than 2 hours after the first signs of hypothermia are detected. Treatment and medical assistance are critical.

- **Treatment**—Call for emergency medical assistance. Do not leave the victim alone. Prevent further heat loss by moving the person to a warmer location out of wind, wet, and cold. Remove cold, wet clothing, and replace with warm, dry clothing or wrap the victim in blankets. If the victim is conscious, provide warm liquids, candy, or sweetened foods. Carbohydrates are the food most quickly transformed into heat and energy. Do not give the victim alcohol or caffeine. Have the person move his or her arms and legs to create muscle heat. If he or she is unable to move, place warm bottles or hot packs on the arm pits, groin, neck, and head. Do not rub the arms and legs or place the person in warm water.

9.2.2 Prevention and Protection

The following general guidelines are recommended for preventing or minimizing cold stress:

- Wear loose, layered clothing, masks, woolen scarves, and hats. Wear liners under hard hats.
- Protect hands with gloves or mittens.
- Never touch cold metal with bare hands.
- Wear waterproof, slip-resistant, insulated boots.
- Use chemical foot and hand warmers (commercially available) inside boots and gloves.
- In extreme cold, cover the mouth and nose with wool or fur to “pre-warm” the air you breathe.
- If wearing a face protector, remove it periodically to check for frostbite.
- Ensure that clothing remains secure around the body, especially at the neck and waist.
- If required to wear chemical protective clothing, remember that it generally does not afford protection against cold stress. In many instances, chemical protective clothing increases susceptibility. Dress carefully if both chemical protection and thermal insulation are required.
- Remove outer layers to avoid overheating, and remove clothing soaked with perspiration; replace layers to avoid becoming chilled.

- Keep clothes dry by wearing water-resistant and wind-resistant clothing and outerwear.
- Wear clothing that will “breathe” or allow water vapor to escape.
- Eat well-balanced meals, ensure adequate intake of liquids and avoid alcoholic beverages. Drink warm, sweet beverages and soups. Limit the intake of caffeinated drinks due to the diuretic and circulatory effects.
- Use available warm shelters and implement work-rest schedules.
- If warm shelters are not available, use cars/vehicles as shelters from the cold. (Ensure that tailpipes are not covered by heavy snowfall).
- Use radiant heaters to provide warmth (if using propane heaters ensure adequate ventilation to avoid carbon monoxide poisoning).
- Monitor yourself and others for changes in physical and mental condition.
- Use the buddy system or supervision to ensure constant protective observation.
- If heavy work must be done, resulting in sweating/wet clothing, take rest periods in heated shelters and change into dry clothing as necessary.
- New employees should not work full-time in the cold during the first days of employment until they become accustomed to the working conditions and the use of required protective clothing.
- Include the weight and bulkiness of clothing in estimating the required work performance and weights to be lifted by the worker.
- Arrange the work in such a way that sitting or standing still for long periods is minimized.
- Perform work protected from drafts to the greatest extent possible. If possible, shield the work area from wind.

Table 9-3 and **Table 9-4** should be consulted to adjust working schedules for wind chill conditions based on equivalent chill temperature (ECT). These tables are guidelines only; ambient temperatures and wind conditions should be monitored frequently, and work schedules adjusted as required. If workers show signs or symptoms of cold stress, the work schedule must be adjusted, as required.

9.2.3 Work/Warming Regimen

Work should be performed during the warmest part of the day. If work is performed continuously in cold or winter conditions or where rain or cool winds are expected, provide heated warming shelters, tents, cabins, or break rooms nearby. Encourage workers to use the shelter at regular intervals, depending on the severity of the cold exposure. **Table 9-4**, Cold Work/Warm-up Schedule for 4-Hour Shifts, provides guidance for working in severe cold weather. The onset of heavy shivering and/or the feeling of excessive fatigue, drowsiness, irritability, or euphoria indicate the need to immediately return to the shelter. Pain, numbness, or tingling in the extremities is indication of the need to immediately return to the shelter. When entering the heated shelter, the outer layer of clothing should be removed and the remainder of the clothing loosened to permit sweat evaporation, or the worker should change into dry clothing. Never return to work in wet clothing.

Table 9-3 Wind Chill Chart

Wind (mph)	Temperature (°F)																	
Calm	40	35	30	25	20	15	10	5	0	-5	-10	-15	-20	-25	-30	-35	-40	-45
5	36	31	25	19	13	7	1	-5	-11	-16	-22	-28	-34	-40	-46	-52	-57	-63
10	34	27	21	15	9	3	-4	-10	-16	-22	-28	-35	-41	-47	-53	-59	-66	-72
15	32	25	19	13	6	0	-7	-13	-19	-26	-32	-39	-45	-51	-58	-64	-71	-77
20	30	24	17	11	4	-2	-9	-15	-22	-29	-35	-42	-48	-55	-61	-68	-74	-81
25	29	23	16	9	3	-4	-11	-17	-24	-31	-37	-44	-51	-58	-64	-71	-78	-84
30	28	22	15	8	1	-5	-12	-19	-26	-33	-39	-46	-53	-60	-67	-73	-80	-87
35	28	21	14	7	0	-7	-14	-21	-27	-34	-41	-48	-55	-62	-69	-76	-82	-89
40	27	20	13	6	-1	-8	-15	-22	-29	-36	-43	-50	-57	-64	-71	-78	-84	-91
45	26	19	12	5	-2	-9	-16	-23	-30	-37	-44	-51	-58	-65	-72	-79	-86	-93
50	26	19	12	4	-3	-10	-17	-24	-31	-38	-45	-52	-60	-67	-74	-81	-88	-95
55	25	18	11	4	-3	-11	-18	-25	-32	-39	-46	-54	-61	-68	-75	-82	-89	-97
60	25	17	10	3	-4	-11	-19	-26	-33	-40	-48	-55	-62	-69	-76	-84	-91	-98

Frostbite Times: 30 minutes; 10 minutes; 5 minutes

$$\text{Wind Chill (°F)} = 35.74 + 0.6215T - 35.75(V^{0.16}) + 0.4275T(V^{0.16})$$

Where, T= Air Temperature (°F) V= Wind Speed (mph)

Effective 11/01/01

Table 9-4 Cold Work/Warm-up Schedule for 4-Hour Shifts

Equivalent Chill Temperature	Maximum Work Period	Number of Breaks
≥–24 °F	Normal	1
-25 °F to –29 °F	75 minutes	2
-3o °F to –34 °F	55 minutes	3
-35 °F to –39 °F	40 minutes	4
-40 °F to -44 °F	30 minutes	5
≤–45 °F	Stop work	Stop work

9.3 WEATHER HAZARDS

It is possible that severe weather will occur during this project. In the event that a storm threatens the area through observation of a storm system (lightning observation and thunder), all field work will be halted and weather service bulletins and civil defense messages will be monitored on local radio or through cell phone applications. The SSHO will determine through visual observations and weather updates (gathered through the radio or cell phone) when it is necessary to halt work and when to re-start field activities, which include observing the "30-30" rule that states:

- If you see lightning and thunder is heard within 30 seconds (approximately 6 miles), seek shelter.
- If you hear thunder, but did not see the lightning, assume that lightning is within 6 miles and seek shelter.
- Remain in the shelter for 30 minutes following the last lightning strike.

When a tornado warning goes into effect, the following actions will be taken:

- If in your vehicle: Leave your vehicle and seek shelter in a sturdy building. As a last resort, seek shelter in a ditch or culvert.
- In buildings: Take shelter in an interior hallway on a lower floor. A closet, bathroom, or other small room with short, stout walls will give some protection from collapse and flying debris. Otherwise, get under heavy furniture and stay away from the windows.
- Out in open country: Seek inside shelter immediately. If a tornado approaches, lie flat in the nearest depression, such as a ditch or culvert, and cover your head with your arms.

Additionally, when wind speed exceeds 40 mph, the following actions will be taken:

- Follow manufacturer instructions in assessing the limitations associated with field equipment.

- Shut down outdoor activities involving work at elevation.
- Move mobile items stored outside to indoor locations.
- Secure any items that cannot be moved inside.
- Be careful opening exterior doors.
- Stay away from power lines.
- Be cautious about downed power lines, tree limbs, and debris on roads.

If weather remains unstable for more than 1 hour, the SSHO will monitor weather bulletins to further assess changing conditions.

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10. STANDARD OPERATING SAFETY PROCEDURES, ENGINEERING CONTROLS, AND WORK PRACTICES

Using common sense, operating under the “buddy system” (or two-person rule), and following safe practices can reduce hazards resulting from normal project activities.

In addition to the general site safety procedures contained in the WESTON Corporate EHS Program field operating procedures guide (which will be available on-site), the following procedures will be used:

- No running or horseplay will be allowed.
- The UXO Technicians will make every effort to identify a suspect UXO item. The UXO will be visually examined for markings and other external features such as shape, size, and external fittings. If an unknown UXO item is encountered, the on-site USACE representative will be notified immediately. Under no circumstances will any fuzed UXO be moved in an attempt to make a definitive identification.
- As a general rule, all fuzed UXO will be detonated in the original position found (BIP). This is the safest method to effect final disposition of munitions. Any item to be BIP will be sandbagged to mitigate blast effects and fragmentation projection. All detonation activities will be coordinated through the USACE Project Manager to allow proper notification to the local authorities and public entities can be made.
- Only UXO-qualified personnel will handle UXO and only during daylight hours. Personnel who will be handling UXO will not wear outer or inner garments such as nylon having static-electricity-generating characteristics.
- All WESTON and subcontractor personnel engaged in field operations will be thoroughly trained and capable of recognizing the specific hazards associated with UXO. All field personnel will be under the supervision of a UXO Technician III or higher.
- General UXO safety guidelines are included below:
  - Consider projectiles containing base-detonating fuses to be armed if the round is fired.
  - Secure arming wires and pop-out pins on unarmed fuses prior to moving UXO.
  - Do not depress plungers; turn vanes; or rotate spindles, levers, setting rings, or other external fittings on UXO.
  - Do not attempt to remove or dismantle any components of UXO.

- UXO personnel are not authorized to render inert any UXO found on-site.
- UXO will not be taken from the Boat Basin, Visitors Information Center MRS.
- Consider UXO, which may have been exposed to fire and detonation, as extremely hazardous.
- Do not rely on the color-coding of munitions for definitive identification.
- Assume that a practice munitions contains a live charge until investigation proves otherwise.
- Do not approach smoking munitions.

10.1 SITE RULES/PROHIBITIONS

10.1.1 Buddy System

All work at the Boat Basin, Visitors Information Center MRS will be performed using the buddy system. Team members will keep in visual contact with each other at all times. Team members will be made aware of any slip, trip, and lifting hazards along with any potential exposure to chemical substances, heat or cold stress, and general hazards within their work area.

10.1.2 Designated Eating/Break Areas

All eating/break areas will be located away from the active work area. No food or beverages will be allowed in any work environments.

10.1.3 Designated Smoking Areas

All regulations governing approved areas for smoking and spark generation will be strictly followed. Smoking is prohibited except in designated smoking areas. The SSHO or UXOSO will identify designated smoking areas. Discarding tobacco materials other than into designated tobacco receptacles is considered littering and is subject to fines.

10.2 WORK PERMITS

Digging permits are required prior to any excavation or trenching at the Boat Basin, Visitors Information Center MRS. The contractor is responsible for maintaining any utility markings. The

SSHO or UXOSO will ensure that a second means of verifying underground utility mark out is employed for all activities that involve the potential for above- or below ground utility contact.

All permits will be retained on-site and available upon request.

10.3 MATERIAL HANDLING PROCEDURES

Employees will use proper PPE when handling soils and other types of objects and debris as part of the scope of this project. Care should be taken in lifting and handling heavy or bulky items because improperly performing these activities is the cause of many back injuries. When two or more workers are required to handle an object, coordination is essential to ensure that the load is lifted uniformly and that the weight is equally divided between the individuals carrying the load. When carrying the object, each worker, if possible, will face the direction in which the object is being carried.

10.4 SPILLS

The procedures described in the following subsections comprise the spill containment program in place for activities at the Boat Basin, Visitors Information Center MRS. Spill procedures will be reviewed with team members by the SSHO or UXOSO.

10.4.1 Spill Control and Prevention

WESTON anticipates that unleaded gasoline, diesel fuel No. 2, and motor oil will be the only substances with hazardous constituents that may be stored on-site and will be in quantities of less than 5 gallons. To decrease the amount of pollutants to be stored on-site, WESTON plans, to the greatest extent possible, to conduct all fueling and repair of vehicles off-site. Hazardous liquids that are necessary to conduct Phase II RI activities will be stored in the smallest quantities possible. Should the storage of hazardous waste or materials with hazardous constituents be necessary, a storage tank constructed primarily of non-earthen materials, or a stationary device designed to contain an accumulation of hazardous waste would be placed within an approved secondary containment of adequate size to contain a spill (110% of storage tank size). The tank would be managed in accordance with the APP and 40 CFR Subpart I.

10.4.1.1 Spill Response

Because of the nature of the operations, the potential for a spill of pollutants during operations is low. The highest probability for a spill will occur during re-fueling operations of equipment (e.g., filling a chainsaw's gas and oil tanks). In the event of a spill, WESTON will notify appropriate emergency responders and federal and state reporting agencies. Additionally, WESTON will be equipped with spill kits on-site as needed for immediate cleanup if a petroleum product is inadvertently spilled. Any spills originating from small containers (e.g., gasoline cans) would be contained using absorbent materials.

If fuel or oil is spilled, the following measures will be taken:

- The spill area will be isolated and contained.
- Proper notifications will be made.
- The liquid and affected soil will be shoveled into a plastic bag and subsequently placed into a U.S. Department of Transportation-approved shipping container.
- Each container will be labeled to identify its contents.
- The container(s) will be shipped off-site and disposed of at a permitted facility in accordance with the CFR 260 to 270.
- Fire-extinguishing equipment meeting 29 CFR Part 1926, Subpart F, shall be on hand and ready for use to control fires.

10.4.2 Notification

In the event of a spill or release, WESTON personnel will immediately dial 911 and will then notify the SSHO or UXOSO or his designee. The SSHO or UXOSO or designee will respond in accordance with the seriousness of the spill or release. The WESTON Project Manager and Federal Team Health and Safety Officer will be informed of any spills or releases, minor or serious. The WESTON SSHO or UXOSO will file an incident report within 24 hours of the accident.

10.5 DRUM/CONTAINER TANK HANDLING

Drums used for containment of site-related media (scrap metal, soil cuttings, decontamination liquids, or groundwater purge liquids) will be open-top 55-gallon reconditioned drums for solid materials and closed-top drums for liquids that comply with United Nations (UN) specifications. The drums will not be filled beyond the 800-pound weight capacity specific to the drum (1A2/X425/S/02). Personnel will use proper tools, lifting techniques, and mechanical equipment (i.e., drum dolly) while using/moving drums to containerize debris.

10.6 MUNITIONS AND EXPLOSIVES OF CONCERN OPERATIONS

Recovered MEC will be BIP to the extent practical. Limited movement of MEC to a common detonation area may occur to minimize impacts to the adjacent public. Donor explosives will be delivered to the Boat Basin, Visitors Information Center MRS on an as needed basis and stored in a fenced and grounded explosives magazine.

All recovered MEC and MPPEH identified as material documented as an explosive hazard will be destroyed on-site, the same day found. In the event this cannot be accomplished because of weather (lightning) or delivery of explosives, then items will be guarded until disposal. All inspected and certified material documented as safe items will be handled and accounted for in accordance with the guidance established in DoD Instruction 4140.62. Sandbag Mitigation may be used for intentional detonations as delineated in the "Use of Sand Bags for Mitigation of Fragmentation and Blast Effects due to Intentional Detonation of Munitions," HNC-ED-CS-S 98-7, dated August 1998. Only one MEC item will be destroyed at a time using this technique.

Radios will be provided to each UXO team or survey team to maintain site communications between teams and site management.

Additional details regarding on-site detonations are provided below under Subsection 10.9.1, Section 3 and 5 of the Work Plan, and in the Explosives Site Plan (ESP) (**Appendix K** of the Work Plan).

10.7 DRUG AWARENESS AND DRUG-FREE WORKPLACE

WESTON fully supports all aspects of the Drug-Free Workplace Act of 1988. WESTON has implemented Operating Practice 05-01-010, Drug-Free Workplace. This practice is in accordance with Defense Acquisition Regulations System subpart 252.223-7004. Strict disciplinary actions are enforced for any violation of WESTON's Drug-Free Workplace policy.

All WESTON employees, as a condition of employment, have documented understanding and receipt of this policy. While on duty, employees will not use or be under the influence of alcohol, narcotics, intoxicants, or similar mind-altering substances. Employees found to be under the influence of or consuming such substances will be immediately removed from the job site. Contractors will enforce WESTON's drug-free workplace requirements.

Any employee under a physician's treatment and taking prescribed narcotics or any medication, including over the counter, that may prevent a person from being ready, willing, and able to safely perform his/her duties will provide a medical clearance statement to their supervisor from the attending physician.

WESTON's Operating Practice emphasizes supervisor training, a provision for self-referral to treatment, and maximum respect for individual confidentiality as well as a provision for identifying and dealing with illegal drug users, including testing. WESTON's practice also provides for education, counseling, rehabilitation, and coordination with available community resources.

10.8 EMPLOYEE DUTY SCHEDULE/BASIC FATIGUE MANAGEMENT PLAN

Personnel will follow WESTON's Employee Schedule. If extended periods of working long hours are required, the SSHO or UXOSO and/or SUXOS will monitor employees for outward signs of fatigue. Employee rotations may need to be adjusted to allow for individual differences in how fatigue-related stress is handled and for employee-specific roles on the project.

While working extended hours, employee travel time to and from work will be minimized to allow for sufficient rest and should be taken into account in determining hours per day and per week limits. Group transportation to and from the work location and lodging will be used to address this situation. Consideration should be given to "awake" time and not just the hours logged on a time sheet.

10.8.1 Fatigue Symptoms

Intrinsic Symptoms

- **Physical** – Frequent, unexplainable headaches, muscle aches and pains, breathing difficulties, blurred/double vision, and/or burning urination.
- **Mental –** Difficulty focusing attention, distracted easily, depression, impaired judgment, and/or poor visual perception.

Extrinsic Symptoms

- **Physical –** Degraded motor skills, tenseness and tremors, intolerant/irritable, increased reaction time, and/or social withdrawal.
- **Mental** – Absentmindedness, poor short-term memory, lack of interest and drive, confusion and fearfulness, slow startle response, worry, and/or anxiety.

10.9 SECURITY PLAN

10.9.1 Site Access and Control

Visitors to the project are required to sign the visitors log maintained by the SSHO or UXOSO. Visitors will be escorted by qualified personnel such as a UXO Technician Level II or above for access to the Boat Basin, Visitors Information Center MRS. Minimum separation distances (MSDs) in the approved ESP (see **Appendix K** of the RI Work Plan) will be maintained during all intrusive work. Access within the MSD will be limited to essential personnel only and will be maintained by the UXO Teams as detailed below in Section 11.

The munition with the greatest fragmentation distance (MGFD) is the 37mm high-explosive (HE) projectile; the MSD for teams for manual unintentional detonation operations is 18 feet based on K40 of the MGFD; the MSD for nonessential personnel from manual unintentional detonation operations is 118 feet based on the hazardous fragmentation distance of the MGFD; and the MSD for all personnel from intentional detonations is 200 feet (using engineering controls) based on the maximum fragmentation distance of the MGFD. Engineering controls (i.e., sandbags) will be used to mitigate the effects of fragmentation and blast effects during demolition and disposal activities. The MSD for all personnel from intentional detonation is 12.5 feet using optional engineering controls (i.e., double sandbags).

The separation distance surrounding the Pyrotechnics Area is 270 ft based on a maximum soil ejecta distance for a 10-pound maximum credible event (with 1.3 times safety factor). This separation distance is greater than the hazardous fragmentation distance of a 37mm projectile.

Intrusive operations will immediately stop if nonessential personnel enter the exclusion zone. In the event this cannot be accomplished because of weather (lightning) or delivery of explosives, then items will be guarded until disposal.

The work area is located on privately-owned property. Some of this land is open space under conservation and thus open to the public for recreational purposes. Signage to alert the public to on-going activities and associated hazards will be erected at strategic access points into the MRS boundary and as directed by USACE. See Section 11 for more detailed information on site control.

10.9.2 Theft

On-site theft of equipment is not expected. No equipment or valuable items will be kept inside vehicles. If it is necessary that equipment remain inside a vehicle, it will be kept out of obvious sight, and the vehicle will be secured (all vehicle doors locked and all windows closed). Personnel will secure vehicles, even if parking for only brief periods, and will carry vehicle keys with them at all times. Vehicles will be parked in well-lit areas.

In the event a theft does occur, local authorities will be promptly notified and appropriate WESTON personnel will be notified. Notice of Incident (NOI) Track information will be completed within 24 hours.

10.9.3 Confrontation

Personnel will be observant of their surroundings. They should ensure their own safety, the safety of their co-workers, and the safety of the public by not confronting or challenging aggressive perpetrators. Authorities should be contacted if they observe any unusual circumstances.

10.10 MOTOR VEHICLE SAFETY

Safety is of utmost importance at WESTON. Employees must act responsibly every day to ensure the safety of themselves and others. This safety commitment also applies when driving vehicles. All employee drivers are required to operate vehicles safely, obeying federal, state, and local laws, and company policies. Driving is a privilege, not a right.

10.11 TRAFFIC

The site is located within WFF. Vehicles may be encountered and care must be taken to avoid motor vehicle accidents at all times. Posted speed limits will be obeyed at all times, and seat belts will be worn when driving. Daily review of traffic hazards and work patterns will be discussed. All drivers will be licensed.

During active RI investigations, minor traffic control (vehicles and/or watercrafts) may be required to limit interferences in the survey areas and ensure safety to workers and the public. These measures will be limited and temporary in nature and are not anticipated to result in significant impacts to the adjacent community.

10.11.1 Employee Requirements/Responsibilities

Drivers of WESTON vehicles must possess a current, valid driver’s license of the appropriate class required for their driving needs, e.g., Class C, Commercial Driver’s License.

All driving duties and functions are to be performed in a safe, legal, and professional manner.

Employee drivers are to attend periodic defensive driving training and other driver safety meetings as scheduled through their local Safety Officers.

Driving requires a high level of skill and alertness. When fatigue, illness, or medication impact alertness, reflexes, and decision-making capabilities, an employee driver should cease driving until the situation improves or is corrected and contact his or her manager to discuss the situation.

Compliance with all federal, state, and local laws is expected.

Unsafe vehicles and related equipment will be reported and repaired. Unsafe vehicles are not to be driven on WESTON business.

The NOITrack system will be used to report any vehicle accident while on the job, or any accident occurring at any time if a company-owned or insured "allowance" vehicle is involved.

Driver orientation program and/or driving evaluation tests may be required of drivers to assess overall driving skills.

10.11.2 Compliance Issues/Driving Practices

10.11.2.1 Speed Limits

Drivers are required to obey posted speed limits and other traffic laws. Fines for any traffic violations are the employee's responsibility.

10.11.2.2 Seat Belts

WESTON drivers and their passengers are required to wear seat belts at all times while the vehicle is in operation.

10.11.2.3 Distracted Driving

It is recognized that distracted driving can contribute to accidents. Accordingly, WESTON employees are to exercise caution and good judgment when driving. Reading maps, eating, placing or receiving a call on a cell phone, and other activities may contribute to an accident. Cell phone use while driving, including the use of hands-free devices, creates a distraction and driver inattention. The following basic guidelines should always be observed:

- Make outgoing calls after you have pulled over to a safe area.
- Let incoming calls go to voice mail, or if answering the phone is necessary, make sure the caller knows you are driving and keep the call short.
- At all times, drivers are to operate vehicles in a safe, legal, and professional manner.

10.11.2.4 Transporting Weapons

Transporting weapons (such as firearms, large knives) or dangerous property (significant or placardable quantities of regulated hazardous materials or substances) is prohibited, unless specifically authorized.

10.11.3 Other Issues

Additional safety procedures may be established at a particular job site or within a Division. WESTON employees are responsible for compliance with any additional safety procedures and safety solutions that apply, or that may be identified.

10.12 SANITATION

Employers shall establish and maintain hygienic sanitation provisions for all employees in all places of employment. General housekeeping activities will occur daily.

10.12.1 Drinking Water

An adequate supply of potable water shall be provided in all places of employment, for both drinking and personal cleansing. Non-potable water shall be identified with markings and be kept separate from potable water.

Cool drinking water shall be provided during hot weather. Only approved potable water systems may be used for the distribution of drinking water. Construction trailers and other temporary or semi-permanent facilities shall be properly connected to the local municipal water supply unless the remoteness of the location makes this prohibitive. If connection to the municipal supply is not possible, temporary potable water systems shall be utilized, with the services provided by a licensed potable water contractor. “Reclaimed water” (treated wastewater) use in potable systems is strictly prohibited.

10.12.2 Toilets

Toilets are required to be present in all places of employment. Where sanitary sewers are not available, job sites shall be provided with chemical toilets, recirculating toilets, or combustion toilets unless prohibited by state/local codes. Hand soap or similar cleansing agents shall be provided. The requirements do not apply to mobile crews or to normally unattended work locations if employees working at these locations have transportation readily available to nearby toilet and/or washing facilities.

Toilet and washing facilities will be provided at the Boat Basin, Visitors Information Center MRS within the fenced area adjacent to the Boat Basin.

10.12.3 Procedures for Vermin Control

The site will be kept clean and organized. Organics such as foods will be wrapped and then discarded to avoid attracting pests.

10.12.4 Waste Disposal

All sweepings, solid or liquid wastes, refuse, and garbage shall be removed in a manner that avoids creating a menace to health and should be discarded as often as necessary or appropriate to maintain sanitary conditions in the place of employment. A dumpster for garbage will be made available.

10.13 EXCAVATION OPERATIONS

A separate Excavation/Trenching Plan is not required as the majority of intrusive operations are anticipated to be less than 5 feet in depth. Hazards that could potentially be encountered are addressed as physical hazards in the AHA process detailed in Section 12 of the APP. The need to excavate deeper than 5 feet is anticipated to be infrequent, and will be assessed in the field based on site-specific conditions for locations warranting follow-on intrusive investigation. General procedures WESTON employs while conducting excavation operations are discussed in this subsection.

Prior to excavating or performing any intrusive subsurface work, a digging permit will be obtained to ensure all underground utilities have been reviewed and addressed. Any available drawings will also be reviewed to locate any underground utilities prior to intrusive work.

Intrusive operations may be conducted by mechanical or manual means as necessary based on the target investigation depth. When mechanical means are employed to investigate an anomaly(ies), UXO Technician III support will be provided for avoidance during excavation. Mechanical excavation shall be performed in 6-inch lifts for removal to within 12 inches of the anomaly(ies); subsequently, removal shall be conducted using manual means only. Excavation in accordance with this methodology is approved in the ESP governing these activities.

Hazards that could potentially be encountered during excavations are falls, engulfment, and injury due to sidewall collapse. Personnel will not enter excavations deeper than 4 feet below ground surface unless the sidewalls are appropriately sloped. If needed, sampling of soils will be collected from soil situated within the excavator bucker. Where space permits, sidewalls will be stepped back to minimize the potential for sidewall collapse. If conditions are such that the sidewalls cannot be stepped back, then shoring or other controls to prevent collapse shall be utilized. Personnel working around an excavation will adhere to 29 CFR Part 1926 OSHA Subpart P, Excavations and Trenches. No material will be stockpiled within 2 feet of the edge of an excavation.

In accordance with OSHA requirements, all excavation activities will be in compliance with 29 CFR 1926 Subpart P. Specific requirements include routine inspections by a competent person (SSHO or UXOSO) to verify safe work conditions, location of utilities, and appropriate worker knowledge of safe work practices. Applicable federal, state, and/or local permits will be obtained prior to commencing excavation activities.

Protective systems for workers will be in accordance with 29 CFR 1926 Subpart P and encompass one or more of the following: sloping, shoring, or shielding. Although not anticipated to be applicable to this DO, any protective system for an excavation greater than 20 feet in depth (or as otherwise determined by site conditions or 29 CFR 1926 Subpart P) will require the services and approval of a registered professional engineer.

10.13.1 Heavy Equipment Operation

Heavy equipment will be operated under the following conditions according to OSHA Regulations and WESTON Field Operating Procedures:

- The operation of heavy equipment will be limited to authorized personnel specifically trained for this task.
- The operator will use the safety devices provided with the equipment, including seat belts. Backup warning indicators and horns will be operable at all times or a trained spotter will direct equipment operations.
- While heavy equipment is in operation, all personnel not directly required in the area will keep a safe distance from the equipment.
- Personnel will avoid moving into the path of operating equipment, and areas blinded from the operator's vision will be avoided.
- Additional riders will not be allowed on equipment unless it is specifically designed for that purpose, i.e., there is an additional seat with a seat belt.
- The operator will document inspection of heavy equipment daily prior to operation.

10.13.2 Hand Tools and Equipment

Before any machinery or mechanized equipment is placed into use it will be inspected, tested, and certified to be in safe operating condition in strict accordance with the manufacturer’s directions and applicable OSHA regulations. Safety inspections and equipment calibration will be required at the beginning of each workday. Any machinery or equipment found to be unsafe will be staged outside the work zone, and its use prohibited until unsafe conditions have been corrected. Only qualified personnel will operate machinery and mechanized equipment or instrumentation. Equipment deficiencies observed on any item that could affect its safe operation will be corrected before continuing operation; otherwise, the item will be tagged out-of-use. Hand tools will be used according to OSHA regulations. Only tools that are in good condition will be used. Improper and defective tools contribute to incidents. The following safe practices will be observed when using hand tools:

- Use tools in the manner for which they were designed.

- Be sure of footing before using any tool.
- Do not use tools that have split handles, mushroom heads, worn jaws, or other defects.
- Do not use makeshift tools or other improper tools.
- Use spark-proof tools where there are explosive vapors, gases, or residue.

10.14 BOAT SAFETY

10.14.1 Water-Based Geophysical Activities

See boating safety standard operating procedure in **Attachment B** of this SSHP.

10.14.2 Dive Operations

See **Appendix G** of the RI Work Plan for boat safety procedures to be used by the dive subcontractor.

11. SITE CONTROL

The SSHO or UXOSO coordinates access control and security on-site. Because of the hazardous nature of UXO, only essential personnel are allowed in the work zone. Essential personnel are those who have completed the required training and meet medical requirements. The work zone is the work site, encompassing an area large enough to prevent personnel injuries from fragmentation resulting from unintentional or intentional detonations. The ESP developed by USACE for these activities is provided as **Appendix K** to the RI Work Plan.

The control of the demolition site must be maintained during the demolition operations. The personnel who are not essential to demolition operations must evacuate to a safe area. The occupied buildings must be evacuated and the access roads entering the detonation area will be blocked during the explosive disposal operations to ensure that unsuspecting individuals are not placed in jeopardy by the explosion. The UXOSO and Demolition Team Leader will ensure that the area is clear of non-essential personnel and equipment prior to permitting the attachment of the initiation devices to the priming charge.

An observer will be stationed where there is a good view of the air and surface approaches to the demolition site. It will be the responsibility of the observer to notify the Team Leader to suspend firing if any aircraft, vehicle, or personnel are seen approaching the general demolition site.

In the event of a fire or unplanned explosion, site personnel will be responsible for extinguishing the fire. If they are unable to do so, they will notify the NASA Wallops Flight Facility Fire Department Main Station #25 and evacuate the area. NOTE: Do not attempt to fight explosive fires.

Prevailing weather condition information will be obtained from a reliable source. These data will be logged before each on-site detonation. The demolition charges will not be primed or connected for electrical firing during the approach or presence of a thunderstorm. Other weather conditions (high winds, dust storms, temperature inversions, low altitude clouds, or cloud coverage of more than 50%) may adversely impact planned demolition operations. The SUXOS will consider these conditions when determining whether or not to conduct demolition operations. If the weather conditions preclude the detonation, WESTON personnel will secure and cover the UXO with sandbags and properly mark the area, until favorable conditions allow the demolition. The personnel will remain at the Boat Basin, Visitors Information Center MRS as long as the possibility of fire exists as the result of a demolition operation.

The potential for cross contamination is not a significant risk to this project based on the anticipated characterization tasks. During on-site operations, the SUXOS will order operations to cease if nonessential personnel are observed within the operating area. To ensure safety, site controls include the following:

- Eating, drinking, and smoking are prohibited except in designated areas.
- Unexploded ordnance operations cease if nonessential personnel are present.
- The SUXOS, SSHO, UXOSO, or designee, will escort authorized site visitors.
- All personnel entering the site, including visitors, shall wear the proper PPE and sign in and out on the site visitors' log.
- The SSHO or UXOSO maintains the Site Control Log to ensure accurate accountability of personnel on-site.
- The SSHO or UXOSO provides a SSHP/MEC safety briefing to all personnel entering the site to inform them of potential site hazards. All personnel must acknowledge this briefing by signing the SSHP Review Form.
- In case of an emergency, personnel will exit the site and move to a designated safe area. The SSHO or UXOSO will determine the designated safe area that is located upwind of the site outside of the fragmentation area. The SUXOS will notify the USACE Ordnance and Explosives Safety Specialist and Project Manager if an emergency warrants site evacuation.

12. PERSONAL HYGIENE AND DECONTAMINATION

12.1 PERSONAL HYGIENE

Employees will practice sound hygiene practices, including washing hands, face, and arms at the hygiene station after operations have concluded. Appropriate hand-washing facilities with soap will be available in the fenced area adjacent to the Boat Basin, Visitors Information Center MRS. In addition, hand sanitizer will be available on-site. Following Centers for Disease Control guidelines, personnel should wet their hands with clean running water and apply soap. A hygiene station will be located in the fenced area adjacent to the Boat Basin, Visitors Information Center MRS. Use warm water if it is available. Rub hands together to form lather and scrub all surfaces. Continue rubbing hands for 20 seconds. Rinse hands well under running water then dry hands using a paper towel. If possible, use that same paper towel to turn off the faucet.

12.2 PERSONNEL DECONTAMINATION

Chemical contamination that exists at the Boat Basin, Visitors Information Center MRS is of low concentrations. Therefore, during ground-based geophysical investigation activities, materials and equipment will not need to be brought through a contamination reduction zone (CRZ). However, instruments and tools will be routinely wiped down with a clean, damp rag or towel to prevent contaminants from being taken to clean areas and from accumulating dirt. Such accumulations can adversely affect equipment operation. Rags will be properly disposed of.

A personnel decontamination station shall be set up in the CRZ for personnel to remove contaminated PPE and to wash when exiting the exclusion zone. Personnel shall be aware of procedures used to decontaminate exclusion zone (EZ) personnel, equipment, and sampling containers. Disposable PPE and other items shall be placed in heavy-duty plastic bags and properly disposed of. Specific decontamination procedures are presented below.

Level D, Modified Level D, and Level C Personnel Decontamination

The steps to be followed for decontamination of personnel using Level D and modified Level D PPE include:

- Step 1: Equipment will be dropped (if any is used).
- Step 2: Boot covers (if worn) will be removed and placed in a disposable container.
- Step 3: Outer gloves (if worn) will be removed and placed in a disposable container.
- Step 4: Coveralls (if worn) will be removed and placed in a disposable container.
- Step 5: Inner gloves (if worn) will be removed and placed in a disposable container.
- Step 6: Hands will be washed and rinsed.

The steps to be followed for decontamination of personnel using Level C PPE include:

- Step 1: Equipment will be dropped (if any is used).
- Step 2: Boot covers (if worn) will be removed and placed in a disposable container.
- Step 3: Outer gloves (if worn) will be removed and placed in a disposable container.
- Step 4: Splash gear will be removed, cleaned, and hung to dry (if worn).
- Step 5: Tyvek or Saranex suits will be removed and placed in a disposable container.
- Step 6: Respirators will be removed and prepared for reuse or decontamination
- Step 7: Inner gloves (if worn) will be removed and placed in a disposable container.
- Step 8: Hands will be washed and rinsed.

12.3 SAMPLE CONTAINER DECONTAMINATION

Sample containers shall be laboratory-cleaned prior to use. Following sample collection and closure of the container, the outside of the container shall be wiped clean. The sample container shall then be placed into the appropriate shipping container.

12.4 DISPOSAL OF DECONTAMINATION WASTE

After all liquids and disposable clothing have been characterized, they will be disposed of properly. Equipment must be cleaned prior to demobilization. Wash waters and residues must be collected for treatment and/or proper disposal.

- Decontamination liquids (i.e., soap and water) will be collected in appropriately sized U.S. Department of Transportation (DOT)-approved containers, characterized for waste disposal (by means of sample analysis results), and marked with approved green (non-hazardous waste) or red (hazardous waste) labels. Arrangements will be made for collection.

- Small quantities of non-hazardous decontamination liquids may be evaluated for disposal via the sanitary sewer.

- Decontamination solids (i.e., decontaminated PPE) will be collected in heavy-duty plastic bags and characterized for waste disposal (by means of sample analysis results). Solids will be classified and disposed of as non-hazardous or hazardous waste according to waste classification by means of sample results. If, according to analysis or sample results, the decontamination solids are deemed hazardous, they will be placed in DOT-approved containers and disposed of.

12.5 EMERGENCY DECONTAMINATION

In the event any personnel at the Boat Basin Visitors Information Center MRS are injured, or appear to exhibit signs of chemical exposure, emergency decontamination will be performed and the proper notifications according to **Table 15-1** will be made. It is worthy to note that essential medical care will not be delayed if personnel are in critical condition. Emergency decontamination in this instance will not occur. Supplies for emergency decontamination will include:

- Eyewash for ocular injury.
- 5-gallon bucket, full of potable water.
- First aid and bloodborne pathogens kit.
- Plastic sheeting.

These materials will be on-site in addition to the general decontamination equipment required for standard decontamination activities. If a minor injury occurs, regular decontamination procedures will be followed as presented in Section 12.1. If emergency decontamination is possible and necessary, the following procedures will be followed:

- If exposure to liquid chemicals occurs, the material will immediately be washed or rinsed off.

- If it does not cause a lengthy delay in obtaining treatment, outer garments will be removed.

- Any PPE will be removed.

- If contaminated clothing cannot be removed, the victim will be wrapped with plastic sheeting prior to transport to the hospital in an ambulance.

13. EQUIPMENT DECONTAMINATION

An equipment decontamination station shall be set up in the CRZ for equipment to be decontaminated when exiting the EZ. Because equipment and vehicle (i.e., drill rig) decontamination is difficult, unnecessary equipment and vehicles shall not be brought into the EZ.

If decontamination is necessary, the following procedures should be followed:

- Within the designated decontamination area, a high-pressure power washer or detergent and water shall be used with a long-handled brush to remove potential contamination from areas contacting surfaces of the EZ (i.e., tires, equipment bases, and shovels).
- Sampling equipment (e.g., split-spoons, sampling spoons, or bowls) will require additional decontamination (after initial soapy water wash) using deionized water and a nitric acid rinse. Sampling equipment will be placed on plastic sheeting to dry.
- Electrically powered equipment shall be de-energized prior to contacting water.
- Care shall be exercised to capture potentially contaminated washwater for subsequent testing and proper disposal.
- Systems for containing decontamination washwater will include permanent decontamination pads with sumps, commercially available temporary decontamination pads, and "kiddie-pools" (for smaller equipment).
- Personnel performing equipment decontamination will wear Level D modified PPE (or Level C if appropriate) with safety goggles or a splash shield.

14. EMERGENCY EQUIPMENT AND FIRST AID EQUIPMENT

14.1 FIRST AID

Two appropriately trained WESTON or subcontractor personnel will provide on-site First Aid and CPR support. In the event specialized or elevated care is necessary, either WESTON or the local EMT and/or ambulance service will transport the injured person to the appropriate medical facility. First Aid and CPR certifications for site personnel are provided in **Attachment 3** of the APP and will be maintained on-site.

14.1.1 Medical Supplies

Medical supplies required to be on-site are listed in **Table 14-1**. The minimum requirements of ANSI Z308.1-1998 and EM 385-1-1, November 2008, Section 03.B (**Table 14-2**), will be met.

14.2 EMERGENCY EQUIPMENT

The emergency equipment listed in **Table 14-1** will be maintained in proper working order and frequently inspected for completeness during site operations. **Table 14-1** lists the minimum equipment necessary.

Table 14-1 Emergency Equipment

Equipment	Location	Operation
First Aid kit	Support vehicle(s)	All operations
Bloodborne pathogens kit	Support vehicle(s)	All operations
Eye wash	Near active work area(s)	Intrusive operations
Air horn	Support vehicle(s)	All operations
Spill kit	Near active fueling operation(s)	As needed for fueling operations
10-pound fire extinguisher	Support vehicle(s)	All operations
Allergy response kit	Support vehicle(s)	All operations, as needed based on staffing requirements

Each team vehicle will contain the equipment listed above. First Aid kits will be sufficient to accommodate the maximum number of people (including visitors) on-site at any given time. The kits will be located at each work site, and all personnel will be informed of their locations. All kit locations will be equipped with adequate water and other supplies necessary to cleanse and decontaminate wounds. The contents of First Responder kits are presented in **Table 14-2**.

Table 14-2 Contents for First Responder Kit

Description	Qty	Description	Qty
Absorbent compress, 32 sq. inches	1	Adhesive Tape, 3/8"x 5 yds	1
Adhesive Bandages, 1"x 3"	16	Analgesic/ pain reliever	16
Antibiotic Treatment, 1/32 Oz.	6	Antiseptic Wipes	6
Bandage Compress, 2" x 36"	4	Bandage Compress, 3" x 36"	2
Bandage Compress, 4" x 36"	1	Breathing Barrier	1
Burn Dressing, 4" x 4"	1	Burn Treatment, 1/32 Oz.	6
CleanseAway Poison Oak & Ivy Cleanser	1	Cold Pack, 4"x 5"	1
Eye Covering, 2.9 sq. inches per eye	2	Eye Wash, 4 Oz.	1
Medical Exam Gloves	2 pair	Roller Bandage, 2" x 6 yds	2
Roller Bandage, 4" x 6 yds	1	Sterile Pad, 3" x 3"	4
Triangular Bandage, 40 x 40 x 56 inches	1		
Contents for BBP Kit			
Breathing Barrier	1	Bodily Fluid Disposal Kit	1
Medical Exam Gloves	1 pair	PDI SaniCloth wipes	2

14.3 FIRE EXTINGUISHERS

The work site will be equipped with a dry-chemical fire extinguisher. Dry-chemical fire extinguishers will be provided at any other site location where flammable materials may present a fire risk. The SUXOS, Project Manager, and USACE Points of Contact will be notified immediately after any fire incident occurring during site activities. All regulations governing approved areas for smoking and spark generation will be strictly followed.

15. EMERGENCY RESPONSE AND CONTINGENCY PROCEDURES

The SSHO or UXOSO will respond to all emergencies. Emergency response procedures will be rehearsed to permit evaluating the effectiveness of the planned response capabilities. In the event that the SSHO or UXOSO is involved in the emergency, a designee will assume responsibility. Specific reporting responsibilities are as follows:

- Notify appropriate individuals, authorities, and/or health-care facilities of the activities and hazards of the emergency.

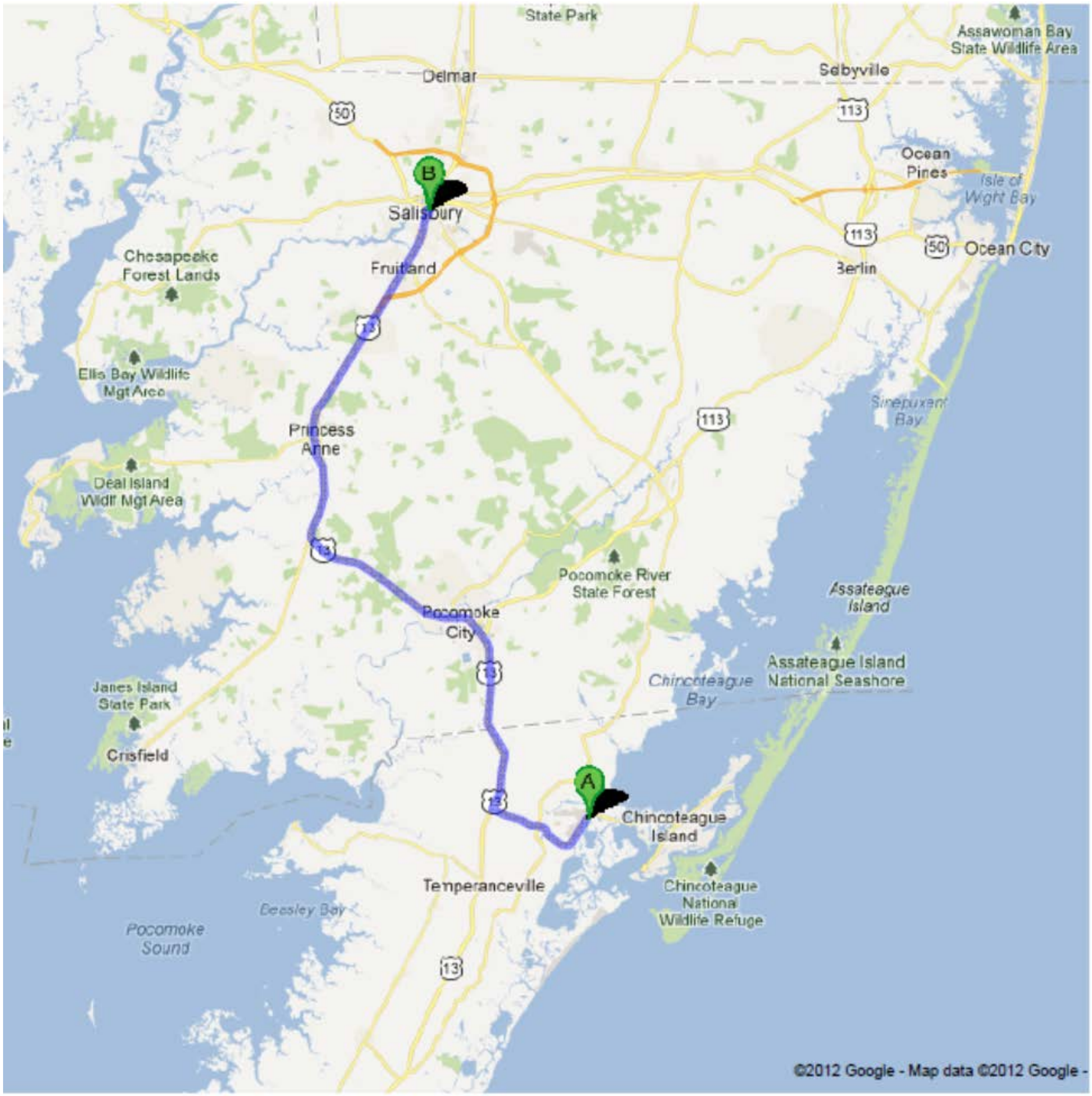
The SSHO or UXOSO will take the following steps to prepare for an emergency and to minimize the impacts:

- Ensure that the following safety equipment is available at the site: eyewash station, First Aid supplies, and fire extinguishers.
- Have working knowledge of all safety equipment available at the site.
- Ensure that a map detailing the most direct route to the hospital is prominently posted, and complete with all necessary telephone numbers.
- Train employees on the basic protocol to be followed in the event of an emergency, i.e., the employees will first stop work, then warn affected employees, and/or subcontractors in the area. The area will then be isolated and pertinent notifications made.
- Verify contact numbers for emergency resources prior to work beginning.
- Ensure the daily log has employee names and sub-contractors on-site so that all individuals can be accounted for in the event of an emergency.
- Conduct a test of the emergency plan in the form of a drill to ensure effectiveness.
- Discuss emergency procedures and emergency equipment location with all site personnel including visitors to the Boat Basin, Visitors Information Center MRS.

15.1 PRE-EMERGENCY PLANNING

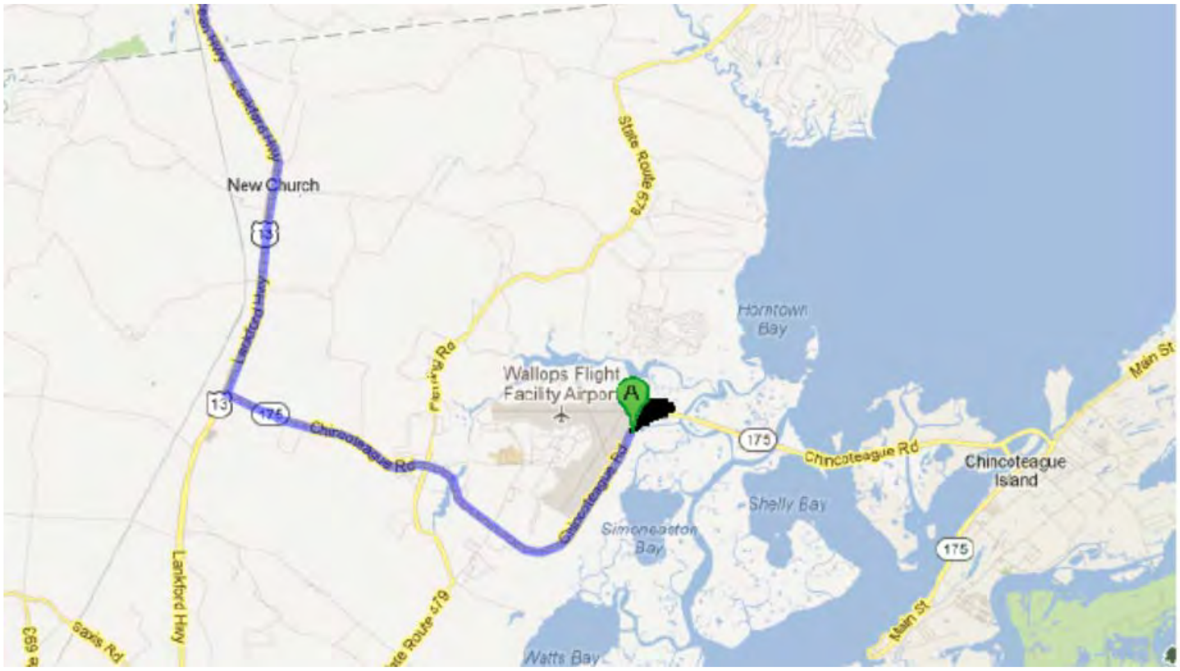
Peninsula Regional Medical Center is located at 100 East Carroll Street, Salisbury, MD. A map showing the route to the hospital (see **Figure 15-1**) will be posted in each site vehicle and a written description of the route will be attached to the map. The hospital route, travel distance, and driving time will be verified prior to work initiation.

Figure 15-1 Hospital Route to Peninsula Regional Medical Center

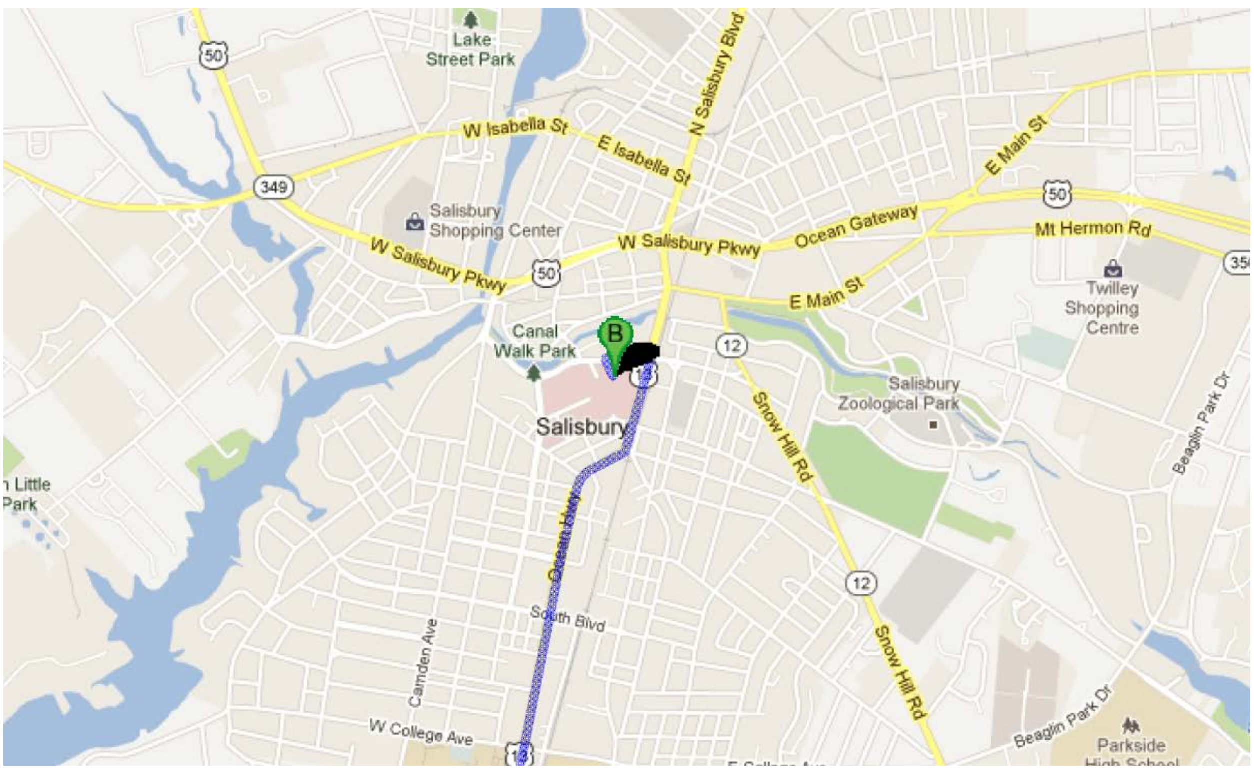


<u>General Overview to Hospital</u>

Note: This map is subject to Google's Terms of Service, and Google is the owner of rights therein.



Wallops Flight Facility Surface Street



Hospital Vicinity Surface Streets

Start Location:	**NASA Visitor Center, Wallops Island, VA**
End Location:	**100 East Carroll Street, Salisbury, MD**
Total Distance:	**42 miles**
Total Time:	**54 minutes**

Directions:

NASA Visitor Center, Wallops Island
NASA Wallops Flight Facility, 2, VA 23337

175	1. Head **southwest** on **VA-175 W/Chincoteague Rd** toward **Wallops Neck Rd** About 8 mins	go 5.8 mi total 5.8 mi
13	2. Turn right onto **US-13 N/Charles M Lankford Jr Memorial Hwy/Lankford Hwy** Continue to follow US-13 N Entering Maryland About 36 mins	go 30.9 mi total 36.7 mi
13	3. Exit onto **US-13 BUS N/S Fruitland Blvd** toward **Fruitland/Salisbury** Continue to follow US-13 BUS N About 9 mins	go 5.2 mi total 42.0 mi
	4. Turn left onto **E Carroll St** About 1 min	go 0.1 mi total 42.1 mi
	5. Turn left to stay on **E Carroll St** Destination will be on the right	go 249 ft total 42.1 mi

100 E Carroll St, Salisbury, MD 21801

These directions are for planning purposes only. You may find that construction projects, traffic, weather, or other events may cause conditions to differ from the map results, and you should plan your route accordingly. You must obey all signs or notices regarding your route.

WESTON has evaluated the Emergency Medical Services. WESTON's form for evaluation and confirmation of these services is presented in **Attachment 7** of the APP.

The SSHO or UXOSO will have a roster of individuals on-site so that they can be accounted for in the event of an emergency.

Pre-task coordination with local emergency response providers for the water-based geophysical investigations and the underwater operations will be conducted directly between subcontract personnel conducting activities and the local fire department.

15.2 PERSONNEL AND LINES OF AUTHORITY FOR EMERGENCY SITUATIONS

Local emergency service support will be utilized if necessary. The SSHO or UXOSO will be appointed as an Emergency Coordinator (EC) and a system implemented to provide a common framework within which people can work together effectively.

15.3 CRITERIA AND PROCEDURES FOR EMERGENCY RECOGNITION AND SITE EVACUATION

15.3.1 Medical Emergency and Personal Injury

The first worker who notices that a medical emergency or personal injury has occurred shall immediately make a subjective decision whether the emergency is life-threatening and/or otherwise serious and will then proceed as described in the following subsections. Chemical contamination that exists at the Boat Basin, Visitors Information Center MRS is of low concentrations; therefore, emergency decontamination of personnel is not anticipated.

15.3.1.1 Life-Threatening and/or Otherwise Serious Incident

If a life-threatening incident occurs, emergency medical assistance will be immediately requested. If an apparent life-threatening and/or otherwise serious incident has occurred, the first person who identifies the situation will summon the SSHO or UXOSO or SUXOS - Site Manager. The SSHO, UXOSO, or the Site Manager, whoever arrives first, will assume the role of EC. The EC shall be apprised of the situation and told where the injured person(s) is/are located. As the EC proceeds to the accident scene, communications channels shall be opened and kept on standby until the EC has surveyed the scene and performed a primary survey of the injured person.

The EC shall then determine whether emergency assistance should be summoned and the information that must be relayed, and shall provide emergency action principles that are consistent with the injury. The EC shall appoint a staff person or persons who will meet the emergency responders and take them quickly to the injured person. If necessary, decontamination of the individual shall be performed at the direction of the EC.

15.3.1.2 Non-Life-Threatening Incident

If it is determined that no threat to life is present, the worker shall assist the injured person to a safe location and contact the SSHO or UXOSO. The injured person will then be treated and monitored in accordance with standard First Aid procedures and this SSHP.

15.3.2 First Aid Procedures

First Aid kits on-site will comply with the criteria contained in ANSI Z308.1-1998. A list of items contained in the kit is presented in **Table 14-2**. In case of injury, the following procedures apply:

- Trained personnel will use approved measures for treatment.
- For minor injuries, routine First Aid procedures will be used.
- For major injuries, an ambulance will be called immediately and the appropriate First Aid administered while awaiting the arrival of the ambulance.

15.3.3 Worker Injury or Illness

The SSHO or UXOSO will be responsible for monitoring the general health of site workers. Site illnesses, conditions, or injuries that can be expected given the working conditions include hypothermia; frostbite; exposure to chemicals found at the Boat Basin, Visitors Information Center MRS; construction-related injuries; insect bites; and injuries caused by slips, trips, and falls.

These conditions will be prevented by properly training site workers in the appropriate use of health and safety equipment, dressing appropriately, monitoring the breathing zone atmosphere, and maintaining good housekeeping procedures. These activities are discussed in more detail throughout this SSHP.

The specific response to an injury or illness will depend on its type and severity, but in general, First Aid will be administered in the field by the SSHO or UXOSO, who will be trained in First Aid and CPR. The worker may then be transported to the hospital designated in this SSHP. General guidelines for First Aid are as follows:

- For minor injuries, routine First Aid procedures will be used.
- For major injuries, an ambulance will be called immediately and the appropriate First Aid administered while awaiting arrival of the ambulance.
- Trained personnel will use approved measures to administer treatment.

15.3.4 Emergency Response

Rescue provisions specific for water-based geophysical investigations are provided in **Attachment B** to this SSHP, and the underwater operations including diving activities are provided in **Appendix G** of the RI Work Plan.

During a ground-based emergency the following actions will be taken, with some actions conducted concurrently. No one will attempt emergency response and/or rescue until the situation has been assessed and the appropriate response outlined. Field activities will cease, personnel will be warned, and the area isolated. The following procedures are for any emergency response:

- Fire or explosion and prevention.
- Spills and spill prevention.
- Inclement weather.
- Evacuation planning.

The minimum actions taken will be as follows:

- All work will cease.
- All affected employees and subcontractors will be warned and/or notified of the emergency.

- The area will be isolated.
- Appropriate notifications will be made.

Rescue and/or response may include the following:

Assess: Assess existing and potential hazards to site personnel and the off-site population.

Determine:

- The need for and extent of a response.
- The need for evacuation of site personnel and off-site population.
- The resources needed for evacuation and response.

Survey Casualties:

- Locate all injured persons and assess their condition.
- Determine resources needed to stabilize and/or transport them.

Request Aid: Contact the required off-site/on-site personnel or facilities, such as the ambulance, fire department, and/or police.

Allocate Resources: Allocate on-site personnel and equipment to rescue and initiate incident response operations.

Extricate: Remove or assist injured persons from the area, using appropriate PPE equipment and procedures.

Control: As trained, and as determined safe, assist in bringing the hazardous situation under complete or temporary control and use measures to prevent the spread of the emergency.

Decontaminate: A low risk of chemical hazards is associated with this activity and with potential site contamination. Contaminant levels are low based on previous SI results. Proper use of modified Level D PPE (or Level C if appropriate), including nitrile gloves, will mitigate risk for exposure. Monitoring in accordance with the SSHP will be conducted. Remove any protective clothing. There is minimal risk of exposure to petroleum fuels and lubricants. Vehicles will not be overfilled. Caution will be used when refueling. Refueling will not be conducted within 100 feet of an open flame or ignition source.

Stabilize: Administer any medical procedures that are necessary before the injured person(s) can be moved. Stabilize or permanently fix the hazardous condition. Attend to what caused the emergency and anything damaged or endangered by the emergency.

Transport: Transport personnel following any necessary decontamination for unforeseen or unexpected potential exposure or measures necessary to avoid contaminating others. Take measures to minimize chemical contamination of the transport vehicle, ambulance, and hospital personnel.

Casualty Logging: Record name of individual, time, destination, and condition upon transport.

Evacuate:

- Move site personnel to a safe distance upwind of the incident.
- Monitor the incident for significant changes. The hazards may diminish, permitting personnel to reenter the site, or hazards may increase and require public evacuation.

Casualty Tracking: Record disposition, condition, and location.

Notification: Notify appropriate individuals and/or entities.

15.3.4.1 Evacuation Routes and Procedures

Personnel shall exit the site by the nearest means of egress during accidents requiring evacuation. Once off-site, personnel shall assemble at the location designated by the SSHO or UXOSO for accountability. Any missing personnel shall be brought to the attention of the responders.

15.3.4.2 Emergency Alarm Systems

Portable telephones and/or two-way radios will be available for site and emergency communications (Project Manager, SUXOS, SSHO or UXOSO, and field staff). Emergency communications and signals are described in the tables below. All field personnel will be trained regarding site emergency signals.

Emergency service personnel (police, fire, ambulance) will be summoned by contacting 911.

15.3.4.3 Hand and Emergency Signals Communications

It is essential that workers have a means of communicating rapidly and effectively during heavy equipment operations, construction, hazardous waste operations, and other types of activities. Communication while wearing PPE can be extremely difficult. The table below presents established guidance for uniform communication protocols to be used, as needed, in field operations.

General Hand Signals

Signal	Meaning
Point index finger toward self	I; me
Point index finger toward object	It; them
Point index finger toward person	You; them
Circle index finger at group	We; us; all of us
Pointed finger on extended arm	Look in that direction
Beckon with index finger	Come here
Point with thumb in a particular direction	Move this way; go this way
Hold index finger up near head	Wait
Slowly ease palm face down	Relax; slow down
Put palm over brow	Scout it out; check it out
Move hand far away from body	Stay away
Hands on top of head	Need assistance
Grip partner's wrist or place both hands around partner's arm	Leave area immediately
Thumbs up	OK; I'm all right
Thumbs down	No; negative; bad; not OK
Hand gripping throat	Cannot breathe; out of air
Wave hands over head from side-to-side	Attention; stand-by for the next signal
Swing hand from direction of person receiving signal to directly overhead and through in circle	Come here
Clenched fist of extended arm	Stop motion/hold position
Draw index finger across front of throat	Shut off engine; cut off power; quit
Place palm face down and rotate from side to side	Unsure; can't decide
Form a circle with thumb and index finger	OK; I understand; agree
Military salute	I understand and will comply

Emergency Signals

Emergency signals are critical for alerting workers of danger and to maintain site control during an emergency. Bullhorns, radios, air horns, and similar devices will be used as described above for emergency communications. Emergency hand signals should be used as a secondary means of communication.

Signal	Meaning
One long sound/blast of the emergency alarm signal, air horn, siren, whistle	Emergency situation, face safety watch and watch or listen for directions
Pause; followed by a number of short sounds, 1, 2, 3, or 4	Evacuate to the predesignated emergency meeting place indicated by the number of sounds
Two long blasts of the emergency alarm signal, air horn, siren, whistle	All clear
Point one arm in direction of evacuation, make a large circling motion with the other arm in direction of evacuation	Evacuate the area
Hand clutching throat	Cannot breathe; out of air
Grip partner’s wrist or place both hands around partner’s arm	Leave area immediately

15.3.4.4 Radio Communications

Personnel will use the radio only for necessary work-related communication. When radio communication is used, personnel will be instructed in the use of the radio, in which channel should be used, and in the following radio guidelines:

- Speak clearly.
- Call the name or call sign of the individual or unit you are trying to reach and identify yourself (e.g., “Unit One; this is Safety”).
- Wait for acknowledgement (e.g., “Safety, this is Unit One”) before you continue transmission.
- Proceed with your transmission. When finished, say “Over” when you expect a response. When transmission is complete and no response is expected, say “Out.”
- When receiving a radio call, acknowledge the call immediately unless doing so would interfere with safety.
- If a transmission is incomplete or not understood, request clarification.

- Emergency calls should begin with the words "Emergency, Emergency, Emergency." Give absolute priority to emergency communication. Unless answering or aiding the emergency call, do not use the radio until certain it will not interfere with further emergency communication.
- Ensure that radios are charged and tested prior to each work shift and as necessary thereafter.
- Malfunctioning radios must not be used and must be replaced immediately.
- Do not transmit false information or unidentified communication.
- Profanity and indecent language are prohibited. Transmittal of sensitive information over the radio is prohibited.

15.4 DECONTAMINATION AND MEDICAL TREATMENT OF INJURED PERSONNEL

A low risk of chemical hazards is associated with this activity and with potential site contamination. Contaminant levels are low based on previous SI results. Proper use of modified Level D PPE (or Level C if appropriate), including nitrile gloves, will mitigate risk for exposure. Monitoring in accordance with **Section 8** of the SSHP will be conducted.

15.5 EMERGENCY MEDICAL FACILITIES AND PHONE NUMBERS FOR RESPONDERS

Peninsula Regional Medical Center is located at 100 East Carroll Street in Salisbury, MD, as shown in **Figure 15-1**, which shall be prominently posted in all field vehicles with the emergency telephone numbers listed in **Tables 15-1** through **15-3**. The emergency telephone numbers, along with the APP, OSHA 300 Log, deficiency tracking system documents, safety and health promotional posters, date of last work day injury, and OSHA Safety and Health poster, will be kept unobstructed and readily available to the workers.

15.6 CRITERIA FOR ALERTING LOCAL COMMUNITY RESPONDERS

In the event of an emergency requiring outside emergency services, WESTON personnel will immediately dial 911 to contact the appropriate organization. Following the phone call, WESTON personnel will contact on-site personnel to inform them that emergency service personnel and equipment will be entering the work area. Subsequent to these notifications, appropriate WESTON personnel will be contacted and informed regarding the situation.

Table 15-1 Emergency Contact Numbers

Organization and/or Point of Contact	Telephone Number
Emergency Service (Ambulance, Fire, Police)	911
Police (non-emergency) Accomack County Sheriff 23323 Wise Court Accomac, VA 23301	(757) 787-1131
Fire (non-emergency) Station 4 Atlantic Fire Company (volunteer fire, no EMS) 10071 Atlantic Road Atlantic, VA 23303	(757) 824-4844
NASA Wallops Flight Facility Fire Department Main Station #25 Wallops Flight Facility, VA	(757) 824-1300
Station 20 Oak Hall Rescue (volunteer fire and full-time EMS)	(757) 824-3370
Hospital Peninsula Regional Medical Center 100 East Carroll Street Salisbury, MD 21801	(410) 546-6400
VA State Police	911
National Response Center	(800) 424-8802

Notes:

*See **Attachment 7** of APP for EMS and/or Rescue Confirmation and Evaluation.
EMS = emergency medical service
NASA = National Aeronautics and Space Administration

Table 15-2 WESTON and USACE Emergency Contact Numbers

Organization and/or Point of Contact	Telephone Number
USACE Baltimore District Project Manager: Sher Zaman	(410) 962-3134 (office) (410) 428-2318 (fax)
USACE Ordnance and Explosives Safety Specialist: Lowell Martin	(410) 350-9860 (cell)
WFF Safety Office	(757) 824-2518
VDEQ Emergency Response	(804) 698-4159
EPA Region III Emergency Response	(215) 814-3033
WESTON Emergency (24 hour) (West Chester)	(610) 692-3000
WESTON Project Manager: Tony Pace	(757) 819-5310 (office) (757) 362-2461 (cell)
WESTON CIH: George Crawford	701-3771 (office) (484) 437-5976 (cell)
WESTON East Division EHS Officer: Lawrence Werts	(610) 701-3912 (office) (215) 815-6237 (cell)
Federal Team Health and Safety Officer: Chris Baer, CSP	(610) 701-3653 (office) (484) 239-4249 (cell)
WESTON Corporate EHS Director: Bill Irwin	(610) 701-3684 (office) (267) 918-8371 (cell)
WESTON Medical Programs Manager: Bill Irwin	(610) 701-3684 (office) (267) 918-8371 (cell)

Notes:

CIH = Certified Industrial Hygienist

CSP = Certified Safety Professional
EHS = Environmental Health and Safety
EPA = U.S. Environmental Protection Agency
USACE = U.S. Army Corps of Engineers
WESTON = Weston Solutions, Inc.
VDEQ = Virginia Department of Environmental Quality
WFF = Wallops Flight Facility

Table 15-3 Other Emergency Contact Numbers

Organization and/or Point of Contact	Telephone Number
Poison Control Center	(800) 962-1253
Spill Response - CHEMTREC	(800) 424-9300
WorkCare WESTON Medical Director Dr. Peter Greaney WorkCare WESTON Program Administrator Heather Lind	From 06:00 to 16:30 Pacific Time, call 800-455-6155 dial 0 or extension 175, Heather Lind to request the on-call clinician
After-Business Hours Contact (Emergency Only)	16:31 to 05:59 Pacific Time and weekends and Holidays, call 800-455-6155 and dial 3 to reach the after-hours answering service. Request that the service connect you with the on-call clinician or the on-call clinician will return your call within 30 minutes.
WESTON Emergency (24 hour) (West Chester)	(610) 701-3720

The majority of the activities at the Boat Basin, Visitors Information Center MRS will be serviced by the NASA Wallops Flight Facility Fire Department Main Station #25.

15.7 PERSONAL PROTECTIVE EQUIPMENT AND EMERGENCY EQUIPMENT

Level D and modified Level D PPE (or Level C if appropriate) will be worn on-site. The emergency equipment listed in **Table 14-1** will be maintained in proper working order and frequently inspected for completeness during site operations. The list identifies the minimum equipment necessary.

Each team will have a First Aid kit sufficient to accommodate the maximum number of people (including visitors) on-site at any given time. The kits will be located at each work site, and all personnel will be informed of their location(s). Kit locations will be equipped with adequate water and other supplies necessary to cleanse and decontaminate burns and other wounds.

15.8 FIRE PREVENTION, PROTECTION, AND RESPONSE

Potential sources of fuel include diesel, gasoline, and combustible loads such as paper and leaves. Sources of ignition include combustion engines and electrical sources. Flammable liquids will be properly stored in safety cans and/or flammable cabinets. Housekeeping will be performed daily to limit fuel loads. Types of fire suppression systems include multipurpose ABC portable fire extinguishers. In case of fire, evacuate the building or area immediately. Activate fire alarms and/or dial 911 or the established Fire Emergency Number from a safe location. Indicate what is happening, the location of the fire, and whether there are injuries. Comply with requests from the 911 operator for information. Do not hang up until told to do so by the operator, or allow the operator to hang up first. Upon completion of the emergency phase, comply with incident notification procedures.

NOTE: No attempt will be made to fight a fire if UXO may be present. If this occurs, all personnel will evacuate and call the local fire department listed in **Table 15-1**.

If the fire is small and manageable with fire-extinguishing equipment at hand, and you are trained in the use of this equipment, you may make the decision to use this equipment while waiting for advanced assistance. Never place yourself in danger, always have a plan for escape, and never attempt to fight a fire if there are any doubts about the type of fire or your ability to successfully fight the fire. Never allow the fire to get between you and your escape route.

15.8.1 Wild Fires

15.8.1.1 Prevention

Site personnel should practice smart fire safety habits and watch out for hazardous conditions. If conditions are dry, wildfires can pose a threat—not only because there is plenty of fuel to burn, but also because rural areas and remote locations often do not have easy access for firefighters. There also is a chance that embers from a fire a mile or more away may fall onto nearby vegetation and cause them to catch fire. The following preventive measures will be observed:

- Smoke only in designated areas.
- Avoid driving through high grass or areas where vehicle exhaust or hot engine surfaces could cause fires.
- Keep a fire extinguisher handy.
- Be extra cautious during the dry season and observe warnings and prohibitions established by the Forestry Service or other agencies.
- Be aware of wild fires in neighboring areas.

15.8.1.2 Awareness and Response

Wildfires can spread quickly and without warning. A subtle shift in the wind could send the flames in your direction even though authorities may have deemed your area safe. Make sure you have a plan in place:

- Be aware of wildfires in neighboring areas.
- Do not attempt to fight forest fires. If a fire or smoke is observed, notify all site personnel, initiate evacuation, and report the fire to the designated emergency agencies.
- Designate a place to meet if there is a fire.
- Identify multiple places you could evacuate to, like a motel outside the danger zone.

If you are driving:

- Roll up your windows and close your air vents.
- Drive slowly and turn on your headlights.
- Don't drive through heavy smoke.

It is very easy to panic, but if you remain calm and prepare for emergency situations, you will increase your chances of making a safe evacuation.

15.8.2 Fire Extinguishing Equipment

Fire extinguishing equipment that meets 29 CFR Part 1926, Subpart F, shall be on hand and ready for use to control fires.

1. Flammable and Combustible Materials (liquids, gases):

   - Properly label, store, handle, and use flammable materials.
   - Do not permit smoking or use of open flame-producing devices within 50 feet of flammable and combustible materials.
   - Obtain MSDS for all flammable materials in use and ensure all personnel are aware of hazards.
   - Label all containers with contents, the word "Flammable," and in accordance with hazard communication requirements.
   - Store materials in well ventilated areas that are free of ignition sources and flame or sparks.
   - Ensure that incompatible materials are stored in locations remote from each other (e.g., keep flammables from oxidizers).
   - Limit quantities to minimum required.
   - Store cylinders in upright and secure positions.
   - Bond and ground containers as (and where) necessary.
   - Use proper storage cabinets for flammable and combustible materials. Contact EHS Staff for assistance.
   - Use only approved containers.
   - Use and dispense only in well-ventilated areas.

2. Combustible Materials (solids):

   - Solid combustible materials include wood, paper, and cloth. Proper housekeeping reduces concerns for combustion of these materials. Use proper receptacles for disposal and dispose of solid combustible materials routinely.

3. Oxidizers:

   - An oxidizer is a substance that increases the flammability of materials, allowing them to burn more easily. Examples include pure oxygen, chlorine, and ammonium nitrate. Store oxidizers in a location remote from flammable and combustible materials.

4. Electric Appliances:

   - Do not use electric appliances near flammable or combustible materials. Never place an appliance on an unstable surface. Use only Underwriters Laboratories (UL)- or Factory Mutual Research Corp. (FM)-approved appliances. Follow the manufacturer's recommendations or requirements for use and maintenance. Obtain approval from EHS staff prior to purchase and use of portable heater units in office settings. Do not leave portable heaters on and unattended.

5. Smoking:

   - Smoking is prohibited indoors. Smoking is allowed only in outdoor, designated areas. Smokers are to maintain smoking areas in a clean and safe condition. Ensure that receptacles for disposal of cigarettes and other smoking materials are appropriately constructed, free of combustible debris, and, when necessary, are cool before being emptied into waste receptacles.

6. Housekeeping:

   - All personnel are responsible for keeping work areas free of combustible materials and debris.

   - Weeds and grass must be properly maintained to limit potential fire hazard.

16. LOGS, REPORTS, AUDITS, INSPECTIONS, AND RECORDKEEPING

16.1 SAFETY LOG

The SSHO or UXOSO will maintain a safety log of all safety-related activities. The SSHO or UXOSO is responsible for ensuring that health and safety activities for the day, as well as safety meeting minutes, are documented in the safety log or filed appropriately. In addition, the SSHO or UXOSO will maintain a Boat Basin, Visitors Information Center MRS OSHA 300 log.

16.2 TRAINING LOG

The SSHO or UXOSO is responsible for ensuring that all training conducted relative to job site activities is documented appropriately.

16.3 SITE CONTROL LOG

A log of all personnel visiting, entering, or working on the site will be maintained. The log will include the following: date, name, agency or company, and the time entering and exiting the site. This information, including dates, will be recorded in the site control log.

16.4 INSPECTION FORMS

Daily safety and health inspections will be conducted by the SSHO or UXOSO with the results recorded in the safety log. The SSHO or UXOSO will conduct periodic safety and health audits to ensure site personnel are performing the tasks in accordance with the RI Work Plan and this SSHP. Specific inspection requirements for this DO are provided in Section 7 of the APP.

ATTACHMENT A

SITE-SPECIFIC HAZARD COMMUNICATION PLAN/CHECKLIST

Hazardous Chemicals

Potentially Brought to Site

The hazardous materials that may be used on-site are presented in the following list, and Material Safety Data Sheets (MSDS) for all reagent type chemicals, solutions, or other identified materials will be available on-site. All subcontractors and other parties working nearby will be informed of the presence of these chemicals and the location of the MSDSs.

Chemical Name	Quantity
Hand Sanitizer	24 16-ounce bottles
Gasoline	2 gallons
Lubricating oil	1 bottle
Hydraulic Fluid	1 gallon
Nitric Acid	Provided as preservative in laboratory sample bottles
Hydrochloric Acid	Provided as preservative in laboratory sample bottles
Sodium Hydroxide	Provided as preservative in laboratory sample bottles
YSI Buffer Solution (pH 10.0)	1 10-oz bottle
YSI Buffer Solution (pH 7.0)	1 10-oz bottle
YSI Buffer Solution (pH 4.0)	1 10-oz bottle
YSI Zobell Solution (powder)	1 4-oz bottle
YSI Conductivity Calibrator	1 10-oz bottle

SITE-SPECIFIC HAZARD COMMUNICATION PLAN/CHECKLIST

To ensure an understanding of and compliance with the Hazard Communication Standard, Weston Solutions, Inc. (WESTON®) will utilize this checklist/document (or similar document) in conjunction with the WESTON Written Hazard Communication Program as a means of meeting site- or location-specific requirements.

Although responsibilities for activities within this document are the primary responsibility of the WESTON Site Safety and Health Officer (SSHO)/Unexploded Ordnance Safety Officer (UXOSO), it is the responsibility of all WESTON and subcontractor personnel to ensure compliance. Responsibilities under various conditions can be found within the WESTON Written Hazard Communication Program.

To ensure that information about the dangers of all hazardous chemicals used by WESTON is known by all affected employees, the following Hazard Communication Program has been established. All affected personnel will participate in the Hazard Communication Program. This written program, as well as WESTON's Corporate Hazard Communication Program, will be available for review by any employee, employee representative, representative of Occupational Safety and Health Administration, National Institute for Occupational Safety and Health, or any affected employer/employee on a multi-employer site.

- ☐ Site or other location name/address: Boat Basin, Visitors Information Center MRS, Wallops Flight Facility, VA
- ☐ Project Manager: Tony Pace
- ☐ Site/Location Safety Officer: *Elizabeth Cunningham and Bill Bounds (SSHO) / Troy Phelps (UXOSO)*
- ☐ List of chemicals compiled, format: Health and Safety Plan: ⊗ Other: ______
- ☐ Location of Material Safety Data Sheet Files: Vehicles and with SSHO or UXOSO
- ☐ Training Conducted by: Name: ______ Date: ______
- ☐ Indicate format of training documentation: Field Log: ☒ Other: Follow-up meetings
- ☐ Client briefing conducted regarding hazard communication: Entry
- ☐ If multi-employer site (client, subcontractor, agency, etc.), indicate name of affected companies: Multiple subcontractors, trades, and vendors
- ☐ Other employer(s) notified of chemicals, labeling, and MSDS information: All subs and vendors:
- ☐ Has WESTON been notified of other employer's or client's hazard communication program(s) as necessary?

List of Hazardous Chemicals

A list of known hazardous chemicals used by WESTON personnel must be prepared and available in a centrally identified location with the Material Safety Data Sheets (MSDSs). Further information on each chemical may be obtained by reviewing the appropriate MSDSs. The list will be arranged to enable cross-reference with the MSDS file and the label on the container. Current chemicals that will be used by WESTON include diesel fuel gasoline, chainsaw bar oil, propane, and oils and greases.

Container Labeling

The SSHO or UXOXO will verify that all containers received from the chemical manufacturer, importer, or distributor for uses on-site are clearly labeled.

The SSHO or UXOSO is responsible for ensuring that labels are placed where required and for comparing MSDS and other information with label information to ensure correctness.

Material Safety Data Sheets

The MSDSs will be obtained for all hazardous materials to be used in performance of this contract in accordance with Federal Acquisition Regulation 52.223-3. These MSDSs and an inventory of hazardous material will be compiled prior to bringing the material on-site. The MSDSs will be maintained at the job site and available to all employees and inspectors. The subcontractor must have an active Hazardous Communication Program in place for all employees as required by Code of Federal Regulations (CFR) 29 CFR 1910.1200. To assist this effort, the SSHO or UXOSO is responsible for establishing and monitoring WESTON's MSDS program for the location. The SSHO or UXOSO will ensure procedures are developed to obtain the necessary MSDSs and will review incoming MSDSs for new or significant health and safety information. He or she will inform affected employees of any new information. If an MSDS is not received at the time of initial shipment, the SSHO or UXOSO will contact the manufacturer and request delivery of an MSDS for that product, in accordance with the requirements of WESTON's Written Hazard Communication Program.

The SSHO or UXOSO will maintain an MSDS file that contains a log of, and copies of, MSDSs for all hazardous chemicals in use at the site, and inform all site workers of the file's location. The MSDSs will be readily available to all employees during each work shift If an MSDS is not available, immediately contact the WESTON SSHO or UXOSO or designated alternate. When a revised MSDS is received, the SSHO or UXOSO will immediately replace the old MSDS.

Employee Training and Information

The SSHO or UXOSO is responsible for the WESTON site-specific personnel training program. The SSHO or UXOSO will ensure that the following program information is supplied to all affected employees.

At the time of initial assignment for employees to the work site or whenever a new hazard is introduced into the work area, employees will attend a health and safety meeting or briefing that includes the information indicated below:

- Hazardous chemicals present at the work site.
- Physical and health risks of the hazardous chemicals.
- Signs and symptoms of overexposure.
- Procedures to follow if employees are overexposed to hazardous chemicals.
- Location of the MSDS file and Written Hazard Communication Program.
- How to determine the presence or release of hazardous chemicals in the employee's work area.
- How to read labels and review MSDSs to obtain hazard information.
- Steps WESTON has taken to reduce or prevent exposure to hazardous chemicals.
- How to reduce or prevent exposure to hazardous chemicals through use of control procedures, work practices, and personal protective equipment.
- Hazardous, nonroutine tasks to be performed (if any).
- Chemicals within unlabeled piping (if any).

Hazardous Nonroutine Tasks

When employees are required to perform hazardous nonroutine tasks, the SSHO or UXOSO will provide affected employee(s) with information about the hazardous chemicals he or she may be using during such activity. This information will include specific chemical hazards, protective and safety measures the employee can use, and steps WESTON is using to reduce the hazards. These steps include, but are not limited to, ventilation, respirators, presence of another employee, and emergency procedures.

Multi-Employer Worksites

The SSHO or UXOSO is responsible for providing other employers with information about hazardous chemicals imported by WESTON to which their employees may be exposed, along with suggested safety precautions. The SSHO or UXOSO and the SUXOS - Site Manager are responsible for obtaining information about hazardous chemicals used by other employers and that WESTON employees may be exposed to. WESTON's chemical list will be made available to other employers upon request. The MSDSs will be provided as necessary.

The location, format, and/or procedures for accessing MSDS information must be relayed to affected employees.

ATTACHMENT B

BOATING SAFETY STANDARD OPERATING PROCEDURES

AFFILIATED RESEARCHERS
Environmental Research, Mapping, and Reporting

STANDARD OPERATING PROCEDURES
FOR
BOATING SAFETY

April 2007
amended April 2009
amended July 2010
amended March 2011
amended May 2011
amended July 2011
amended May 2012

(989) 739-5471 • 3585 North US Highway 23, Oscoda, MI 48750 • www.affiliatedresearchers.com
Service-disabled Veteran-owned small business • Certified HUBZone business consideration

PRE-BRIEFING PROJECT DETAILS AND GENERAL SAFETY

In order to ensure safety during the project, the procedure to be used during the project, and safety boating safety procedures will be explained to all members and others prior to their boarding the boat.

Review of Project Details

The Project Lead or designee will review with all members the scope, objectives, data, and other details of the project to ensure all members understand equipment operations, roles, positions, and expected times of project accomplishments.

General Safety

The Project Lead or designee will explain general safety precautions and procedures to ensure all members understand the safe and correct manner of accomplishing their respective duties.

*General safety precautions and procedures include:

1. *Review all project safety documents (HASP, AHA, float plan).
2. *Brief members of local weather (wind, rain), river conditions (stage) water (waves) conditions for current day.
    a. CAUTION: Outdoor work shall not take place if lightning or thunder is noted in the area, as determined by the AFFILIATED RESEARCHERS Field Team Manager.
3. *Review project area, hazards, navigation points, access points, and any other relevant information.
4. *Review communication procedures and radio channels to be used
5. *Explain life vest/jackets procedures.
    a. Life vest/jackets are to be worn by all members at all times while on boat, boat dock, or kayak
    b. An automatic inflatable PFD will be worn at all times, unless surface water temperatures are below 55^0F.
        i. A *Mustang MJ6214 Classic Flotation Bomber* jacket will be worn at all times while onboard boat, dock, or kayak when surface water temperatures are below 55^0F.
        ii. A *Mustang MS-195 Integrity HX Flotation Suit* survival suit will be worn at all times while onboard boat, dock, or kayak when surface water temperatures are below 40^0F.
    c. Explain the proper wear and use of the PFD
6. *Explain location, function, and operation of all equipment
7. *Explain procedure and roles of each member for launching the boat
8. *Explain to members of all known possible safety risks to include:
    a. Injury or falling off dock due to tripping over equipment
    b. Injury or falling off dock due to movement of other crew members
    c. Injury or falling off dock due to wet, icy, or other slippery conditions

*minimum required item to be accomplished and/or briefed to non-crew members assigned to the boat operations.

   d. Injury resulting from body extremities caught between boat and dock
   e. Tripping over, or entanglement in dock lines
   f. Cuts or splinters from docks
   g. Falling in the water while entering the boat
   h. Obstructions or equipment to avoid on the boat
   i. Getting injured from moving boat trailer or tow vehicle
   j. any other issues
9. *Explain to members the reason cellular phone conversations will be limited to only project related necessities.

PROCEDURE FOR TRAILERING

1. Check local weather to ensure favorable conditions
2. Confirm all boat manuals and registration documents are onboard
3. CAUTION: Ensure trailer wheel bearings have been recently greased
4. Confirm boat is in compliance with all local, State, and Federal boating requirements
5. Confirm trailer tongue is latched and locked, with safety chains attached to tow-vehicle
6. Confirm trailer lights are plugged-in and working
7. Confirm equipment has been removed from the boat as required
8. Confirm trailer-boat winch strap has been tightened and safety chain is attached to boat
9. Confirm all tie-down straps are attached and tightened
10. CAUTION: Ensure engine is in raised and locked position before trailering
11. Confirm motor is properly supported with transom resting-latch
12. Confirm Bimini top is erected for towing (15' Whaler; 20' pontoon)
13. Confirm gas tank vapor seals are slightly vented (12' Whaler, 15' Whaler, 20' Pontoon)
14. Conduct safety walk-around
15. Commands and signals used for launching the boat
    a. Verbal
       i. "Back" = backup
       ii. "Left" = turn boat left
       iii. "Right" = turn boat right
       iv. "Stop" = stop backing up
       v. "Good" = boat is in correct position
    b. Non-Verbal Signals (all signals are to be demonstrated)
       i. "Back-up" = arms extended upward, bent at elbows, and waving forward and backward
       ii. "Turn boat left" = left arm extended horizontally outward away from body
       iii. "Turn boat right" = right arm extended horizontally outward from body
       iv. "Stop" = one arm extended horizontally forward with the hand open
       v. "Boat is in correct position" = arm extending with thumb up

PROCEDURE FOR PREPARING FOR BOAT LAUNCHING

1. CAUTION: Outdoor work shall not take place if lightning or thunder is noted in the area, as determined by the AFFILIATED RESEARCHERS Field Team Manager.
2. Confirm installation of drain plug

*minimum required item to be accomplished and/or briefed to non-crew members assigned to the boat operations.

3. Attach motor if required (12’ Whaler and Inflatable)
    a. Hand tighten screw-down clamps
    b. Install redundant bolts
    c. Lock screw-down clamps together with padlock
    d. Confirm operator safety strap is attached to the motor
4. Confirm fuel quantity is adequate
5. CAUTION: Always ensure adequate ventilation when refueling
6. Loosen gas tank vapor seal as needed (12’ Whaler, 15’ Whaler, 20’ Pontoon)
7. Install Bimini Top (12’ Whaler)
8. Install GPS antenna and echo sounder bracket as required
9. Load gear on boat unless it will inhibit occupant loading
10. Remove all straps, trailer-boat winch cable, and trailer-boat safety chain
11. Attach dock lines to boat
12. Attach fenders to boat if required
13. CAUTION: Ensure the person in the tow vehicle backing the boat, and the person “spotting” both have an operational hand held VHF radio to coordinate the launching of the boat.

PROCEDURE FOR LAUNCHING BOAT

1. CAUTION: Outdoor work shall not take place if lightning or thunder is noted in the area, as determined by the AFFILIATED RESEARCHERS Field Team Manager.
2. CAUTION: Persons involved in boat launching shall not use cellular phones during the boat launching procedures.
3. CAUTION: The boat will not be launched under existing or forecasted conditions of hazardous weather.
4. Designate one qualified member to back the tow-vehicle and boat, and one qualified member as “spotter” to help guide the backing of the boat.
5. CAUTION: The person in the tow vehicle backing the boat, and the person “spotting” shall both have an operational hand held VHF radio to safely coordinate the launching of the boat.
6. CAUTION: Prior to backing the boat, the driver of the tow-vehicle will roll down the windows on both sides of the tow-vehicle to enable better hearing of “spotter” commands.
7. The spotter will hold dock lines, walk along side the boat as it is being backed, and help guide the driver of tow-vehicle while the boat is being backed.
8. The boat will be backed down the boat ramp until the aft portion of the boat begins to float.
9. The spotter will use the dock lines to safely remove the boat off the trailer, and secure the boat to the dock.
    a. The front dock line will be fastened first with at least one full rap followed by 3 or more half-hitch knots
    b. The rear dock line will be fastened second in the same manner.
10. After receiving a affirmative signal (“clear”) from the spotter, the driver will slowly pull-away the tow-vehicle and trailer from the dock slowly
11. All equipment will be stored off the deck and out of the way of foot travel

*minimum required item to be accomplished and/or briefed to non-crew members assigned to the boat operations.

12. Driver will park the tow-vehicle and trailer, remove any additional items (i.e. cell phone, jackets, etc.) and lock the tow-vehicle.

PROCEDURE FOR STARTING BOAT

1. CAUTION: Outdoor work shall not take place if lightning or thunder is noted in the area, as determined by the AFFILIATED RESEARCHERS Field Team Manager.
2. CAUTION: The boat engine will not be started under existing or forecasted conditions of hazardous weather.
3. Spotter or designated boat operator will start the boat in accordance with manufacturers operating procedures, while driver is parking the tow-vehicle and trailer.
4. CAUTION: Before starting engine, ensure engine is in the tilted down sufficiently to ensure the water cooling intake hole is submerged.
5. CAUTION: Before staring engine, ensure shift-level is in neutral positions.
6. Ensure fuel line bulb has been pumped full before attempting to start engine.
7. NO PERSON UNDER THE INFLUENCE OF ALCOHOL OR ILLEGALLY OBTAINED DRUGS IS PERMITTED ON THE BOAT.
8. After starting engine, ensure all boat instruments and equipment is on and/or operating properly.

*SAFETY BRIEFING FOR BOAT OPERATION

The Boat Operator or designee will explain the safety precautions and procedures to ensure all members understand the safe and proper manner of accomplishing their respective duties.

*Safety precautions and procedures briefing should include:

1. *The Boat Operator will make all decision regarding boat operations and boating safety.
2. *Brief members of local weather (wind, rain), river conditions (stage) water (waves) conditions for current day
   a. CAUTION: Outdoor work shall not take place if lightning or thunder is noted in the area, as determined by the AFFILIATED RESEARCHERS Field Team Manager.
3. *PFD is to be worn at all times while on the boat
4. *Proper wear and use of PFD
5. *Location, function, and operation of all the boat instruments and equipment
6. *Proper operation of boat motor in case the designated boat operator becomes unable
   a. Starting, operating, and stopping the engine
   b. Basic rules of safe boating
   c. The function and use of the safety bracelet
   d. The function and operation of boat instruments and equipment
   e. Location of anchor and its proper use
   f. Location of navigation-anchor light and its use
   g. Operation of the boat radio
   h. Location and use of emergency equipment
7. *Procedures for a man-overboard
   a. Crew member steering the boat is in command

*minimum required item to be accomplished and/or briefed to non-crew members assigned to the boat operations.

   b. Slow boat immediately
   c. Who and when to throw flotation device
   d. Turn boat and slowly motor toward person overboard
   e. Designated crew members assist in recovering person overboard
   f. Determine if medical attention is needed
   g. Provide medical attention as needed
   h. Use radio or telephone to seek professional medical attention if required
8. *Possible safety risks that may occur while working on boat, to include:
   a. Dangers of un-stowed equipment
   b. Injury or falling overboard due to waves, boat wake, movement of other crew members
   c. Injury or falling overboard due to work relating to project
   d. Sunburn or injury to the eyes due to long unprotected exposure to the sun
   e. Dehydration due to long exposure to the sun
9. *All equipment will be stored off the deck and out of the way of foot travel
10. *CAUTION: Only AFFILIATED RESEARCHERS crew members shall be allowed to assist in the launching, operations, landing, docking, and trailering procedures.
11. *CAUTION: Persons onboard boat shall not use cellular phones during boat operations except for project related communications.

PROCEDURE FOR OPERATION OF BOAT

1. The Boat Operator will make all decision regarding boat operations and boating safety.
2. NO PERSON UNDER THE INFLUENCE OF ALCOHOL OR DRUGS IS PERMITTED ON THE BOAT.
3. CAUTION: outdoor work shall not take place if lightning or thunder is noted in the area, as determined by the AFFILIATED RESEARCHERS Field Team Manager.
4. CAUTION: PDFs shall be worn at all times while on the boats.
5. CAUTION: Engine on all boats should be tilted up in shallow waters, while maintaining the water cooling intake is submerged.
6. CAUTION: The boat will not leave the dock until all members are seated and confirmed ready.
7. CAUTION: Persons onboard boat shall not use cellular phones during boat operations except for project related communications.
8. CAUTION: The boat will not be operated at speeds in excess of safe operation under given conditions of visibility, crowds, waves, water depth, hazards, regulations, posted speeds, or otherwise.
9. CAUTION: The boat operator will be aware of and follow all State and Federal boating regulations, as well local ordinances.
10. CAUTION: The boat operator will not depart the dock under existing or forecasted adverse weather conditions.
11. CAUTION: The 21’ Steiger should not be navigated into waters with less than 6 foot of depth in rocky areas, or 4.5 foot of depth in sandy areas.
12. CAUTION: The15’ Boston Whaler should not be navigated into waters with less than 4 foot of depth in rocky areas, or 2.5 foot depth in sandy areas.

*minimum required item to be accomplished and/or briefed to non-crew members assigned to the boat operations.

13. CAUTION: The 20' Pontoon should not be navigated into waters with less than 3 foot of depth in rocky areas, or 2.0 foot depth in sandy areas.
14. CAUTION: The 12' Boston Whaler should not be navigated into waters with less than 3 foot of depth in rocky areas, or 2.0 foot depth in sandy areas.
15. All incidents involving health, safety, and/or equipment damage will be reported to Quality Assurance Manager

PROCEDURE FOR DOCKING BOAT

1. All equipment will be stored off the deck and out of the way of foot travel.
2. Boat Operator will steer boat slowly upwind towards upwind side of boat dock; or
    a. if docking parallel in river, boat operator will steer boat slowly up-current and land with bow facing up-current; or
    b. if docking perpendicular in river, boat operator will steel boat slowly up-current and land on up-current side of dock.
3. CAUTION: Persons onboard boat shall not use cellular phones during the boat docking.
4. Designate one or more crew member to tie-off boat to the dock.
    a. CAUTION: Only AFFILIATED RESEARCHERS crew members shall be allowed to assist in the landing/docking procedure.
    b. CAUTION: Crew member should not jump from boat to dock at any time.
5. Once the boat is in proper position, the crew member with the dock lines will be told by the boat operator or designee to tie-off boat.
    a. The front dock line will be fastened first with at least one rap followed by 3 or more half-hitch knots
    b. The rear dock line will be fastened second in the same manner.
6. All equipment will be stored of the deck out of the way of foot travel, but where it can be easily retrieved once the boat is trailered.
7. One qualified member will be designated to back the tow-vehicle and boat trailer down the boat launch.
8. Another qualified member will be designated as a "spotter" to guide the driver of the tow-vehicle down (using previously mention signals), and adjust the boats alignment with the trailer.
    a. CAUTION: The person in the tow vehicle backing the boat, and the person "spotting" shall both have an operational hand held VHF radio to safely coordinate the launching of the boat.
    b. CAUTION: Other members will stay off the dock, and away from tow-vehicle
9. Once the trailer is in position, the spotter will connect trailer strap and safety to boat, and throw dock-lines onto boat.
10. Once boat is aligned and secured on trailer, spotter will signal the driver to pull forward.
11. Once out of the boat is trailered to safe position, away from traffic, it will be prepped for departure.

PROCEDURE FOR DEPARTURE-DEMOBILIZATION

1. Remove and put away dock lines
2. Remove the drain plug and set in the back of the boat (12' Whaler, 15' Whaler)

*minimum required item to be accomplished and/or briefed to non-crew members assigned to the boat operations.

3. Raise or remove motor as required. If motor is removed:
    a. detach gas tank line
    b. unlock padlock on screw down clamps
    c. remove redundant bolts
    d. loosen screw down clamps
    e. remove motor and store in truck
    f. confirm emergency safety strap in attached to the motor
4. Tighten vapor seal on gas tank to prevent gas from leaking but to allow vapor to vent during trailering (12' Whaler, 15' Whaler, 20' Pontoon)
5. Secure (15' Whaler) or remove (12' Whaler) Bimini Top as required
6. Lower GPS antennae
7. Remove remaining gear in the boat
8. Attach and tighten rear boat straps
9. Confirm trailer-boat strap is tight, and safety chain attached
10. Confirm trailer tongue latch in down and locked
11. Confirm all trailer lights are operational
12. Conduct safety walk-around

INCIDENT REPORTING

1. All incidents involving health, safety, and/or equipment damage will be reported by the Field Team Leader and the Boat Operator to Quality Assurance Manager.

*minimum required item to be accomplished and/or briefed to non-crew members assigned to the boat operations.

APPROVALS

May 2012

Christopher Martin
Senior Technician
Boat Operator

Date

May 2012

Rollin C. Reineck, Jr.
Quality Assurance Manager
Director

Date

*minimum required item to be accomplished and/or briefed to non-crew members assigned to the boat operations.

ATTACHMENT 3

RESUMES AND CERTIFICATIONS FOR IDENTIFIED SAFETY PERSONNEL

Elizabeth A. Cunningham

Qualifications Summary

- More than 3 years of professional experience.
- More than 2 years of safety experience
- Extensive technical writing experience with HASPs, FSPs, EPPs, and other related documents.
- Expertise with operation of XRF, MultiRAE, Dexsil analysis for PCBs, TVA-1000, Jerome H_2S meters, various air monitoring equipment, YSIs, GPS units, IR machines, atomic absorption spectrometers, and other laboratory equipment.
- Skilled in Forms II Lite, Scribe, WISER, Drumtrak, ArcGIS, and Microsoft Word, Excel, and PowerPoint.

Education

B.S., Environmental Science - Elizabethtown College (2010)

Training, Memberships & Awards

- 40-Hour Hazardous Waste Site Training Course, OSHA 29 CFR 1910.120(e)(3), Compliance Solutions (2010)
- 8-Hour Hazardous Waste Refresher Course, OSHA 29 CFR 1910.120(e)(8), WESTON (2013)
- 8-Hour Managers and Supervisors Course (SHSC), OSHA 29 CFR 1910.120(e)(4), WESTON (2011)
- First Aid/CPR/AED Training, Medic First Aid (2013)
- Bloodborne Pathogens Training – Initial, OSHA 29 CFR 1910.1030, WESTON (2011); Refresher (2013)
- Trenching/Excavation Competent Person Training Course, OSHA 29 CFR 1026 Subpart P, WESTON (2011)
- Fall Protection Competent Person Training Course – Initial, OSHA 29 CFR 1926 Subpart M, WESTON (2011)
- Boating Safety, Pennsylvania Fish and Boat Commission (2011)
- 30-Hour Construction Safety and Health Training Course, OSHA 29 CFR 1926, WESTON (2011)
- IS-100 Introduction to Incident Command System, FEMA (2010)
- IS-200 Basic Incident Command System, FEMA (2010)
- IS-301 Radiological Emergency Response, FEMA (2010)
- IS-906 Basic Workplace Security Awareness, FEMA (2011)
- Niton XRF Spectrum Analyzer Training, ThermoFisher Scientific (2010)

Employment History

2008 to Present WESTON

2007 to 2009 Elizabethtown College Chemistry Department

Key Projects

Dust Monitoring, Price Battery, Hamburg, PA, U.S. Environmental Protection Agency (EPA) Region 3 Superfund Technical Assessment and Response Team (START), Field Safety Officer. Use personal dataRAM (PDR) devices, SKCs, and Gillian pumps to monitor dust levels during excavations at site. Deployed PDRs along perimeter of site to monitor dust levels and ensure minimal public exposure. Use hand auger to collect soil samples and followed standard EPA protocol for processing and analyzing soil with X-ray fluorescence (XRF) technology. Determined PPE selection by using XRF technology to determine levels of lead present in work area. Conducted oversight of Emergency Response and Removal Services (ERRS) contractors' excavation operations to ensure proper safety protocols were followed. Evaluated each excavation area to determine if traffic control plan was needed. Attend and participate in daily morning tailgate meetings concerning scope of work for day and health and safety issues. Promoted behavior based safety to remind everyone of work hazards and how accidents can be prevented since this is a long term on-going site and complacency can be an issue. [8-10 to Present; WESTON; Proj. No. 20403.012]

Hamburg Lead Site, Hamburg, PA, EPA Region 3, START, Project Lead. Manage samples, site data, staffing needs, and equipment inventory. As Field Safety Officer, conducted morning health and safety meetings which discussed possible risks for the day's work. Frequent interaction with client and ERRS contractors concerning work progression and any health and safety issues. Use Dataram 1000s to monitor dust levels and used XRF technology to screen for in situ lead levels. Provided oversight of ERRS contractors ensuring EPA protocol was followed. Used results from datarams to advise ERRS on which PPE should be used. This site, which was on a steeply sloped river bank, had a high risk for accidents as it involved removal of trees, large machinery operating on the steep slope, and movement of large boulders by the heavy machinery. The site is the town park, which has high visibility to the public and required interaction with town residents. [11-11 to 5-12; WESTON]

Precision National Plating, Clarks Summit, PA, EPA Region 3 START, Assistant Geoscientist. Ensured public safety by conducting air monitoring for H_2S using Jerome meter at a hexavalent chromium remediation site. Responsible for collecting and logging air data and taking photographs of site. Frequent interaction with client, PRP contractor, and the public. Interaction with PRP contractor included scheduling air monitoring rounds and gathering daily calcium polysulfide injection amounts. As a backup Field Safety Officer, concerns at this sight included needing high visibility clothes because of hunters, potential for large wildlife encounters, and working in extreme cold. [10-10 to Present; WESTON]

Chaperone Technologies, East Stroudsburg, PA, EPA Region 3 START, Field Safety Officer. Acted as field safety officer for an investigation into an abandoned biochemical lab. Conducted work in level B PPE. Conducted air monitoring for worker protection utilizing a Multi-RAE, and TVA-1000 to ensure safety of employees.

Former Mohr Orchard Pesticide Site, Schnecksville, PA, EPA Region 3 START, Assistant Geoscientist. Site is currently a large residential area that was formerly an orchard which used pesticides containing lead and arsenic. Acted as back up Field Safety Officer. Responsibilities included dust monitoring by using datarams and PDRs at excavation sites and analyzing of dust data to ensure minimal dust was being created. Oversight of excavations included maintaining daily logbook and taking video and photo documentaries of progress. Collect pre-excavation and post-excavation samples, and process and analyze samples using standard EPA protocol for XRF technology. Post excavation samples had to be below the action level, preventing any further exposure to the public. [9-10 to 8-12; WESTON]

Clearview Landfill Site, Lower Darby, PA, EPA Region 3 START, Assistant Geoscientist. Conducted air monitoring utilizing MiniRAE and AreaRAE to monitor volatile organic compound (VOC) and methane levels; Ludlum machine to monitor radiation levels; and Dataram 1500 to monitor dust levels for worker and community protection. Since the primary contaminant on site was PCBs, air monitoring during excavation was of crucial importance. Dust levels were kept to an absolute minimum to reduce exposure to both workers and the public. [11-11 to 1-12; WESTON]

Emergency Response, Luzerne Mercury Spill, Nanticoke, PA, EPA Region 3 START, Assistant Geoscientist. Responded quickly to emergency call of mercury spilled on bridge pillar. Upon arriving at scene, it was discovered that a student had collected some of the mercury and taken it to their home and school. Lumex mercury meter was used to monitor mercury levels while contractors cleaned up puddles of mercury and to determine if mercury vapor was present in the school, the student's locker, and the student's home. Health and Safety tasks included selection of proper PPE and protection of public from mercury by using Lumex meter. [9-11 to 10-11; WESTON]

Emergency Response, Pittston Methane Release, West Pittston, PA, EPA Region 3 START, Assistant Geoscientist. Responded to weekend emergency call of a methane release in a home. Used MultiRAE and TVA to monitor gas and explosive levels inside the home. Collected air samples using Summa canisters. Used Multi-RAE and TVA-1000 to determine adequate PPE was chosen. Safety duties included determining proper PPE, use of hand signals or radio for communication, buddy system, and NOMAX suits in case an explosive atmosphere was encountered. Conducted cost analysis for air rotary drilling and further assessment at the site. [9-11 to 10-11; WESTON]

Compliance Solutions

"Today's Training... Tomorrow's Solution"

3980 Quebec St, 2nd Floor Denver, CO 80207-1633   800-711-2706

Student Affiliation:
Weston Solutions, Inc
31719

Certificate of Completion

This is to certify that

Elizabeth Cunningham

has been tested and successfully meets the training requirements for

40-Hour HAZWOPER

29 CFR 1910.120(e)

Presented

Friday, July 23, 2010

Compliance Solutions Occupational Trainers, Inc.

Certificate Number: *754813709*

Neval Gupta
Vice President

Dane Wilcox
Instructor

WESTON SOLUTIONS®
Restoring Resource Efficiency

This Certifies That

ELIZABETH CUNNINGHAM

Has Completed the

8-Hour HAZWOPER Refresher Training Course

In accordance with 29 CFR 1910.120(e)(8) completed on 04/23/2013 in West Chester, PA

Ted Blackburn CSP, CET

TRAINING MANAGER
Ted Blackburn, CSP, CET

Christopher Baer CSP

INSTRUCTOR
Christopher M. Baer CSP

1_15876_04232013

Weston Solutions, Inc • 1400 Weston Way • West Chester, PA • 19380

06P-0910-2

This Certifies That

ELIZABETH CUNNINGHAM

Has Completed the

30-Hour Construction Safety and Health Training Course

In accordance with OSHA Outreach Training Program (Includes Competent Person Instruction as indicated in 29 CFR 1926 Subparts C, E, M, P, & X) completed on 03/11/2011 in West Chester, PA

Owen B. Douglass, Jr., PhD, CIH

TRAINING MANAGER

Owen B. Douglass, Jr., PhD, CIH

T.L. Blackburn CSP, CSP

INSTRUCTOR

Theodore L. Blackburn

82_15876_03112011

Weston Solutions, Inc • 1400 Weston Way • West Chester, PA • 19380

06P-0910-2

This Certifies That

ELIZABETH CUNNINGHAM

Has Completed the

8-Hour Site Manager and Supervisor Training Course

In accordance with 29 CFR 1910.120(e)(4) completed on 12/15/2011 in West Chester, PA

TRAINING MANAGER
Owen B. Douglass, Jr., PhD, CIH

INSTRUCTOR
George M. Crawford Jr CIH

195_15876_12152011

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WESTON SOLUTIONS®
Restoring Resource Efficiency

This Certifies That

ELIZABETH CUNNINGHAM

Has Completed the

Excavation & Trenching Competent Person

completed on 03/11/2011 in West Chester, PA

TRAINING MANAGER
Owen B. Douglass, Jr., PhD, CIH

INSTRUCTOR
Theodore L. Blackburn

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06P-0910-2

WESTON SOLUTIONS®
Restoring Resource Efficiency

This Certifies That

ELIZABETH CUNNINGHAM

Has Completed the

Fall Protection Competent Person Initial

completed on 03/10/2011 in West Chester, PA

TRAINING MANAGER
Owen B. Douglass, Jr., PhD, CIH

INSTRUCTOR
Theodore L. Blackburn

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06P-0910-2

WESTON SOLUTIONS®
Restoring Resource Efficiency

This Certifies That

ELIZABETH CUNNINGHAM

Has Completed the

Bloodborne Pathogens Training Course Initial

In accordance with 29 CFR 1910.1030 completed on 07/21/2011 in Chesapeake, VA

Owen B Douglass Jr PhD, CIH

TRAINING MANAGER
Owen B. Douglass, Jr., PhD, CIH

George M Crawford Jr CIH

INSTRUCTOR
George M. Crawford Jr CIH

11_15876_07212011

Weston Solutions, Inc • 1400 Weston Way • West Chester, PA • 19380

06P-0910-2

Restoring Resource Efficiency

This Certifies That

ELIZABETH CUNNINGHAM

Has Completed the

Bloodborne Pathogens Training Course Refresher

In accordance with 29 CFR 1910.1030 completed on 04/23/2013 in West Chester, PA

TRAINING MANAGER
Ted Blackburn, CSP, CET

INSTRUCTOR
Christopher M. Baer CSP

2_15876_04232013

Weston Solutions, Inc • 1400 Weston Way • West Chester, PA • 19380

06P-0910-2

American Red Cross

This recognizes that
Elizabeth Cunningham
has completed the requirements for
Adult and Child First Aid/CPR/AED
conducted by
Weston Solutions, Inc.
Date completed: **05/29/2013**
The American Red Cross recognizes
this certificate is valid from
completion date for: **2 Years**

redcross.org

Instructor's Signature

Julie Ostertag

Chapter

Southeastern Pennsylvania

Holder's Signature

570211 Stock No. 656798

Emergency Management Institute

FEMA

This Certificate of Achievement is to acknowledge that

ELIZABETH A CUNNINGHAM

has reaffirmed a dedication to serve in times of crisis through continued professional development and completion of the independent study course:

IS-00100.a
Introduction to the Incident Command System,
ICS-100

Issued this 7th Day of June, 2010

AUTHORIZED IACET PROVIDER

0.3 IACET CEU

Cortez Lawrence, PhD
Superintendent
Emergency Management Institute

Emergency Management Institute

U.S. DEPARTMENT OF HOMELAND SECURITY

FEMA

This Certificate of Achievement is to acknowledge that

ELIZABETH CUNNINGHAM

has reaffirmed a dedication to serve in times of crisis through continued professional development and completion of the independent study course:

IS-00120.a
An Introduction to Exercises

Issued this 11th Day of April, 2013

AUTHORIZED IACET PROVIDER

0.5 IACET CEU

Tony Russell
Superintendent
Emergency Management Institute

Emergency Management Institute

U.S. DEPARTMENT OF HOMELAND SECURITY

FEMA

This Certificate of Achievement is to acknowledge that

ELIZABETH CUNNINGHAM

has reaffirmed a dedication to serve in times of crisis through continued professional development and completion of the independent study course:

IS-00130
Exercise Evaluation and Improvement Planning

Issued this 15th Day of April, 2013

AUTHORIZED IACET PROVIDER

Tony Russell
Superintendent
Emergency Management Institute

0.5 IACET CEU

Emergency Management Institute

FEMA

This Certificate of Achievement is to acknowledge that

ELIZABETH A CUNNINGHAM

has reaffirmed a dedication to serve in times of crisis through continued professional development and completion of the independent study course:

IS-00200.a
ICS for Single Resources and Initial Action Incidents, ICS-200

Issued this 8th Day of June, 2010

AUTHORIZED IACET PROVIDER

0.3 IACET CEU

Cortez Lawrence, PhD
Superintendent
Emergency Management Institute

Emergency Management Institute

FEMA

This Certificate of Achievement is to acknowledge that

ELIZABETH CUNNINGHAM

has reafﬁrmed a dedication to serve in times of crisis through continued professional development and completion of the independent study course:

IS-00301
Radiological Emergency Response

Issued this 7th Day of December, 2010

AUTHORIZED IACET PROVIDER

Vilma Schifano Milmoe
Superintendent (Acting)
Emergency Management Institute

1.0 IACET CEU

Emergency Management Institute

U.S. DEPARTMENT OF HOMELAND SECURITY

FEMA

This Certificate of Achievement is to acknowledge that

ELIZABETH CUNNINGHAM

has reaffirmed a dedication to serve in times of crisis through continued professional development and completion of the independent study course:

IS-00906
Basic Workplace Security Awareness

Issued this 15th Day of April, 2011

AUTHORIZED IACET PROVIDER

Vilma Schifano Milmoe
Vilma Schifano Milmoe
Superintendent (Acting)
Emergency Management Institute

0.1 IACET CEU

COMMONWEALTH OF PENNSYLVANIA
FISH AND BOAT COMMISSION

BOATING SAFETY EDUCATION CERTIFICATE

ELIZABETH CUNNINGHAM

COURSE TYPE: EXAM

NO. W0112082 DATE OF ISSUE 07/19/2011

D.O.B 07/15/1988 EYES BRN HAIR BRN SEX F

Thermo Fisher
SCIENTIFIC

September 24, 2010

Elizabeth Cunningham
Weston Solutions Inc
1400 Weston Way
West Chester, PA 19380

Subject: Radiation Safety and Operation Training Certificate – Thermo Scientific Niton XRF Analyzers

Dear Elizabeth:

Congratulations on having successfully completed the Thermo Fisher Scientific Manufacturer's Training Course on the operation, monitoring, and maintenance of our handheld Thermo Scientific Niton x-ray fluorescence (XRF) analyzers. We admire your effort in attending this course and have enclosed your certificate of completion. This document certifies that you have been trained in radiation safety and monitoring, measurement technology, and routine analyzer maintenance pertaining to the use of Thermo Scientific Niton XRF instruments.

Please feel free to contact us to discuss your testing and analysis needs. Our trained, technical staff will help you identify best practices and testing methods that can increase productivity and help save you time and money.

For further information or to schedule an on-site demonstration at your convenience, please call us at (800) 875-1578. We also invite you to visit our web site at www.thermo.com/niton. We are committed to solving your analysis needs.

Best regards,

Sophie Ung

Sophie Ung
Radiation Safety Training Coordinator
Thermo Scientific Niton Analyzers

Radiation Safety and Operation of Niton XRF Analyzers

CUSTOMER TRAINING

This is to certify that

Elizabeth Cunningham

has successfully completed the one day Thermo Fisher Scientific Niton Analyzer Manufacturer's Training Course. The topics of this course include radiation safety, monitoring, device operation, and machine maintenance of the Niton XRF Analyzer.

(CIH's – The ABIH Awards 1 CM point, approval # 08-354)

Course date:	2010 September 16
Location:	Pittsburgh, PA
Certificate Number:	10:2000380000011hbYN

Customer Training Certificate

Sophie Ung
Radiation Safety Training Coordinator

James Blute, CHP
Manager of Health and Safety

WILLIAM J. BOUNDS, JR., P.G.

Qualifications Summary

- More than 15 years of professional experience.
- 12 years of construction industry, asbestos, and lead based paint safety experience
- Experience as safety office and performing duties including job safety meeting, PPE training and selection, activitiy hazard and exposure analysis, training of site personnel, and air monitoring through the use of safety monitoring equipment.
- Onsite site safety monitoring of personnel through air monitoring and personnel stress/heat monitoring during completion of field activities.
- Implemented corporate safety plan through enforcement of the respiratory protection plan, worker protection plan, and medical monitoring plan.
- 8 years of experience with AST and UST closure assessment and abatement and safety oversight
- 5 years of experience in lead paint and asbestos hazard analysis and safety
- 10 years of experience with level A and B PPE dealing with hazardous materials spill response and confined space entry
- Experience with worker fall protection on jobsites
- Provided boater/water safety training and PPE selection to personnel working on hazardous materials spill response on water bodies.

Registration

Licensed Professional Geologist in the Commonwealth of Virginia (No. 2801001524; 2004)
Professional Soil Scientist in the Commonwealth of Virginia (No. 3701000168; 2003)
Registered Environmental Assessor in the State of California (No. 07719; 2002)
Licensed Asbestos Inspector in the Commonwealth of Virginia, Department of Professional Occupation Regulation (DPOR) (No. 3303002798; 1998)
Licensed Lead Inspector License in the Commonwealth of Virginia (No. 3355001087; 1997)

Field of Competence

Project geoscientist responsible for implementing and enforcing project safety requirements in accordance with industry and company standards. Competent and qualified experience in performing several safety and site-related tasks including hazard assessment, respiratory protection, air monitoring, personal protective equipment (PPE) selection, personnel training, medical monitoring, confined space entry and monitoring, materials handling, storage, manifesting, and disposal. Previously functioned as the corporate safety officer for a company of 20 employees and enforced the corporate safety program through training, implementation of the respiratory protection plan, establishing hazard communication programs, safety equipment calibration and inspections, medical monitoring, fall protection, water safety, and construction equipment inspections.

Education

M.S., Geology—Old Dominion University (2001)
B.S., Geology—Old Dominion University (1997)

Credentials

8-Hour Site Manager/Field Safety Officer Course, WESTON (2013)
30-Hour Construction Safety and Health Training Course, OSHA 29 CFR 1926, WESTON (2012)
Bloodborne Pathogens Training, OSHA 29 CFR 1910.1030 – Initial, WESTON (2012)

Confined Space Training – Entrant, Attendant, Non-Entry Rescue, OSHA 29 CFR 1910.146, WESTON (2012)
Fall Protection Competent Person Training Course – Initial, OSHA 29 CFR 1926 Subpart M, WESTON (2012)
Underground Utilities Competent Person Training, WESTON (2012)
First Aid/CPR Training, Red Cross (2012)
8-Hour Hazardous Waste Refresher Course, OSHA 29 CFR 1910.120(e)(8), WESTON (2012)
40-Hour HAZWOPER, OSHA 29 CFR 1910.120(e)(3), Tidewater Community College (2001)
Function-Specific Dangerous Goods Shipping, WESTON (2012)
IS-100 Intro to the Incident command system (2012)
IS-200 Basic Incident Command System (2012)
Microbial Indoor Air Quality, On-Line Course (2000)

Employment History

2012-Present WESTON
2004-2012 PetroChem Recovery Services 2003-2004 Marine Chemist 2002-2004
Michael Baker Corp. 2000-2002 Metropolitan Laboratories 2001-2005 Tidewater Community College, Adjunct Faculty 1997-2001Old Dominion University 1996-2000 United Mortgage 1992-1993 Bluewater Yachts 1989-1992
Federal Bureau of Investigation

Key Projects

Site Investigation (SI), Wallops Flight Facility, Wallops Island, VA, NASA, Associate Geoscientist – (July 2012 to September 2012) Performed field activities and safety oversight during completion of a Site Inspection (SI) to determine the environmental impact from activities at a NASA facility from previous military activities. Completed safety oversight and sampling activities including the assessment of site personnel exposure to site-related contaminants through air and heat stress monitoring. . Assisted in soil and groundwater sample collection and processing for analysis. Inspected and calibrated sampling and safety equipment for us in daily activities and recorded all findings. Assisted with the selection, training, and inspection of required PPE.

Site Investigation (SI), Former Nansemond Ordnance Depot, Suffolk, VA, U.S. Army Corps of Engineers (USACE), Baltimore District, Associate Geoscientist (April 2012 – July 2012 & October 2012 - Present) Performed SI to determine the environmental impact of activities performed at a former military facility. Assessed site activities, hazards, and conditions of field visits and sampling events to determine contaminants of concern (COCs), extent of contamination, and requirements for monitoring and selection of PPE. Reported findings and made recommendations to client. Provided support to management in presentations to the client regarding status of the project and delivery schedules. **Environmental Projects, Various Locations, Multiple Projects, Geologist - (August 2004 to April 2012)** Performed a wide variety of environmental projects for government, commercial, and residential clients. Projects include underground/aboveground storage tank (UST/AST) closures, hazardous materials spill response, safety management, soil water and air sampling, environmental cleanups, and permitting. Provided safety management and job safety oversight by providing job safety briefings, personnel monitoring, PPE selection and training, hazard analysis, training compliance, and assisted with respiratory protection selection. Implemented and evaluated company safety program requirements including worker respiratory protection, medical monitoring and site safety programs. Provided training to employees as to the proper use of Level A and Level B PPE.

Completed oversight and provided safety compliance for the collection of soil, water, and air samples for compliance and cleanup requirements associated with hazardous materials releases. Oversaw drill crew safety and installation of environmental monitoring equipment via rotary drilling techniques, direct push technologies, and hand auguring methods. Performed soil classification of boring cuttings and logs and identified impacted soils resulting from hazardous material releases into the environment. Collected soil and groundwater samples to determine contamination concentrations for remediation investigations and made recommendations based on analytical results and field observations.

Performed oversight and provided safety compliance for UST/AST closure. Work involved excavation of UST with excavator and/or backhoes, removal of UST, sampling of soils for regulatory compliance and writing/submission of closure reports. Conducted tailgate safety meetings and advised workers on task and conditions that posed a work hazard, such as excavation awareness, equipment awareness, and confined spaces. Performed air monitoring for confined space entry and evaluated worker exposure to airborne hazards. Provided workers with appropriate PPE and ensured employee was trained and familiar with use of equipment and PPE. Completed safety oversight of Level A and Level B work for confined space work and inspected all equipment used during those activities.

Provided safety oversight and assisted spill response crews responding to hazardous materials spills including source material excavation and removal and coordinating disposal of contaminated materials through manifesting, hauling, and disposal of materials. Inspected/prepared hazardous waste and IDW for disposal by performing hazard characterization and segregation of materials for storage and disposal, completing manifest documentation, assuring compliance with HAZCOM/labeling requirements, and coordinating with transportation and disposal facilities for acceptance of materials. Performed air monitoring of site conditions to evaluate worker exposure from a release of hazardous materials and provided personnel appropriate PPE based on findings. Informed site personnel of hazards through safety briefings and as conditions changed. Provided onsite safety inspection of work area to changing conditions and made workers aware of those conditions. Completed oversight of Level A and Level B work for hazardous materials spill response and inspected all equipment used during those activities.

Other duties included assisting/training personnel in boating/water safety and selection of PPE and personal floatation devices (PFD) for spill responses on water bodies. Assisted personnel with fall protection and inspected hoist systems during work performed at elevations. Provided workers training in the recognition of hazards on the job site and how to report and make others aware of these conditions.

Environmental Projects, Various Locations, Government Clients, Environmental Associate – (June 2002 to February 2004) Performed a wide variety of environmental projects for multiple government clients. Collected environmental samples, including soil and groundwater, to determine human and ecological risks associated with contamination on government facilities. Completed reports and developed abatement/remedial plans for the site based on site assessments. Assisted in implementing the abatement/remedial plans and collected soil, air, water, asbestos, and lead based paint samples. Performed an auditory protection survey for a shipbuilding client through monitoring of decibel levels with a dosimeter during all phases of the shipbuilding activities. Provided additional recommendations based on auditory findings including updating of the worker hearing protection plan. Assisted in writing, development, and implementing the site safety plans for a variety of work sites and activities. Assisted personnel in the selection and use of PPE for respiratory protection and provided daily safety meeting at work sites. Provided OSHA 40 hour refresher training to personnel in accordance with 29 CFR 1910.120. Developed a lead based paint and asbestos inspector training program according to VDPOR, AHERA, and HUD regulations. **Asbestos and Lead Paint Projects, Various Locations, Multiple Clients, Environmental Specialist – (February 2000 to June 2002)** Monitored asbestos and lead paint abatement projects for government, commercial, and residential clients by overseeing workers, providing tailgate meetings, checking licensure documentation, selection of training of PPE, performed workplace air monitoring, provided hazard analysis, and observing/correcting safe work practices. Oversight of work crew safety monitoring and performed respirator fit checks to workers. Performed inspections and risk assessments for asbestos and lead paint, and developed abatement strategies. Inspected/prepared materials for disposal by segregating hazardous materials and completing manifest documentation and HAZCOM/labeling requirements. Provided classroom instruction and training in asbestos, lead paint, and hazardous materials response to commercial and government clients. Performed environmental SIs for various commercial clients, and made recommendations based on findings. **Arsenic Loading of Soils from Coal Shipping, Hampton Roads, VA, Thesis, Laboratory Technician – (December 1997 to August 2001)** Evaluated additional loading effect to soils from windblown dust generated during shipping and loading of coal into commercial vessels. Collected soil samples from the Hampton Roads region to be analyzed for coal particles originating from a coal terminal and determined the distribution of the particles, which followed prevailing winds. Analyzed soil samples for arsenic contaminants present in coal to historical arsenic background concentrations to determine whether windblown coal particles impacted soil concentrations of arsenic. **Network Maintenance/Repair, Virginia Beach, VA, United Mortgage, Network Administrator – (May 1996 to February 2000)** Responsible for network maintenance, setup, and repair of workstations, installation of new software, and employee training. **Boat Construction/Maintenance/Repair, Hampton, VA,**

Bluewater Yachts, Marine Technician – (September 1992 to April 1993) Performed boat construction, maintenance, and repair including welding, fiberglass work, engine repair, and carpentry. Responsible for segregating and manifesting used oil, antifreeze, paint, and solvents for disposal. **Field Operations/Background Investigations, Washington, DC, Federal Bureau of Investigation (FBI) – (April 1989 to September 1992)** Assisted with field operations and background investigation for potential employees of the government requiring security clearance. Held a secret service clearance for work with case files.

Commonwealth of Virginia
State Board for Community Colleges

Tidewater Community College

This is to certify that

William Bounds

is presented this

Award of Completion

40 Hour Hazardous Waste Operations and Emergency Response Training

Given this 18th day of May Two Thousand One

President

Chancellor, Virginia Community College System

WESTON SOLUTIONS®
Restoring Resource Efficiency

This Certifies That

WILLIAM BOUNDS JR

Has Completed the

30-Hour Construction Safety and Health Training Course

In accordance with OSHA Outreach Training Program (Includes Competent Person Instruction as indicated in 29 CFR 1926 Subparts C, E, M, P, & X) completed on 11/16/2012 in West Chester, PA

TRAINING MANAGER
Owen B. Douglass, Jr., PhD, CIH

INSTRUCTOR
Theodore L. Blackburn

82_17418_11162012

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06P-0910-2

WESTON SOLUTIONS®
Restoring Resource Efficiency

This Certifies That

WILLIAM BOUNDS JR

Has Completed the

8-Hour HAZWOPER Refresher Training Course

In accordance with 29 CFR 1910.120(e)(8) completed on 05/14/2013 in Chesapeake, VA

TRAINING MANAGER
Ted Blackburn, CSP, CET

INSTRUCTOR
Christopher M. Baer CSP

1_17418_05142013

Weston Solutions, Inc • 1400 Weston Way • West Chester, PA • 19380

06P-0910-2

WESTON SOLUTIONS
Restoring Resource Efficiency

This Certifies That

WILLIAM BOUNDS JR

Has Completed the

8-Hour Site Manager and Supervisor Training Course

In accordance with 29 CFR 1910.120(e)(4) completed on 03/14/2013 in Chesapeake, VA

Ted Blackburn CSP, CET

TRAINING MANAGER
Ted Blackburn, CSP, CET

Christopher Baer CSP

INSTRUCTOR
Christopher M. Baer CSP

Weston Solutions, Inc • 1400 Weston Way • West Chester, PA • 19380

06P-0910-2

Site Manager/Field Safety Officer EHS Certification Form

Employee Name: William J Bounds	Employee Number: 020581	Division: NVA	Profit Center: Federal

Managers Certification:

Choose One	Managers Initials	Date of Hire
This employee has been employed by WESTON for one year or more.	LJW III	
If Less than 1 year, is the service requirement waved by Manager? (Justify)		4/16/2012

Comments: ______

I certify that the employee listed above has appropriate qualifications and experience and demonstrates the ability and ambition to serve as a WESTON **Field Safety Officer** ______ **Site Manager** ______ **Both** X

Manager's Name: (print) Craig J. LaCosse

Signature: [signature] **Date:** May 23, 2013

Division EHS Manager Certification and Qualification Record

A.) Field Safety Officer:

	HAZWOPER (Initial Highest)	PPE Level (Circle)	Construction (Initial Highest)	Yrs Experience (Check)		Professional Certification (Circle)
FSO Level 1		A B C D		Min 1	☐	
FSO Level 2		A B C D		Min 3	☐	
FSO Level 3		A B C D		Min 5	☐	
FSO Level 4		A B C D		Min 5	☒	
FSO Level 5**		A B C D		Min 10	☐	ASP STS CHST
FSO Level 6**		A B C D		Min 10	☐	CSP CIH

Note: * Can be used for Level 2 Construction SM/FSO, to meet EM 385-1-1 or as interim (for six months only) for an experienced SM/FSO until they can take the 30 hour course.

**This employee has had a minimum of 24 hours of related training in each of the last 5 years

B.) Site Manager/Field Safety Officer:

HAZWOPER *(29 CFR 1910.120 Compliance)*

	Yes	No	Date
40-Hr HAZWOPER	☒	☐	5/18/2001
8-Hr HAZWOPER Refresher	☒	☐	6/7/2012
8-Hr HAZWOPER Site Managers/ Supervisors Course:	☒	☐	3/14/2013
24-Hrs Supervised On-The-Job Training	☒	☐	6/1/2001

CONSTRUCTION

	Yes	No	Date
10 Hour OSHA Construction Course *	☐	☒	
30-Hour OSHA Construction Course	☒	☐	11/16/2012
8-Hour Site Manager/Field Safety Officer EHS Compliance Training Course (Initial)	☒	☐	3/14/2013
8-Hour Site Manager/Field Safety Officer EHS Compliance Training Course (Annual Refresher)	☐	☐	

COMPETENT PERSON

	Yes	No	Date
Excavation(Type "C" Soil only)	☒	☐	6/8/2012
Scaffolding	☐	☐	
Hearing	☒	☐	12/2003
Excavation	☒	☐	6/8/2012
Hazard Com	☒	☐	5/18/2001
Confined Space	☒	☐	6/8/2012
Fall Protection	☒	☐	6/8/2012
PPE	☒	☐	5/18/2001

I have certified this individual as a Field Safety Officer at the above levels:

DEHS Manager's Name: (print) Lawrence J Werts III

Signature: Lawrence J Werts III **Date:** 6/6/13

WESTON SOLUTIONS®
Restoring Resource Efficiency

This Certifies That

WILLIAM BOUNDS JR

Has Completed the

2013 GHS Hazard Communication Training

In Accordance with 29 CFR 1910.1200 as Updated with the GHS Requirements completed on 05/14/2013 in Chesapeake, VA

TRAINING MANAGER
Ted Blackburn, CSP, CET

INSTRUCTOR
Christopher M. Baer CSP

1304_17418_05142013 *Weston Solutions, Inc • 1400 Weston Way • West Chester, PA • 19380*

06P-0910-2

WESTON SOLUTIONS®
Restoring Resource Efficiency

This Certifies That

WILLIAM BOUNDS JR

Has Completed the

Excavation & Trenching Competent Person

completed on 11/16/2012 in West Chester, PA

TRAINING MANAGER
Owen B. Douglass, Jr., PhD, CIH

INSTRUCTOR
Theodore L. Blackburn

545_17418_11162012 *Weston Solutions, Inc • 1400 Weston Way • West Chester, PA • 19380*

06P-0910-2

This Certifies That

WILLIAM BOUNDS JR

Has Completed the

Shipping and Transporting Dangerous Goods - Admin/Field Personnel Initial

completed on 10/09/2012 in WebEx + Conference Call, PA

TRAINING MANAGER
Owen B. Douglass, Jr., PhD, CIH

INSTRUCTOR
James D. Newman

1029_17418_10092012 *Weston Solutions, Inc • 1400 Weston Way • West Chester, PA • 19380*

06P-0910-2

Restoring Resource Efficiency

This Certifies That

WILLIAM BOUNDS JR

Has Completed the

Hydrogen Sulfide Safety

completed on 05/14/2013 in Chesapeake, VA

INSTRUCTOR

Christopher M. Baer CSP

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06P-0910-2

WESTON SOLUTIONS®
Restoring Resource Efficiency

This Certifies That

WILLIAM BOUNDS JR

Has Completed the

Bloodborne Pathogens Training Course Initial

In accordance with 29 CFR 1910.1030 completed on 06/07/2012 in Chesapeake, VA

Owen B Douglass Jr PhD, CIH
TRAINING MANAGER
Owen B. Douglass, Jr., PhD, CIH

George M Crawford Jr CIH
INSTRUCTOR
George M. Crawford Jr CIH

11_17418_06072012

Weston Solutions, Inc • 1400 Weston Way • West Chester, PA • 19380

This Certifies That

WILLIAM BOUNDS JR

Has Completed the

Bloodborne Pathogens Training Course Refresher

In accordance with 29 CFR 1910.1030 completed on 05/14/2013 in Chesapeake, VA

TRAINING MANAGER
Ted Blackburn, CSP, CET

INSTRUCTOR
Christopher M. Baer CSP

2_17418_05142013

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06P-0910-2

American Red Cross

This recognizes that
William Bounds
has completed the requirements for
Adult CPR
conducted by
Southeastern Virginia Chapter
Date completed: **07/20/2012**
The American Red Cross recognizes
this certificate is valid from
completion date for: **2 Years**

American Red Cross

This recognizes that
William Bounds
has completed the requirements for
AED-Adult
conducted by
Southeastern Virginia Chapter
Date completed: **07/20/2012**
The American Red Cross recognizes
this certificate is valid from
completion date for: **2 Years**

American Red Cross

This recognizes that
William Bounds
has completed the requirements for
First Aid
conducted by
Southeastern Virginia Chapter
Date completed: **07/20/2012**
The American Red Cross recognizes
this certificate is valid from
completion date for: **2 Years**

07/25/2013

LAST NAME	BOUNDS
FIRST NAME	WILLIAM

FIT TEST REPORT

ID NUMBER	020581		
LAST NAME	BOUNDS	**CUSTOM1**	
FIRST NAME	WILLIAM	**CUSTOM2**	
COMPANY	WESTON	**CUSTOM3**	
LOCATION	NORFOLK	**CUSTOM4**	
NOTE			
TEST DATE	07/24/2013	**PORTACOUNT S/N**	16475
TEST TIME	09:30	**N95-COMPANION**	N
DUE DATE	07/24/2014		
RESPIRATOR	MSA ULTRA TWIN FULL FAC	**PROTOCOL**	OSHA 29CFR1910.134
MANUFACTURER	MSA	**PASS LEVEL**	500
MODEL	ULTRA TWIN		
MASK STYLE	FULL FACE	**APPROVAL**	C BAER
MASK SIZE	MEDIUM	**EFFICIENCY <99%**	N

EXERCISE	DURATION (sec)	FIT FACTOR	PASS
NORMAL BREATHING	60	59300	Y
DEEP BREATHING	60	25400	Y
HEAD SIDE TO SIDE	60	59800	Y
HEAD UP AND DOWN	60	178000	Y
TALKING	60	35100	Y
GRIMACE	15	Excl.	
BENDING OVER	60	24600	Y
NORMAL BREATHING	60	88200	Y

OVERALL FIT FACTOR 44000 Y

FITTEST OPERATOR [signature] **DATE** 7/24/13

C BAER

NAME **DATE**

WILLIAM BOUNDS

07/25/2013

LAST NAME	BOUNDS
FIRST NAME	WILLIAM

FIT TEST REPORT

ID NUMBER	020581		
LAST NAME	BOUNDS	**CUSTOM1**	
FIRST NAME	WILLIAM	**CUSTOM2**	
COMPANY	WESTON	**CUSTOM3**	
LOCATION	NORFOLK	**CUSTOM4**	
NOTE			

TEST DATE	07/24/2013	**PORTACOUNT S/N**	16475
TEST TIME	09:41	**N95-COMPANION**	N
DUE DATE	07/24/2014		

RESPIRATOR	SCOTT AV 3000 SURE SEAL	**PROTOCOL**	OSHA 29CFR1910.134
MANUFACTURER	SCOTT	**PASS LEVEL**	500
MODEL	AV 3000 SURE SEAL		
MASK STYLE	FULL FACE	**APPROVAL**	C BAER
MASK SIZE	MEDIUM	**EFFICIENCY <99%**	N

EXERCISE	DURATION (sec)	FIT FACTOR	PASS
NORMAL BREATHING	60	617	Y
DEEP BREATHING	60	7980	Y
HEAD SIDE TO SIDE	60	15700	Y
HEAD UP AND DOWN	60	10300	Y
TALKING	60	1560	Y
GRIMACE	15	Excl.	
BENDING OVER	60	8310	Y
NORMAL BREATHING	60	11800	Y

OVERALL FIT FACTOR 2540 Y

FITTEST OPERATOR [signature] **DATE** 7/24/13

C BAER

NAME **DATE**

WILLIAM BOUNDS

WORKCARE™
Making Health Count

WORK STATUS REPORT

Employer Copy

TYPE OF EXAMINATION: **Annual Exam**
EXAM CLASSIFICATION: **Periodic Examination**
PLACE OF EXAMINATION: **2295 - Bayview Medical Center- Now Care**

EMPLOYEE:	**Bounds, William**	**COMPANY:**	**Weston Solutions, Inc**
ID:	**020581**	**POSITION:**	**Associate Geoscientist**
DATE OF EXAM:	**05/16/2013**	**LOCATION:**	**Weston-West Chester (Federal)**
EXPIRATION DATE:	**05/16/2015**	**SITE:**	

The following recommendations are based on a review of one or all of the following: a base history questionnaire, supporting diagnostic tests, physical examination, and the essential functions of the position applied for or occupied by the individual named above.

The following recommendations includes review of the following exam components:

- *Blood Lead/ZPP*
- *Urine Heavy Metals Screen 3822 (Panel includes Urine Ar*

	Yes	No	Undecided
Has the employee any detected medical conditions that would increase his/her risk of material health impairment from occupational exposure in accordance with 29 CFR §1910.120?	☐	☒	☐
Does the employee have any limitations in the use of respirators in accordance with 29 CFR §1910.134?	☐	☒	☐
Examination in accordance with OSHA 1910.120, 1926.1101 (Asbestos Certification). Employee has been informed of the increased risk of lung cancer attributable to the combined effect of smoking and asbestos exposure.	☒	☐	☐

STATUS

☐ **QUALIFIED** The examination indicates no significant medical condition. Employee can be assigned any work consistent with skills and training.

☒ **QUALIFIED - WITH LIMITATIONS** The examination indicates that a medical condition currently exists that limits work assignments on the following basis:

☒ ***Able to participate in biomedical response to all agents excluding smallpox. Not able to participate in collection activities.***

☐ **NOT QUALIFIED**

☐ **DEFERRED** The examination indicated that additional information is necessary. The employee has been given the following instructions.

COMMENTS:

I have reviewed the medical data of the above named employee, and informed the employee of the results of the medical examination and any medical conditions that require follow-up examination or treatment.

Name of Physician: Irene L. Grace, M.D. Date: 05/23/13

Signature: Irene L. Grace, MD

Qualifications Summary

- More than 14 years of experience in the UXO/EOD field.
- More than 8 years of supervisory/management experience including demolition operations.
- UXO location and clearance on civilian locations and military installations.
- Conducted QC inspections, analyzed MEC and operational risk and hazards, and enforced compliance with safety regulations.
- Development of programmatic policy/ procedures and management of programs.
- Completed SI, RI/FS, EE/CA, removal, construction support, and ordnance avoidance projects.

WILLIAM TROY PHELPS

Registration

Construction Quality Management for Contractors Certification, USACE (2010)
UXO Certification, USACE Huntsville Center (No. 0460)
Licensed Blaster (unrestricted) in the Commonwealth of Virginia (since 2003)
Licensed Blaster (limited) in the Commonwealth of Pennsylvania (Since 2009)

Education

U.S. Naval School for Explosive Ordnance Disposal (1997)
U.S. Air Force Fire Fighter Specialist

Credentials

Behavior-Based Safety Training – Phase I, WESTON (2011)
Fall Protection Competent Person Training Course – Initial, OSHA 29 CFR 1926 Subpart M, WESTON (2009)
Trenching/Excavation Competent Person Training Course, OSHA 29 CFR 1926 Subpart P, WESTON (2009)
Underground Utilities Competent Person Training, WESTON (2008)
Explosive Ordnance Disposal Phases I and II – Surface (CINS A-431-0069/A-431-0012), Naval School Explosive Ordnance Disposal (1997)
30-Hour Construction Safety Training, OSHA 29 CFR 1926, WESTON (2009)
10-Hour Construction Safety Training, OSHA 29 CFR 1926, Advance Online Solutions, Inc. (2007)
8-Hour Managers and Supervisors Course (SHSC), OSHA 29 CFR 1910.120(e)(4), WESTON (2009)
40-Hour HAZWOPER Training, OSHA 29 CFR 1910.120(e)(3), Human Factors Applications, Inc. (1997)
8-Hour HAZWOPER Refresher Course, OSHA 29 CFR 1910.120(e)(8), WESTON (2012)
First Aid/CPR refresher training, (2012)
Bloodborne Pathogens Refresher Training, OSHA 29 CFR 1910.1030, WESTON (2012)
Radiation worker II (2009)

Employment History

2007-Present WESTON, UXO Field Project Leader

Employment History (Continued)

2003-2007	Zapata Engineering, UXO Technician
2000-2002	UXB International, UXO Technician
1999	EOD Technologies, UXO Technician
1997-1998	Human Factors Applications, UXO Technician
1991-2002	U.S. Air Force Reserves

Key Projects

Management of Munitions and Explosives of Concern (MEC) Operations, West Chester, PA, Weston Solutions, Inc., Munitions and Explosives of Concern (MEC) Operations/Technical Manager for the Central Division. Manage and oversee every-day operations that involve MEC for WESTON's Central Division MEC center of excellence (CX). Research appropriate and relevant manuals, pamphlets, publications, tech data, etc., to ensure the MEC documents are current and referenced properly. Cognizant of all MEC projects within Central Division footprint to enable review of all MEC-related documents as well as place key personnel in appropriate positions and ensure that equipment and explosives are available prior to field work. Interact with PM and site staff members to ensure adherence to schedule and work plan requirements, including Quality Assurance (QA) Plans and Health and Safety Plans (HASPs). Create, implement, and audit quality in accordance with client objectives, work plans, and appropriate regulations. Current MEC Quality Manager on U.S. Army Corps of Engineers (USACE) Omaha projects and National Guard Bureau (NGB) projects. [07-10 to present]

Unexploded Ordnance (UXO) and MEC Removal Action for CAU 408: Bomblet Target Area, Tonopah Test Range, Nevada, Department of Energy (DOE) and Stoller Navarro Joint Venture, Senior UXO Supervisor (SUXOS). Duties included managing, overseeing, and guiding all MEC operations and all UXO teams. Extensive knowledge of all Technician (1, 2, and 3) duties and requirements as stated in work control package and in accordance with all state and federal regulations. Worked closely with client and other agencies in planning our clearance activities along with demolition operations for air space clearance required. Every-day planning of clearance activities including surveying with the recognition of areas of concern (AOCs) and order of clearance, and team composition and their placement in coordination with other teams. All explosive operations as well as certification of all types of munitions-related scrap and their final disposition. [11-09 to 06-10]

UXO MEC Removal Action at Munitions Response Site (MRS)-R02D and MRS-R02B, Tobyhanna State Park, Pennsylvania, Pennsylvania Department of Environmental Protection (PADEP), SUXOS. Duties included managing, overseeing, and guiding all MEC operations and all UXO teams. Extensive knowledge of all Technician (1, 2, and 3) duties and requirements as stated in Work Plan and in accordance with all state and federal regulations. Responsible for every-day planning of clearance activities, including surveying with the recognition of AOCs and order of clearance, and team composition and their placement in coordination with other teams. Also responsible for all explosive operations as well as certification of all types of munitions-related scrap and their final disposition. [4-09 to 11-09]

UXO Beach Clearance, Surf City, NJ, USACE Philadelphia District (CENAP), Technician 3, Team Leader. Duties included Technician 3 and team leader of Team 5, which was also

Key Projects (Continued)

known as the "surf team." Team was responsible for sweeping areas from low-tide markers out to a distance of 150 feet or a depth of 4 feet. The team utilized the MK-26 ferrous metal locator and required dry suits and life vests. Water temperature: 40°; tide conditions: rough. [2-09 to 4-09]

Reacquisition of Anomalies, Chino Hills, CA, Aerojet, Technician 3, Site Safety Officer (SSO), Quality Control (QC) Officer. Schonstedts were utilized in a grid-type setting, but also warranted reacquiring anomalies established by using an EM-61. The data taken met criteria determined by both client and WESTON geographic information system (GIS) and allowed reacquisition. The areas inaccessible to the EM-61 were then swept, and numerous items were recovered; all passed QC by both client and WESTON. [1-09 to 2-09]

Sweep and Clearance of Beachfront, Former Nansemond Ordnance Depot, Virginia, USACE Baltimore District (CENAB), Technician 3, Team Leader, Demolition Supervisor (VA Blaster On-Site), Alternate Site UXO Supervisor. Responsibilities included Technician 3, team leader, demolition supervisor, and Alternate Site UXO Supervisor. Five-man team used Schonstedts to sweep grids along the known AOCs. Team began finding MEC closer to the actual beachfront area and began a manual sift operation that produced over 1,100 pounds of raw explosives and several MEC items that needed to be detonated. The team sifted until CENAB was satisfied that no explosive hazards remained. [3-08 to 1-09]

Sweep and Clearance of Munitions Debris, Main Burning Grounds, Former Nansemond Ordnance Depot, Virginia, CENAB, Technician 2/3, Team Leader, Demolition Supervisor (VA Blaster On-Site). Responsibilities included Technician 2/3, team leader, and demolition supervisor. Working with USACE Baltimore District and Norfolk District, five-man team used Schonstedts to "mag and dig," which involved laying lanes in a 100-foot by 100-foot grid and sweeping north to south, then rotating 180 degrees and sweeping east to west. A large amount of munitions debris and cultural debris was present, which required the team to manually sift certain areas until CENAB was satisfied that no hazards remained. [10-07 to 3-08]

Explosive Operations, Various Locations, Multiple Clients, Technician 2/3. Conducted Technician 2 responsibilities in accordance with Work Plan and served as Technician 3 for explosives operations, including blasting work. Operated many types of heavy equipment. [1-03 to 9-07]

Explosive Operations, Fort Belvoir, VA, USACE CENAB, Blaster On-Site. Served as Blaster On-site from November 2006 to September 2007. [1-03 to 9-07]

Explosive Operations, Former Nansemond Ordnance Depot, VA, USACE Huntsville, Blaster On-Site. [1-03 to 11-06]

UXO Clearance, Former Nansemond Ordnance Depot, VA, USACE, Huntsville, UXO Technician 2. Performed Technician 2 responsibilities in accordance with Work Plan. Operated heavy equipment, including backhoe and mini-excavator. [4-00 to 12-02]

UXO Services, Empire Ranges, Republic of Panama, USACE, Huntsville, UXO Technician 2. Performed UXO Technician 2 responsibilities in accordance with Work Plan. [1-99 to 9-99]

Key Projects (Continued)

UXO Services, Tobyhanna State Park, PA, USACE Rock Island, **UXO Technician 2.** Performed Technician 2 responsibilities in accordance with Work Plan. [10-97 to 12-97; 4-98 to 12-98]

AdvanceOnline Training Center

Certificate of Completion

William Phelps

has met the online course completion requirements for

OSHA 10-Hour Construction Safety

This student has completed the formal instruction for the 10-Hour Construction Outreach Program. Topics covered in this program were Introduction to OSHA, Electrical Safety, Excavation Safety, Fall Protection, Forklift Safety, Ladder Safety, Materials Handling, Permit-Required Confined Spaces, Personal Protective Equipment, and Scaffold Safety.

Certificate ID: 307_5794
Instructor: Gleason, Rick
Continuing Education Units: 1.0

Date: 5/2/2007 9:57:15 PM
Time Online: 14:15:00

AdvanceOnline Solutions, Inc.

5858 Westheimer Rd. Ste. 405
Houston, TX 77057
www.brightbrains.com
(713) 621-1100

This education program meets the Criteria for Certification established by the Authorized Provider Commission of the International Association for Continuing Education and Training, 1200 19th St., NW, Suite 300, Washington, DC 20036-2401.

Site Manager/Field Safety Officer EHS Certification Form

Employee Name: William Troy Phelps	Employee Number: 019324	Division: Mid-Atlantic	Profit Center: 1531-Fed

Managers Certification:

Choose One	Managers Initials	Date of Hire
This employee has been employed by WESTON for one year or more.	Lp	10/2007
If Less than 1 year, is the service requirement waved by Manager? (Justify)		

Comments: ______

I certify that the employee listed above has appropriate qualifications and experience and demonstrates the ability and ambition to serve as a WESTON **Field Safety Officer** ______ **Site Manager** ______ **Both** ✓

Manager's Name: (print) LAURA PASTOR

Signature: Laura Pastor **Date:** 22 July 09

Division EHS Manager Certification and Qualification Record

A.) Field Safety Officer:

	HAZWOPER (Initial Highest)	HAZWOPER PPE Level (Circle)	Construction (Initial Highest)	Yrs Experience (Check)	Professional Certification (Circle)
FSO Level 1		A B C D		Min 1 ☐	
FSO Level 2		A B C D		Min 3 ☐	
FSO Level 3		A B C D		Min 5 ☐	
FSO Level 4		A B C D		Min 5 ☑	
FSO Level 5**		A B C D		Min 10 ☐	ASP STS CHST
FSO Level 6**		A B C D		Min 10 ☐	CSP CIH

Note: * Can be used for Level 2 Construction SM/FSO, to meet EM 385-1-1 or as interim (for six months only) for an experienced SM/FSO until they can take the 30 hour course.

**This employee has had a minimum of 24 hours of related training in each of the last 5 years

B.) Site Manager/Field Safety Officer:

HAZWOPER *(29 CFR 1910.120 Compliance)*

	Yes	No	Date
40-Hr HAZWOPER	☒	☐	10/24/97
8-Hr HAZWOPER Refresher	☒	☐	09/10/09
8-Hr HAZWOPER Site Managers/ Supervisors Course:	☒	☐	04/02/09
24-Hrs Supervised On-The-Job Training	☒	☐	

CONSTRUCTION

	Yes	No	Date
10 Hour OSHA Construction Course *	☒	☐	10/02/07
30-Hour OSHA Construction Course	☒	☐	04/10/09
8-Hour Site Manager/Field Safety Officer EHS Compliance Training Course (Initial)	☒	☐	04/02/09
8-Hour Site Manager/Field Safety Officer EHS Compliance Training Course (Annual Refresher)	☐	☐	

COMPETENT PERSON

	Yes	No	Date
Excavation(Type "C" Soil only)	☒	☐	04/10/09
Scaffolding	☒	☐	04/10/09
Hearing	☐	☐	
Excavation	☒	☐	04/10/09
Hazard Com	☐	☐	
Confined Space	☐	☐	
Fall Protection	☒	☐	04/09/09
PPE	☐	☐	

I have certified this individual as a Field Safety Officer at the above levels:

DEHS Manager's Name: (print) Lawrence J Werts III

Signature: Lawrence J Werts III **Date:** 18 Aug 09

MEC work only LJW III

WESTON SOLUTIONS®
Restoring Resource Efficiency

This Certifies That

WILLIAM PHELPS

Has Completed the

Underground Utilities Competent Person Training

has successfully completed Underground Utilities Competent Person Training in accordance with WESTON Field Operating Procedure (FLD) 34 completed on 09/12/2008 in Chesapeake, VA

George M Crawford CIH

INSTRUCTOR
George M. Crawford Jr CIH

1040_15612_09122008 *Weston Solutions, Inc • 1400 Weston Way • West Chester, PA • 19380*

WESTON SOLUTIONS®
Restoring Resource Efficiency

This Certifies That

WILLIAM PHELPS

Has Completed the

Behavior Based Safety - Phase I

Behavior Based Safety - Phase I completed on 03/02/2011 in WebEx & Conference Call, PA

INSTRUCTOR
Owen B. Douglass Jr PhD, CIH

1018_15612_03022011 *Weston Solutions, Inc • 1400 Weston Way • West Chester, PA • 19380*

06P-0910-2

HFA

CERTIFICATE OF TRAINING

This Certifies That

WILLIAM T. PHELPS

Satisfactorily Completed the

OSHA 40 - Hour Hazardous Waste Site Worker
& Emergency Response Course

Hazardous Waste Operations
29 CFR 1910.120(e)(1)&(9)

PRESENTED BY HUMAN FACTORS APPLICATIONS, INC.

Dated this 24th Day of October 19 97

Michael L Weininger
INSTRUCTOR

This Certifies That

WILLIAM PHELPS

Has Completed the

Fall Protection Competent Person Initial

completed on 04/09/2009 in Vernon Hills, IL

Conrad W. Lehr, CET

TRAINING MANAGER
Conrad W. Lehr, CET, CIT

Ted Blackburn CSP, CET

INSTRUCTOR
Theodore L. Blackburn CSP, CET

548_15612_04092009

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06P-0910-2

WESTON SOLUTIONS®
Restoring Resource Efficiency

This Certifies That

WILLIAM PHELPS

Has Completed the

Excavation & Trenching Competent Person

completed on 04/10/2009 in Vernon Hills, IL

TRAINING MANAGER
Conrad W. Lehr, CET, CIT

INSTRUCTOR
Theodore L. Blackburn CSP, CET

545_15612_04102009 *Weston Solutions, Inc • 1400 Weston Way • West Chester, PA • 19380*

06P-0910-2

This Certifies That

WILLIAM PHELPS

Has Completed the

8-Hour Site Manager and Supervisor Training Course

In accordance with 29 CFR 1910.120(e)(4) completed on 04/02/2009 in West Chester, PA

TRAINING MANAGER
Conrad W. Lehr, CET, CIT

INSTRUCTOR
Conrad W. Lehr

195_15612_04022009

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06P-0910-2

Naval School
Explosive Ordnance Disposal

Certificate of Completion

Presented to

SRA William T. Phelps, USAF

for having successfully completed the prescribed course of study for
EXPLOSIVE ORDNANCE DISPOSAL
Phase I & II - Surface (CINs A-431-0069/A-431-0012)
on this, 01st day of July, 1997

CDR J. C. McLAWHORN, USN
Commanding Officer

WESTON SOLUTIONS®
Restoring Resource Efficiency

This Certifies That

WILLIAM PHELPS

Has Completed the

30-Hour Construction Safety and Health Training Course

In accordance with OSHA Outreach Training Program (Includes Competent Person Instruction as indicated in 29 CFR 1926 Subparts C, E, M, P, & X) completed on 04/10/2009 in Vernon Hills, IL

TRAINING MANAGER
Conrad W. Lehr, CET, CIT

INSTRUCTOR
Theodore L. Blackburn CSP, CET

82_15612_04102009

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06P-0910-2

WESTON SOLUTIONS
Restoring Resource Efficiency

This Certifies That

WILLIAM PHELPS

Has Completed the

Bloodborne Pathogens Training Course Refresher

In accordance with 29 CFR 1910.1030 completed on 10/31/2012 in Tempe, AZ

Owen B. Douglass, Jr., PhD, CIH
TRAINING MANAGER
Owen B. Douglass, Jr., PhD, CIH

Mike S. Stuart
INSTRUCTOR
Michael S. Stuart

2_15612_10312012

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06P-0910-2

WESTON SOLUTIONS®
Restoring Resource Efficiency

This Certifies That

WILLIAM PHELPS

Has Completed the

8-Hour HAZWOPER Refresher Training Course

In accordance with 29 CFR 1910.120(e)(8) completed on 10/31/2012 in Tempe, AZ

TRAINING MANAGER
Owen B. Douglass, Jr., PhD, CIH

INSTRUCTOR
Michael S. Stuart

1_15612_10312012

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06P-0910-2

Certificate Of Completion

IS HEREBY PRESENTED TO

william phelps

In Recognition Of Successful Completion Of CPRToday! Inc. Training Course In

BASIC FIRST AID

62803220-5463	November 1, 2012 (November 2014)	Trevor R. Karas
Certification Number	Certification Date (Expiration Date)	Instructor's Signature

LET IT BE KNOWN THAT THE ABOVE NAMED INDIVIDUAL HAS SUCCESSFULLY MET EVALUATION OBJECTIVES CONSISTENT WITH NATIONALLY-RECOGNIZED ECC/ILCOR/AHA COGNITIVE ASSESSMENT GUIDELINES FOR EMERGENCY CARE AND RESUSCITATION, AND IN ACCORDANCE WITH NATIONAL HEALTH & SAFETY FOUNDATION AND CPRTODAY INC. STANDARDS AND CERTIFICATION TERMS & CONDITIONS

LET IT BE KNOWN THAT

william phelps

Has Successfully Completed CPRToday! Inc. Training Course In

BASIC FIRST AID

62803220-5463	11/01/2012 (11/2014)	Trevor R. Karas
Certification Number	Certified On (Exp. Date)	Instructor

This individual has successfully met evaluation objectives consistent with ECC/ILCOR/AHA and nationally-recognized cognitive assessment guidelines and CPRToday! Inc. Terms & Conditions

Certificate Of Completion

IS HEREBY PRESENTED TO

william phelps

In Recognition Of Successful Completion Of CPRToday! Inc. Training Course In

Basic Life Support
Adult CPR, Child CPR & Infant CPR

67400711-1858	November 1, 2012 (November 2014)	Regina Bennett
Certification Number	Certification Date (Expiration Date)	Instructor's Signature

LET IT BE KNOWN THAT THE ABOVE NAMED INDIVIDUAL HAS SUCCESSFULLY MET EVALUATION OBJECTIVES CONSISTENT WITH NATIONALLY-RECOGNIZED ECC/ILCOR/AHA COGNITIVE ASSESSMENT GUIDELINES FOR EMERGENCY CARE AND RESUSCITATION, AND IN ACCORDANCE WITH NATIONAL HEALTH & SAFETY FOUNDATION AND CPRTODAY INC. STANDARDS AND CERTIFICATION TERMS & CONDITIONS

WORK STATUS REPORT

Employer Copy

TYPE OF EXAMINATION: Annual Exam
EXAM CLASSIFICATION: Periodic Examination
PLACE OF EXAMINATION: 1452 - CONCENTRA-GOLDEN

EMPLOYEE: Phelps, William
ID: 019324
DATE OF EXAM: 09/25/2012
EXPIRATION DATE: 09/25/2014

COMPANY: Weston Solutions, Inc
POSITION: Operations Manager
LOCATION: Weston-Dayton (DOH)
SITE: Springfield

The following recommendations are based on a review of one or all of the following: a base history questionnaire, supporting diagnostic tests, physical examination, and the essential functions of the position applied for or occupied by the individual named above.

	Yes	No	Undecided
Has the employee any detected medical conditions that would increase his/her risk of material health impairment from occupational exposure in accordance with 29 CFR §1910.120?	☐	X	☐
Does the employee have any limitations in the use of respirators in accordance with 29 CFR §1910.134?	☐	X	☐

STATUS

[X] **QUALIFIED** The examination indicates no significant medical condition. Employee can be assigned any work consistent with skills and training.

[ ] **QUALIFIED - WITH LIMITATIONS** The examination indicates that a medical condition currently exists that limits work assignments on the following basis:

[ ] **NOT QUALIFIED**

[ ] **DEFERRED** The examination indicated that additional information is necessary. The employee has been given the following instructions.

COMMENTS:

I have reviewed the medical data of the above named employee, and informed the employee of the results of the medical examination and any medical conditions that require follow-up examination or treatment.

Name of Physician: Peter P. Greaney, M.D. Date: 09/28/12

Signature: Peter P Greaney MD

BRIAN R. GRASSMYER

Qualifications Summary

- Over 22 years of EOD expertise garnered through active military duty and UXO private industry clearance operations.
- Development and implementation of approved UXO and explosives safety procedures in compliance with all DOD, federal, state, and local statutes and codes.
- Experienced analyzing UXO and explosives operational risks, hazards, and safety requirements.
- Experienced establishing and ensuring compliance with site-specific safety requirements for UXO and explosives operations.
- Conducting safety inspections to ensure compliance with UXO and safety codes.

Registration

UXO Certification, USACE Huntsville Center (No. 2151)

Education

B.A., Homeland Security—American Military University (2006)
EOD Assistant Course, U.S. Navy (1985)
Basic EOD School, U.S. Navy (1987)
Advanced EOD Course, U.S. Navy (1992)
Master Training Specialist (MTS) Certification (2001)

Credentials

30-Hour Outreach Training for the Construction Industry, OSHA Training Institute (2010)
40-Hour Hazardous Waste Site Training Course, OSHA 29 CFR 1910.120(e)(3), Safety Unlimited, Inc. (2009)
8-Hour HAZWOPER Supervisor Training, (2009)
8-Hour Hazardous Waste Refresher Course, OSHA 29 CFR 1910.120(e)(8),(2012)
First Aid/CPR/AED, (2012)
Quality Auditor Training, (2010)
Specialized WMD EOD, Sandia Nuclear Laboratory (SNL) EOD (2007)
Radioactive Dispersal Device Course, Idaho Nuclear Laboratory (INL) (2006)
Homemade Explosives Chemical Energetics Course, Dugway Proving Ground (DPG) (2006)
Advanced Chemical/Biological Course, Dugway Proving Ground (2005)
JEOD Course, Los Alamos Nuclear Laboratory (LANL) (2003)
Improvised Explosive Device (IED) Advanced Electronics and Basic Alarm Theory Application Course, (2002)
NATO United Kingdom (IED) Course, (2000)
Hazardous Waste Operations and Emergency Response, (1999)
Post-Blast Investigator Course, FBI (1999)
Advanced Access and Disablement Course for Improvised Nuclear Devices (INDs), (1998)
Explosive Entry Technique (Breacher) Course, (1995)
Tomahawk Recovery Operation and Decontamination Course, (1992)
EOD MK16 UBA Mix Gas Supervisor Course, (1989)
Second Class Diver School, (1987)
SCUBA School, (1984)

Employment History

2011-Present	WESTON [4-11 to Present; West Chester, PA; UXO Technician 3]
2011	EA Engineering, Science and Technology
2009-2010	EOD Technology, Inc.
1984-2007	U.S. Navy, Active Duty

Key Projects

Remedial Investigation (RI) at 11 Munitions Response Sites (MRSs), West Point, NY, Military Munitions Response Program (MMRP), Senior Unexploded Ordnance Supervisor (SUXOS). Responsible for the safe, efficient execution of performance-based task order (TO) on this highly complex stakeholder rich facility. Duties include daily coordination with Directorate of Public Works (DPW) Environmental Management Division staff, Directorate of Emergency Services (DES), residents, and tenants of other facilities on-post. Manages more than 12 on-site multidisciplinary personnel including UXO staff, munitions constituent (MC) samplers, geophysicists, surveyors, and community outreach staff. [4-11 to 8-11; WESTON; Proj. No. 03886.551.001]

Munitions and Explosives of Concern (MEC) Removal Action at MRSs, Tobyhanna Artillery Range Formerly Used Defense Site (FUDS), Tobyhanna, PA, SUXOS. Provided leadership and direction of removal activities. Supervised UXO personnel conducting detection, investigation, excavation, and transportation and storage operations. Managed 27 UXO technicians and staff on-site for this removal in public park and State Game Lands. [2 week on-site project; WESTON; Proj. No. 03886.551.003]

Munitions Avoidance for Stormwater Collection, Fort Liggett, CA, UXO Safety/Escort. Overall Safety Officer during munitions avoidance in order to set stormwater collection devices in flash flooding/flooding streams and rivers to collect stormwater samples. Supervised environmental personnel in safe entry into and exit from clearance lanes and flooding streams. [2-11; EA Eng. Science & Technology]

Material Potentially Presenting an Explosive Hazard (MPPEH) Surface/Subsurface Clearance, Yuma II Project, California, UXO Safety Officer/Quality Control Supervisor (UXOSO/QCS). Served as Safety Officer/QCS during the surface/subsurface clearance to 1 ft of all MPPEH from the Chocolate Mountain Range site. Cleared ranges, including 4, 5, and 6 South, of all metal and wood debris and cleared new target areas for replacement of targets. All metals were moved into RHA for future demilitarization operations. [11-10 to 12-10; EODT, Inc.]

Excavation of Underground Radiation Material Areas, Tonopah, NV, UXOSO/QCS. Served as Safety Officer/QCS during the excavation of four underground radiation material areas, clearing depleted uranium contamination from the soil. [8-10 to 9-10; EODT, Inc.]

MEC Recovery and Clearance, Niland, CA, UXOSO/QCS. Served as Safety Officer/QCS during MEC recovery and clearance of 714 acres at 3 and 15 North ranges located at Marine Air Corps Station Yuma, and removal of 2.2 million pounds of munitions debris (MD), range debris

Key Projects (Continued)

(RD), and heavy metal scrap (15 tanks) to an RHA for processing of scrap metal to off-base facilities. [6-10 to 8-10; EODT, Inc.]

MEC Recovery and Clearance, Tonopah, NV, UXO Technician III. Served as team leader during MEC recovery and clearance of 8,631 acres. Supervised surface and subsurface clearance operations using mag-and-dig techniques. [2-10 to 5-10; EODT, Inc.]

Target Clearance, Fort Huachuca, AZ, UXO Technician II. Was team member during clearance of 38 targets. Recovered 455,000 pounds of target debris (five tanks). Installed five new green targets. [11-09 to 12-09; EODT, Inc.]

MEC Recovery and Demolition, Fort Devens, MA, UXO Technician II. Was team member during MEC recovery and demolition of approximately 1,500 items. Processed 300 pounds of target debris and removed 95,000 items (M118). Searched 83 acres and installed 8 green targets. [10-09 to 11-09; EODT, Inc.]

UXO Surface/Subsurface Clearance, Yakima, WA, UXO Technician II. Was team member during U.S. Army Corps of Engineers (USACE) project performing surface, subsurface, and mag-and-dig operations (1,046 grids cleared). [7-09 to 9-09; EODT, Inc.]

E-9, COMEODGRU TWO, Norfolk, VA, Assistant Operational Readiness and Evaluation Officer/Command Inspection Team/Master EOD Technician.

- Training and Safety Program Manager for Defense Threat Reduction Agency (DTRA). Supervised and managed global war on terrorism (GWOT) detachments with regards to training, safety equipment, and funding.
- Managed the operational readiness for 8 sea/shore commands of more than 488 EOD technicians and 110 fleet Navy divers. Lead Controller/Safety Observer for 23 major command inspections for East Coast deploying EOD assets.
- Exercise Coordinator and Safety Manager for all U.S. Navy EOD assets in support of DTRA exercise DINGO KING 2006, a complex national-level nuclear weapons exercise held in Kings Bay, GA, involving 25 military, federal government, and state organizations and agencies.
- U.S. Navy EOD Project Manager for exercise DIRECT FOCUS 2005 and 2006. Lead Controller and Safety Observer for all U.S. Navy EOD assets working in conjunction with U.S. Department of Energy (DOE) and ARG response to nuclear weapon accident/incident response drills.
- Supervised and directed improvised explosive devices (IEDs) safety training for all deploying COMEODGRU TWO staff to GWOT war zones. [2-04 to 10-07; U.S. Navy]

E-8/E-9, EOD Training and Evaluation Unit Two, Fort Story, VA, IED Division Officer/Command Safety Officer/Command Explosive Safety Officer Assistance/Range, Magazine, and Armory Manager/Master Training Specialist/Master EOD Technician.

Key Projects (Continued)

- Managed surface ordnance/IED/Weapons of Mass Destruction (WMD) Division with the daily logistics for 110 acres of ordnance training areas. Responsible for the daily training activities and safety of all students.
- Command Safety Manager for all downrange exercise scenarios.
- Trained more than 800 U.S. Navy EOD/local EOD law enforcement students to identify and render safe U.S. and foreign surface ordnance and IED/WMD ordnance.
- Demolition Range Manager and Range Safety Officer (RSO). Supervised the safe operations for 2,643 explosive transportation and demolition evolutions.
- Managed and directed the complete revision of command safety policies. Supervised and directed 11 Divisional Safety Petty Officers.
- Supervised and conducted three command industrial hygiene surveys given by the Naval Safety Center.
- Managed the maintenance of three magazines containing more than 2,000 pounds of training explosives.
- Served as Explosive Qualification and Certification Board Member.
- Developed and revised detailed Explosive Safety Processes (SOPs) for magazine, explosives transportation, and demolition operations.
- Supervised two commandwide explosive safety inspections (ESIs) given by the Navy Safety Center. Command scored Outstanding on both inspections. [1-00 to 2-04; U.S. Navy]

E-7/E-8, EOD Mobile Unit Two, Little Creek, VA, Master EOD Technician, Leading Chief Petty Officer (LCPO).

- LCPO Detachment 26 onboard USS Saipan (LPH-2) during Mediterranean Sea deployment.
- Supervised nine multinational bilateral EOD exercises in the Mediterranean. Training included IEDs, landmine identification, close quarters battle, and small arms proficiency.
- Conducted joint U.S. Navy SEAL and EOD security missions for Joint Special Operations task force and their air crew into Bosnia/Herzegovina in support of Operation Joint Endeavor.
- RSO for five live target range clearance operations in support of EOD Detachment Roosevelt Roads, Puerto Rico, and Fleet exercises COMPUEX, SOCEX, and JTFEX (Vieques Island).
- Assigned to Readiness Assessment and Training Department with the primary duties of supervising the evaluation 145 EOD technicians at 9 shore and 18 mobile detachments. Supervised 26 Readiness Assist Visits (RAVs), and was Senior Evaluator/Safety Observer for all RAVs conducted.

Key Projects (Continued)

- EOD White Force Command/Safety Controller for two major fleet cold weather exercises: ESSEX MTN-98, 99, bi-lateral multiforce EOD exercises with the EOD Canadian forces and U.S. Army, Marine, Navy EOD forces.
- CINCLANTFLT EOD coordinator for NATO exercise NORTHERN VIKING-99, a multinational EOD exercise held in Keflavik, Iceland.
- Icelandic EOD exercise coordinator for VIKING THUNDER-98. [11-94 to 1-00; U.S. Navy]

COMNAVSPECWARDEVGRU, Dam Neck, VA, Master EOD Technician E-6/E-7, Student.

- Completed a 6-month advanced SEAL operator course. [4-94 to 11-94; U.S. Navy]

EOD Mobile Unit Six Detachment Panama City, Panama City, FL, Senior EOD Technician, E-6, Leading Petty Officer (LPO). [10-91 to 4-94; U.S. Navy]

EOD Mobile Unit Five, Subic Bay, Philippines, LPO Onboard USS MIDWAY (CV-41), Basic EOD Technician, E-5/E-6, LPO. Duty was EOD Flight Deck Ordnance response technician. [4-88 to 10-91; U.S. Navy]

EOD Mobile Unit Two, Fort Story, VA, Various Assignments as EOD Assistant. [4-84 to 4-88; U.S. Navy]

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BRIAN GRASSMYER

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Taylor Alan Sikes

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In Accordance With Federal OSHA Regulation 29 CFR 1910.120

Julius P. Griggs

Julius P. Griggs
Instructor #892

6/11/2009
Issue Date

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Certificate Number

TO VERIFY THE VALIDITY OF THIS CERTIFICATE, go to www.SafetyUnlimited.com/certificate.htm

CERTIFICATE OF COMPLETION

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for satisfactory participation in

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29 CFR Part 1910.120 - 8 Contact Hour(s)

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This certificate does not in itself indicate initial 24 or 40 Hour HAZWOPER Training

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Julius P. Griggs	090810421734	8/10/2009
Julius P. Griggs Instructor #892	Certificate Number	Issue Date

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Gunner's Mate (Missiles) Second Class
Brian R. Grassmuer, USN

having successfully completed
the prescribed course of study for

NAVY BASIC EXPLOSIVE ORDNANCE DISPOSAL

is awarded this
Certificate

this 18th day of December A.D. 1987

M. A. Murray
M. A. MURRAY, CDR, USN
COMMANDING OFFICER

OSEA
The Workplace Experts

Letter of Transmittal

Corporate Office
Western New York
3748 South Park Avenue
Buffalo, NY 14219-1802
716-821-0091
Fax: 716-821-0232
e-mail: Experts@osea.com
Website: www.osea.com

Central New York
3532 James St.
Suite 202
Syracuse, NY 13206
315-431-4526
Fax: 315-431-4906

Southeastern U.S.
8430 University Exec Park Dr.
Suite 614
Charlotte, NC 28262
704-399-7945
Fax: 704-399-7946

To: Brian Grassmyer **2705 Rex Lane** **Virginia Beach, VA 23456**	Date: November 14, 2011 Re: Training documentation Fax:

✓ Attached
☐ Copy of Letter
☐ Invoice/Statement
☐ Prints __#
☐ Under Separate Cover
✓ Certificates/Wallet Cards

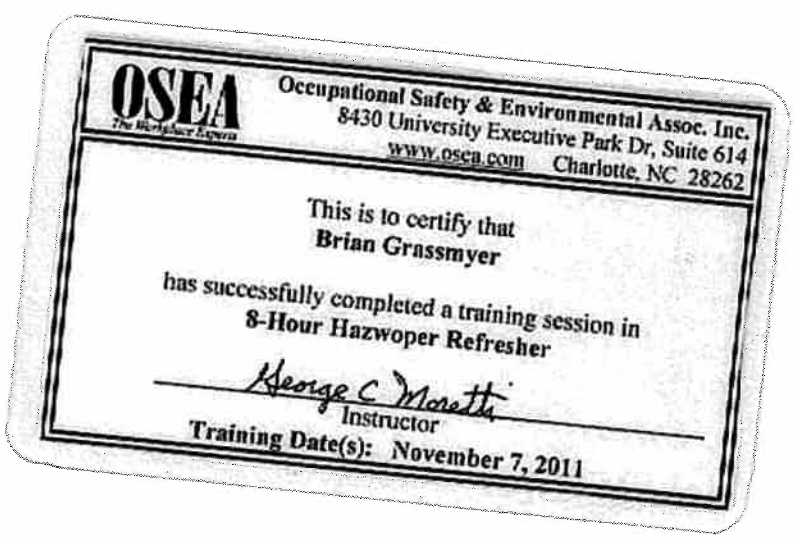
These are transmitted as checked below:

☐ For Approval
☐ For Your Info/Use
☐ Returned
☐ As Requested
☐ Approved/Reviewed As Submitted
☐ Approved/Reviewed As Noted
✓ **For Record/Files**
☐ For Distribution

Enclosed is your wallet certification card for completion of the 8-Hour Hazwoper Refresher November 7th at OSEA Charlotte.

Give us a call if you have any questions, or contact me at experts@osea.com. Please let us know when OSEA can be of further assistance. Thank you!

Chris Gloo
Administrative Assistant, OSEA/Corporate-Buffalo NY


OSEA The Workplace Experts
Occupational Safety & Environmental Assoc. Inc.
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www.osea.com Charlotte, NC 28262

This is to certify that
Brian Grassmyer
has successfully completed a training session in
8-Hour Hazwoper Refresher

George C Moretti
Instructor

Training Date(s): November 7, 2011

Certificate Of Completion

IS HEREBY PRESENTED TO

Brian Grassmyer

In Recognition Of Successful Completion Of CPRToday! Inc. Training Course In

BASIC FIRST AID

37689493-6882	July 16, 2012 (July 2014)	Trevor R. Karas
Certification Number	Certification Date (Expiration Date)	Instructor's Signature

LET IT BE KNOWN THAT THE ABOVE NAMED INDIVIDUAL HAS SUCCESSFULLY MET EVALUATION OBJECTIVES CONSISTENT WITH NATIONALLY-RECOGNIZED ECC/ILCOR/AHA COGNITIVE ASSESSMENT GUIDELINES FOR EMERGENCY CARE AND RESUSCITATION, AND IN ACCORDANCE WITH NATIONAL HEALTH & SAFETY FOUNDATION AND CPRTODAY INC. STANDARDS AND CERTIFICATION TERMS & CONDITIONS

Certificate Of Completion

IS HEREBY PRESENTED TO

Brian Grassmyer

In Recognition Of Successful Completion Of CPRToday! Inc. Training Course In

Basic Life Support
Adult CPR

64043114-8119	July 16, 2012 (July 2014)	Regina Bennett
Certification Number	Certification Date (Expiration Date)	Instructor's Signature

LET IT BE KNOWN THAT THE ABOVE NAMED INDIVIDUAL HAS SUCCESSFULLY MET EVALUATION OBJECTIVES CONSISTENT WITH NATIONALLY-RECOGNIZED ECC/ILCOR/AHA COGNITIVE ASSESSMENT GUIDELINES FOR EMERGENCY CARE AND RESUSCITATION, AND IN ACCORDANCE WITH NATIONAL HEALTH & SAFETY FOUNDATION AND CPRTODAY INC. STANDARDS AND CERTIFICATION TERMS & CONDITIONS

WORKCARE™
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WORK STATUS REPORT

Employer Copy

TYPE OF EXAMINATION: **Annual Exam**
EXAM CLASSIFICATION: **Periodic Examination**
PLACE OF EXAMINATION: **1301 - Concentra-Phoenix (1818 E Sky Harbor Circle N)**

EMPLOYEE:	**Grassmyer, Brian**	**COMPANY:**	**Weston Solutions, Inc**
ID:		**POSITION:**	**Sr. UXO Supervisor**
DATE OF EXAM:	**03/28/2012**	**LOCATION:**	**Weston-West Chester (Federal)**
EXPIRATION DATE:	**03/28/2014**	**SITE:**	

The following recommendations are based on a review of one or all of the following: a base history questionnaire, supporting diagnostic tests, physical examination, and the essential functions of the position applied for or occupied by the individual named above.

	Yes	No	Undecided
Has the employee any detected medical conditions that would increase his/her risk of material health impairment from occupational exposure in accordance with 29 CFR §1910.120?	☐	☒ X	☐
Does the employee have any limitations in the use of respirators in accordance with 29 CFR §1910.134?	☐	☒ X	☐

STATUS

1. ☒ X **QUALIFIED** The examination indicates no significant medical condition. Employee can be assigned any work consistent with skills and training.

2. ☐ **QUALIFIED - WITH LIMITATIONS** The examination indicates that a medical condition currently exists that limits work assignments on the following basis:

3. ☐ **NOT QUALIFIED**

4. ☐ **DEFERRED** The examination indicated that additional information is necessary. The employee has been given the following instructions.

COMMENTS:

Qualified for biennial frequency.

I have reviewed the medical data of the above named employee, and informed the employee of the results of the medical examination and any medical conditions that require follow-up examination or treatment.

Name of Physician: Peter P. Greaney, M.D. Date: 04/03/12

Signature: Peter P Greaney MD

BRIAN MICHAEL GUTHRIE

Qualifications Summary

- Over 6 years of professional experience in the fields of geophysical investigations and environmental science.
- Over 5 years of additional master's level course work in engineering and geological engineering.
- Primary skills are in electromagnetic and magnetic fields.
- Served as Field Lead and Site Geophysicist on numerous projects.
- Performed numerous electromagnetic and magnetic surveys for MEC.
- Performed numerous geophysical investigations for environmental applications, including locating USTs, landfill delineation, and mapping of subsurface geology.
- Experienced in utilizing electromagnetic and magnetic surveys interfaced with most positioning methods available.
- Experience in surface and groundwater sampling, site and soil characterization and sampling, hazardous material categorizing, and field crew management.
- Skilled in many computer software programs and applications.
- Skilled in driving trucks, vans, ATVs, boats, and pulling trailers.

Education

B.A., Geology (Concentration in Environmental Science)—Slippery Rock University (1999)
Graduate Course Work, Engineering Geology—Idaho State University (2006-2007)
Graduate Course Work, Geological Engineering—South Dakota School of Mines and Technology (2002-2005)
Professional Development, Slope Stability and Landslides—University of Wisconsin-Madison (2005)

Credentials

8-Hour Hazardous Waste Refresher Course, OSHA 29 CFR 1910.120(e)(8), WESTON (2013)
Bloodborne Pathogens Training – Initial, OSHA 29 CFR 1910.1030, WESTON (2008)
Bloodborne Pathogens Refresher Training, OSHA 29 CFR 1910.1030, WESTON (2012)
Fall Protection Competent Person Training Course – Initial, OSHA 29 CFR 1926 Subpart M, WESTON (2008)
Trenching/Excavation Competent Person Training Course, OSHA 29 CFR 1026 Subpart P, WESTON (2008)
Behavior-Based Safety Training – Phase I, WESTON (2008)
8-Hour Managers and Supervisors Course (SHSC), OSHA 29 CFR 1910.120(e)(4), WESTON (2001)
Shipping and Transporting Dangerous Goods – Administrative/ Field Personnel – Initial, Weston Solutions, Inc., Manual of Procedures for Shipping and Transporting Dangerous Goods Training Course, 49 CFR 172 Subpart H, WESTON (2010)
AED ReviveR Initial Training, Medic First Aid (2008)
30-Hour Construction Safety and Health Training Course, OSHA 29 CFR 1926, U.S. Department of Labor (2008)
40-Hour Hazardous Waste Operations Course, OSHA 29 CFR 1910.120(e)(3)(i), Envirogenics Health and Safety Training Institute (2000)
Short Course, Oasis Montaj II Data Processing (2009)
ICS-200 Basic Incident Command System, Online Course, Emergency Management Institute (2010)
ICS-100 Introduction to Incident Command System, Online Course, Emergency Management Institute (2010)
Boating Safety, Pennsylvania Boater Education Online Course, Pennsylvania Fish and Boat Commission (2011)
Site Manager/Field Safety Officer, WESTON (2009)

Credentials (Continued)

Environmental and Engineering Geophysical Society (Active Member-2009)
Association of Environmental and Engineering Geologists (2010)
Eagle Scout (1992)

Employment History

2008-Present	WESTON
2007-2008	Catholic Charities of Idaho
2006-2007	Idaho State University, Student and Graduate Teaching Assistant
2006	Idaho Association of Soil Conservation Districts
2002-2005	South Dakota School of Mines and Technology, Student and Graduate Teaching Assistant
2000-2002	WESTON
1999-2000	Springfield Grille
1999	Slippery Rock University, Student and Lab Assistant

Key Projects

Sample Collection, Preparation, Hazard Categorization, Various Locations, U.S. Environmental Protection Agency (EPA) Region 3, Superfund Technical Assessment and Response Team (START), Environmental Scientist. Perform a variety of duties at several EPA Superfund sites. Activities include collecting interior dust samples using a high efficiency particulate air (HEPA) vacuum on carpeted floors, and wipe samples from hard floor surfaces; confirmation soil sampling and sample preparation for X-ray fluorescence (XRF) analysis for lead contamination; groundwater and residential well sampling using Grundfos pumps, bailers, and YSI 6820 water quality meters; trained a member of the field sampling crew on groundwater sampling; performed hazardous material categorizing (HazCat) through various hazcatting tests and with the use of the rad meter Ludlum Model 12 detector (Pancake Model 44-9), the Ahura First Defender for rapid identification of unknown solids and liquids, and the Multi-Rae photoionization detector (PID). Performed air monitoring through the use of remote Area-Raes and provided oversight of drum removal operations. [9-10 to Present]

Geophysical Investigations for Former Nansemond Ordnance Depot (FNOD) Formerly Used Defense Site (FUDS), Suffolk, VA, U.S. Army Corps of Engineers (USACE), Baltimore District (CENAB) and Norfolk District (CENAO), Military Munitions Response Program (MMRP), Project Geophysicist. Geophysical investigations were performed at the Riverbank Area of FNOD to detect potential munitions and explosives of concern (MEC) burial areas and potential individual MEC items. Prepared site geophysical investigation Work Plan; collected high quality geophysical data using a variety of instrumentation including the Geonics Limited EM31-MK2, the EM61-MK2, and the Geometrics G-858 magnetometer. Data were collected using the real-time kinematic global positioning system (GPS) and line and fiducial methods; designed and built a portable man-carried gurney system for the EM61-MK2 that can be easily shipped; trained and led a geophysical data collection team; performed data processing, target picking, and prepared the site investigation (SI) report. Work was performed during high

Key Projects (Continued)

temperature and humid conditions, in heavily wooded terrain, and along a rocky shoreline. [5-11 to 10-11]

Remedial Investigation (RI) for U.S. Army Garrison – West Point, West Point, NY, USACE, CENAB, MMRP, Geophysical Team Lead. Performed geophysical investigations as part of MMRP RI for MEC/munitions constituents (MC). WESTON was able to successfully perform the RI safely and efficiently on West Point's military campus. Challenges included working around university buildings, athletic fields, schools, residential neighborhoods, and in areas of rugged terrain that required planning and coordination with West Point. Designed and built a portable, man-carried gurney system for the EM61-MK2 for use in rugged terrain areas. Served as a geophysical team lead collecting high quality EM61-MK2 data in both wheel mode and line and fiducial. Data processing included preprocessing line and fiducial data using Dat61 software. [4-11 to 5-11]

RI for Ricochet Area Munitions Response Site (MRS) in Pennsylvania State Game Lands 211, Adjacent to Fort Indiantown Gap, PA, Pennsylvania National Guard Bureau (NGB), MMRP, Geophysical Team Lead. Performed geophysical investigations for an RI for MEC/MC. WESTON successfully completed the RI safely and efficiently on public lands and in very rugged conditions. Acted as a geophysical team lead in collecting high quality G-858 magnetometer data in challenging wooded and mountainous terrain and navigating the instrument-aided visual transects for the unexploded ordnance (UXO) technicians using a handheld Garmin GPS unit. Prepared Work Plans and Health and Safety Plans (HASPs); and assisted in preparation of the final RI report. WESTON received an Outstanding Performance letter from NGB for providing outstanding technical services and for maintaining an aggressive schedule for completing the field investigations on time despite a 2-month delay in award of the contract. [10-09 to 5-10]

Baseline Water Sampling, Pennsylvania, Confidential Client, Field Technician. Project demonstrated WESTON's ability to supply field teams on very short notice and perform baseline water sampling at multiple sites in eastern Pennsylvania with very tight deadlines. Project involved direct interaction with public landowners/residents in a very sensitive situation. Involved with early stages of the project, sampling and assisting in establishing sampling routine and data transmission. Tasks included contacting and scheduling sampling times with residents; performing baseline water sampling; packing and shipping coolers; providing data sheets to be entered into an electronic data deliverable (EDD); and training additional personnel/field crews. Experienced in using Multi-Rae PID, TVA 1000 PID/flame ionization detector (FID), and in calibration of air-monitoring instruments. [9-10]

Geophysical Investigations, Point Lay, AK, 611th Civil Engineer Squadron (CES) and Air Force Center for Engineering and the Environment (AFCEE), Project Geophysicist. Performed geophysical investigations using EM-31 integrated with Trimble Pro XRS GPS and with GSSI SIR3000 ground penetrating radar (GPR) with a 400-megaHertz (MHz) antenna. Survey was for landfill delineation for planned excavation and removal of materials. Responsible for coordinating with the Project Scientist, performing surveys, data processing using Geosoft Oasis montaj and Radan, and final report writing. Surveys were completed within a very limited time-frame and in challenging Arctic conditions without incident. [4-09]

Key Projects (Continued)

Active Screening Assessment (ASA) Storage Well Characterization, Various Locations, Confidential Client, Assistant Project Geoscientist. Had direct interaction with client who maintains the facilities, as well as direct landowner interaction as required. Activities included collection of soil samples and associated quality control (QC) samples; coordination with project office and laboratory for sample pickup and supply delivery; use of organic vapor monitor (OVM) and combustible gas indicator (CGI); characterization of liquid removal points (LRPs) and storage well using GPS, digital photographs, site sketches, facility condition surveys, and LRP questionnaires; report review; and providing client and field coordinator with weekly updates of characterization work through Excel and data transmission. [6-00 to 7-01]

Geophysical Investigations, Seneca Army Depot, Seneca, NY, USACE, Assistant Geoscientist. Activities included collection of data using an EM-61 and Trimble Pro XRS differential global positioning system (DGPS) for UXO or MEC; field documentation; providing client and Project Manager with field summaries through Microsoft Word and Excel; downloading files from dataloggers using Pathfinder 2.80 and DAT61 (EM-61 program); and data evaluation using Pathfinder. [8-01 to 9-01]

Geophysical Investigations, Mare Island, CA, WESTON, Assistant Geoscientist. Activities included data collection covering 120 acres using a Geonics EM-61 MK2 towed array and Trimble Pro XRS DGPS for UXO/MEC; field documentation; design and construction of WESTON's first EM-61 MK2 towed array; assistance in designing apparatus for mechanizing geophysical investigations of slopes; oversight of field teams collecting data; use of digital photographs, all-terrain vehicles (ATVs); providing Project Geophysicist with file summaries using Excel; downloading and converting files by use of Pathfinder 2.80 and Lynx (EM-61 program); and providing project coordinator with daily progress updates. [9-01 to 12-01]

Groundwater Sampling and Bioremediation Oversight, Crozet, VA, Confidential Client, Assistant Geoscientist. Collected groundwater samples using a Grundfos Redi-Flo2 pump, sounding tape measure, water quality monitor YSI 3560, and bailer. Assisted in oversight of hydrogen-releasing compounds (HRCs) injection; and coordinated with the laboratory for shipping of samples. [8-01]

Subsurface Investigations, Chambersburg, PA, Letterkenny Army Depot (LEAD), Assistant Geoscientist. Assisted in the collection of electrical resistivity profiles using Advanced Geosciences, Inc. SuperSting R1/IP single channel resistivity system to identify karst features and potential faults for future placement of monitoring wells. Activities included clearing brush to lay cables, setting up electrical resistivity lines, and use of digital photographs, Trimble Pro XRS DGPS, and the laser-level survey. [10-00]

Soil and Groundwater Characterization and Sampling, Chambersburg, PA, LEAD, Assistant Geoscientist. Activities included completing geophysical investigations prior to start of soil characterization and sampling using a Geonics Limited EM-31 and Trimble Pro XRS DGPS, identifying and marking areas for further investigation, and supervising trenching activities. Responsible for photo-documentation, collecting soil and water samples, and conducting initial data analysis. Assisted in preparation of report and recommendations for remediation. [12-01 to 1-02]

Key Projects (Continued)

Geophysical Investigations, Miamisburg, OH, Confidential Client, Assistant Geoscientist. Performed data collection using an EM-31 integrated with Trimble Pro XRS DGPS to identify potential buried drums; follow-up surveys across the site consisted of electrical resistivity (ER) profiling using Advanced Geosciences, Inc. SuperSting R1/IP single channel resistivity system. Additional activities included downloading EM-31 and GPS data, initial processing and analysis of EM-31 data, and performing analysis of electrical resistivity data using EarthVision software. Field efforts were completed on time despite lost equipment and airport delays. [4-02]

Geophysical Investigations, New Jersey, Confidential Client, USACE, Hazardous, Toxic, Radioactive Waste (HTRW) 2000 Contract, Field Lead Geoscientist. Performed geophysical surveys over an approximately 1-acre area to identify potential buried utilities under soil boring/sampling locations. Initial surveys consisted of using a Geonics Limited EM-61 integrated with a Trimble Pro XRS DGPS to locate anomalous areas. Follow-up GPR was conducted over anomalies identified in the EM-61 surveys as well as over the proposed boring locations. Performed GPR data analysis using Radan software, providing the Project Manager with initial maps, and recommended adjustments to boring locations. [4-02]

Geophysical Investigations, Spring Valley Formerly Used Defense Site (FUDS), Washington, DC, USACE, CENAB, Assistant Geoscientist. Assisted in performing geophysical investigations looking for evidence of MEC and chemical warfare materiel (CWM) for this high profile FUDS project. Data collection was performed using a Geonics EM-61 MK2, the Geometrics 856 base station, and the G-858 magnetometer. Surveys included grid setups, data collection, photo-documentation, data download, and preliminary data processing. The project site was highly visible by the public and required careful interactions with the public and being sensitive to their questions and concerns. [4-02 to 5-02]

Geophysical Investigations, Marina, CA, Fort Ord Reuse Authority, Field Team Leader. Performed geophysical investigations for MEC using a variety of instruments, including EM61-MK2 towed array, 858 MagMapper with the 856 base station; real-time kinematic (RTK) positioning system, and Archer Personal Digital Assistants (PDAs) with UXOFast^{SM} software. Performed target reacquisition; coordinated field efforts with the site Senior UXO Supervisor (SUXOS) and project geophysicist; managed three field teams assisting with data collection; provided project geophysicist with daily transmission of data and daily reports. [3-08 to 9-08;]

Geophysical Investigations, Barksdale Air Force Base (AFB), Bossier City, LA, AFCEE, Project Geophysicist. Performed geophysical confirmation surveys using a Geonics Limited EM-31 integrated with Trimble Pro XRS DGPS; responsible for coordination with Project Manager, field surveys, data processing using Oasis montaj, and writing a final report of the investigations. The task was completed safely, on time, and with no incidents. [9-08]

Characterization and Remediation Activities, Berks Sand Pit Superfund Site, Macungie, PA, Pennsylvania Department of Environmental Protection (PADEP), Field Geoscientist. For this groundwater remediation project, the site required additional investigations and characterization to identify a new recovery well location in highly fractured granite bedrock. Project activities included writing Request for Proposals (RFPs); assisting in selection of subcontractors; coordinating site visits with all potential subcontractors; submitting appropriate documentation for bidding process; writing requisitions; developing Work Plans and updating or

Key Projects (Continued)

amending the Health and Safety Plan (HASP); and writing reports. Site activities included performing very low frequency (VLF) geophysical surveys, and providing subcontractor oversight of electrical resistivity surveys. Results of the surveys were used to perform a fracture analysis and identify a prime location for a new recovery well. Additional activities included drilling oversight; performing a 12-hour pump test with sampling; coordinating with the laboratory; providing general oversight of vendors for plant maintenance; and direct interaction with the client. The new well location was a success, and the well was connected to the on-site treatment plant. [5-09 to 3-10]

Geophysical Investigations, Sunchief Mill Site, Globe, AZ, U.S. Forest Service (USFS), Globe Ranger District, Project Geophysicist. Project consisted of geophysical investigations to search for a potential underground storage tank (UST) and waste burial sites on an abandoned mill site. Geophysical investigations included geophysical surveys using a Geonics Limited EM-31 MK2 integrated with Trimble Pro XRS DGPS, and a GSSI SIR-3000 GPR. Site activities included identifying potential areas for the UST, recording site features via GPS, and providing the client, who was on-site during field activities, with real-time results of the surveys. The project was successfully completed on time. The on-site client was very satisfied with the field results and of the work by the entire field team. [1-10]

OSHA 600307183

U.S. Department of Labor
Occupational Safety and Health Administration

Brian Guthrie

has successfully completed a 30-hour Occupational Safety and Health Training Course in

Construction Safety & Health

5473 9-19-08

(Trainer) (Date)

Site Manager/Field Safety Officer EHS Certification Form

Employee Name: Brian Guthrie	Employee Number: 16249	Division: Mid-Atlantic	Profit Center: Federal - 1494

Managers Certification:

Choose One	Managers Initials	Date of Hire
This employee has been employed by WESTON for one year or more.		
If Less than 1 year, is the service requirement waved by Manager? (Justify)		

Comments: ____________________

I certify that the employee listed above has appropriate qualifications and experience and demonstrates the ability and ambition to serve as a WESTON **Field Safety Officer** ✓ **Site Manager** _______ **Both** _______

Manager's Name: (print) NICHOLAS PALCZUK

Signature: [signature] **Date:** 7/1/09

Division EHS Manager Certification and Qualification Record

A.) Field Safety Officer:

	HAZWOPER		Construction	Yrs Experience	Professional Certification
	(Initial Highest)	PPE Level (Circle)	(Initial Highest)	(Check)	(Circle)
FSO Level 1		A B C D		Min 1 ☐	
FSO Level 2		A B C D		Min 3 ☐	
FSO Level 3		A B C D		Min 5 ☑	
FSO Level 4		A B C D		Min 5 ☐	
FSO Level 5**		A B C D		Min 10 ☐	ASP STS CHST
FSO Level 6**		A B C D		Min 10 ☐	CSP CIH

Note: * Can be used for Level 2 Construction SM/FSO, to meet EM 385-1-1 or as interim (for six months only) for an experienced SM/FSO until they can take the 30 hour course.

**This employee has had a minimum of 24 hours of related training in each of the last 5 years

B.) Site Manager/Field Safety Officer:

HAZWOPER *(29 CFR 1910.120 Compliance)*

	Yes	No	Date
40-Hr HAZWOPER	X	☐	6/23/00
8-Hr HAZWOPER Refresher	X	☐	1/5/09
8-Hr HAZWOPER Site Managers/ Supervisors Course:	X	☐	1/24/01
24-Hrs Supervised On-The-Job Training	☐	☐	

CONSTRUCTION

	Yes	No	Date
10 Hour OSHA Construction Course *	☐	☐	
30-Hour OSHA Construction Course	X	☐	9/19/08
8-Hour Site Manager/Field Safety Officer EHS Compliance Training Course (Initial)	☐	☐	
8-Hour Site Manager/Field Safety Officer EHS Compliance Training Course (Annual Refresher)	☐	☐	

COMPETENT PERSON

	Yes	No	Date
Excavation(Type "C" Soil only)	X	☐	9/19/08
Scaffolding	X	☐	9/19/08
Hearing	X	☐	6/23/00
Excavation	X	☐	9/19/08
Hazard Com	X	☐	6/23/00
Confined Space	☐	☐	
Fall Protection	X	☐	9/18/08
PPE	X	☐	6/23/00

I have certified this individual as a Field Safety Officer at the above levels:

DEHS Manager's Name: (print) Lawrence J Wertz III

Signature: [signature] **Date:** 18 AUG 09

This Certifies That

BRIAN GUTHRIE

Has Completed the

Shipping and Transporting Dangerous Goods - Admin/Field Personnel Initial

completed on 03/04/2010 in West Chester, PA

TRAINING MANAGER
Owen B. Douglass, Jr., PhD, CIH

INSTRUCTOR
Lawrence J. Werts

1029_15766_03042010 *Weston Solutions, Inc • 1400 Weston Way • West Chester, PA • 19380*

06P-0910-2

This Certifies That

BRIAN GUTHRIE

Has Completed the

Behavior Based Safety - Phase I

Behavior Based Safety - Phase I completed on 10/14/2008 in West Chester, PA

INSTRUCTOR

Owen B. Douglass Jr PHD, CIH

1018_15766_10142008 *Weston Solutions, Inc • 1400 Weston Way • West Chester, PA • 19380*

ENVIROGENICS

Health & Safety Training Institute

3812 B Quakerbridge Road, Suite 208

Mercerville, NJ 08619

(609) 586-0700

This is to Certify that

Brian Guthrie

has completed the requirements for training in

OSHA 1910.120 40-HR Hazardous Waste Operations

6/23/2001

Instructor — Expires

CERTIFICATE OF COMPLETION

This certificate awarded to

Brian Guthrie

for satisfactory participation in

OSHA 8 Hour Hazwoper Refresher

29 CFR Part 1910.120 - 8 Contact Hour(s)

Awarded on March 5, 2013.

Eduwhere
Your compliance connection

Toni White

Eduwhere

Eduwhere · PO Box 4704 · Chapel Hill, NC 27515 · www.eduwhere.com

COMMONWEALTH OF PENNSYLVANIA
FISH AND BOAT COMMISSION

BOATING SAFETY EDUCATION CERTIFICATE

BRIAN H GUTHRIE

COURSE TYPE: EXAM

NO. W0115588 DATE OF ISSUE 10/28/2011

D.O.B. 12/04/1975 EYES BLU HAIR RED SEX M

WESTON SOLUTIONS
Restoring Resource Efficiency

This Certifies That

BRIAN GUTHRIE

Has Completed the

Fall Protection Competent Person Initial

completed on 09/18/2008 in West Chester, PA

TRAINING MANAGER
Conrad W. Lehr, CET, CIT

INSTRUCTOR
Conrad W. Lehr

548_15766_09182008

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06P-0910-2

WESTON SOLUTIONS®

Restoring Resource Efficiency

This Certifies That

BRIAN GUTHRIE

Has Completed the

Excavation & Trenching Competent Person

completed on 09/19/2008 in West Chester, PA

TRAINING MANAGER

Conrad W. Lehr, CET, CIT

INSTRUCTOR

Conrad W. Lehr

545_15766_09192008

Weston Solutions, Inc • 1400 Weston Way • West Chester, PA • 19380

06P-0910-2

ROY F. WESTON, INC.

THIS CERTIFIES THAT

Brian Guthrie

HAS COMPLETED THE

8 Hour Site Managers and Supervisors Training Course*

in accordance with 29 CFR 1910.120 (e)(4) completed on 01/24/2001 at Charleston, WV

Conrad W Lehr, CET

TRAINING MANAGER
Conrad W. Lehr, CET

WESTON
MANAGERS DESIGNERS/CONSULTANTS

Conrad W Lehr, CET

INSTRUCTOR
Conrad W. Lehr CET

Cert. No. 31820012

ROY F. WESTON, INC · 1400 WESTON WAY · WEST CHESTER, PA · 19380

00P-1712

American Red Cross

This recognizes that

Brian Guthrie

has completed the requirements for

Adult and Pediatric

First Aid/ CPR/AED

conducted by

American Red Cross

Date completed: **3/27/2013**

Valid for **2** year(s)

redcross.org

Instructor's Signature

Steven J. Bobby

Chapter

American Red Cross

Holder's Signature

Stock No. 656798

WorkCare™ Making Health Count

WORK STATUS REPORT

Employer Copy

TYPE OF EXAMINATION: Annual Exam
EXAM CLASSIFICATION: Periodic Examination
PLACE OF EXAMINATION: 1853 - UPMC URGENT CARE-HERMITAGE

EMPLOYEE:	Guthrie, Brian	**COMPANY:**	Weston Solutions, Inc
ID:	016249	**POSITION:**	Associate Geoscientist
DATE OF EXAM:	01/08/2013	**LOCATION:**	Weston-West Chester (Federal)
EXPIRATION DATE:	01/08/2015	**SITE:**	West Chester

The following recommendations are based on a review of one or all of the following: a base history questionnaire, supporting diagnostic tests, physical examination, and the essential functions of the position applied for or occupied by the individual named above.

	Yes	No	Undecided
Has the employee any detected medical conditions that would increase his/her risk of material health impairment from occupational exposure in accordance with 29 CFR §1910.120?	☐	☒	☐
Does the employee have any limitations in the use of respirators in accordance with 29 CFR §1910.134?	☐	☒	☐

STATUS

☐ **QUALIFIED** The examination indicates no significant medical condition. Employee can be assigned any work consistent with skills and training.

☒ **QUALIFIED - WITH LIMITATIONS** The examination indicates that a medical condition currently exists that limits work assignments on the following basis:

☒ ***No driving***
Not to work at unprotected heights
Not to work near (within 20 feet) of operating equipment
Caution on uneven terrain
Not to work unaccompanied

☐ **NOT QUALIFIED**

☐ **DEFERRED** The examination indicated that additional information is necessary. The employee has been given the following instructions.

COMMENTS:

I have reviewed the medical data of the above named employee, and informed the employee of the results of the medical examination and any medical conditions that require follow-up examination or treatment.

Name of Physician: Peter P. Greaney, M.D. Date: 01/14/13

Signature: Peter P Greaney MD

Naval School
Explosive Ordnance Disposal

This is to certify that

A1C Casey C. Faust, USAF

has successfully completed the

Basic EOD Course

Surface (CIN A-431-0012)

Class 03010S

In witness thereof, this certificate has been signed and given under my hand at

Naval School Explosive Ordnance Disposal, Eglin AFB, Florida

This 9th day of May in the Year of Our Lord, Two Thousand Three

Commanding Officer

NAVSCOLEOD 1500/26

Certificate of Completion

This certifies that

Casey Faust

has successfully completed

OSHA 40 Hour HAZWOPER Training

In Accordance With Federal OSHA Regulation 29 CFR 1910.120

Julius Griggs	**Jules Griggs**
Outreach Instructor	Training Director

Julius P. Griggs	**110530146984**	**5/30/2011**
Julius P. Griggs Program Administrator	Certificate Number	Issue Date

ONLINE TRAINING
OTS
SYSTEMS

eHAZWOPER
690 E. Los Angeles Ave Suite 180 Simi Valley, CA 93065
http://ehazwoper.otsystems.net

Annual Refresher Training Required

CERTIFICATE OF COMPLETION

This certificate awarded to

Casey Faust

for satisfactory participation in

OSHA 8 Hour Hazwoper Refresher
29 CFR Part 1910.120 - 8 Contact Hour(s)

Awarded on December 16, 2012.

Eduwhere
Your compliance connection

Toni White

Eduwhere

Eduwhere · PO Box 4704 · Chapel Hill, NC 27515 · www.eduwhere.com

OSHA.COM
Online OSHA Training

Certificate of Course Completion

Katherine M Morrison	40 Hr HAZWOPER	01/04/2012 21:56 CST
Student's Name	**Course Title**	**Course Completion Date**

	2187846
Student's Signature	**Certificate Number**

40

# of hours approved

I hereby attest that I have completed the above named safety course in accordance with the ethical guidelines defined by, OSHA.com I acknowledge that I consumed all information and took all Pertinent quizzes and/or final tests.

OSHA.com

WESTON SOLUTIONS®
Restoring Resource Efficiency

This Certifies That

KATHERINE MORRISON

Has Completed the

8-Hour HAZWOPER Refresher Training Course

In accordance with 29 CFR 1910.120(e)(8) completed on 03/12/2013 in West Chester, PA

Ted Blackburn CSP, CET

TRAINING MANAGER
Ted Blackburn, CSP, CET

Christopher Baer CSP

INSTRUCTOR
Christopher M. Baer CSP

1_17450_03122013

Weston Solutions, Inc • 1400 Weston Way • West Chester, PA • 19380

06P-0910-2

WESTON SOLUTIONS
Restoring Resource Efficiency

This Certifies That

KATHERINE MORRISON

Has Completed the

8-Hour Site Manager and Supervisor Training Course

In accordance with 29 CFR 1910.120(e)(4) completed on 04/05/2013 in West Chester, PA

Ted Blackburn CSP, CET

TRAINING MANAGER
Ted Blackburn, CSP, CET

Christopher Baer CSP

INSTRUCTOR
Christopher M. Baer CSP

195_17450_04052013

Weston Solutions, Inc • 1400 Weston Way • West Chester, PA • 19380

Restoring Resource Efficiency

This Certifies That

KATHERINE MORRISON

Has Completed the

Bloodborne Pathogens Training Course Initial

In accordance with 29 CFR 1910.1030 completed on 05/07/2012 in West Chester, PA

Owen B Douglass Jr PhD, CIH

TRAINING MANAGER

Owen B. Douglass, Jr., PhD, CIH

George M Crawford Jr CIH

INSTRUCTOR

George M. Crawford Jr CIH

11_17450_05072012

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06P-0910-2

WESTON SOLUTIONS®
Restoring Resource Efficiency

This Certifies That

KATHERINE MORRISON

Has Completed the

Bloodborne Pathogens Training Course Refresher

In accordance with 29 CFR 1910.1030 completed on 03/12/2013 in West Chester, PA

Ted Blackburn CSP, CET

TRAINING MANAGER
Ted Blackburn, CSP, CET

Christopher Baer CSP

INSTRUCTOR
Christopher M. Baer CSP

2_17450_03122013

Weston Solutions, Inc • 1400 Weston Way • West Chester, PA • 19380

06P-0910-2

This recognizes that

Katherine Morrison

has completed the requirements for

Adult CPR/AED/First Aid

conducted by

American Red Cross

Date completed: **04/06/13**

Valid for **2** year(s)

redcross.org

Instructor's Signature

Chapter

Maryland-Delmarva Territory

Holder's Signature

579911 Stock No. 656798

WORKCARE™
Making Health Count

WORK STATUS REPORT

Employer Copy

TYPE OF EXAMINATION: CMV Exam
EXAM CLASSIFICATION: CMV Exam
PLACE OF EXAMINATION: 3561 - HEALTHWORKS

EMPLOYEE:	**Morrison, Katherine**	**COMPANY:**	**Weston Solutions, Inc**
ID:		**POSITION:**	**Assistant Project Scientist**
DATE OF EXAM:	**05/03/2013**	**LOCATION:**	**Weston-West Chester (Federal)**
EXPIRATION DATE:	**05/03/2015**	**SITE:**	

The following recommendations are based on a review of one or all of the following: a base history questionnaire, supporting diagnostic tests, physical examination, and the essential functions of the position applied for or occupied by the individual named above.

STATUS

[X] **QUALIFIED** The examination indicates no significant medical condition. Employee can be assigned any work consistent with skills and training.

[ ] **QUALIFIED - WITH LIMITATIONS** The examination indicates that a medical condition currently exists that limits work assignments on the following basis:

[ ] **NOT QUALIFIED**

[ ] **DEFERRED** The examination indicated that additional information is necessary. The employee has been given the following instructions.

COMMENTS:

I have reviewed the medical data of the above named employee, and informed the employee of the results of the medical examination and any medical conditions that require follow-up examination or treatment.

Name of Physician: Irene L. Grace, M.D. Date: 05/10/13

Signature: Irene L Grace, MD

Student Affiliation:
Weston Solutions, Inc
31719

Compliance Solutions

"Today's Training... Tomorrow's Solution"

3980 Quebec St., 2nd Floor, Denver CO 80207-1633 800-711-2706

Certificate of Completion

This is to certify that

Stacey Dorn

has been tested and successfully meets the training requirements for

40-Hour HAZWOPER
as per 29 CFR 1910.120(e)

Presented

Friday, September 28, 2012

Compliance Solutions Occupational Trainers, Inc.

Certificate Number: 754851203

Neval Gupta
Vice President

Dane Wilcox
Instructor

SOLUTIONS

Restoring Resource Efficiency

This Certifies That

STACEY DORN

Has Completed the

8-Hour HAZWOPER Refresher Training Course

In accordance with 29 CFR 1910.120(e)(8) completed on 02/27/2013 in Vernon Hills, IL

Owen B Douglass Jr PhD, CIH

TRAINING MANAGER

Owen B. Douglass, Jr., PhD, CIH

Ted Deecke

INSTRUCTOR

Theodore Deecke

1_17585_02272013

Weston Solutions, Inc • 1400 Weston Way • West Chester, PA • 19380

06P-0910-2

WESTON SOLUTIONS

Restoring Resource Efficiency

This Certifies That

STACEY DORN

Has Completed the

8-Hour Site Manager and Supervisor Training Course

In accordance with 29 CFR 1910.120(e)(4) completed on 03/14/2013 in Chesapeake, VA

Ted Blackburn CSP, CET

TRAINING MANAGER

Ted Blackburn, CSP, CET

Christopher Baer CSP

INSTRUCTOR

Christopher M. Baer CSP

Weston Solutions, Inc • 1400 Weston Way • West Chester, PA • 19380

06P-0910-2

This Certifies That

STACEY DORN

Has Completed the

Bloodborne Pathogens Training Course Refresher

In accordance with 29 CFR 1910.1030 completed on 02/27/2013 in Vernon Hills, IL

TRAINING MANAGER
Owen B. Douglass, Jr., PhD, CIH

INSTRUCTOR
James L. Waldo

2_17585_02272013

Weston Solutions, Inc • 1400 Weston Way • West Chester, PA • 19380

American Red Cross

This recognizes that
Stacey Dorn
has completed the requirements for
First Aid
conducted by
Southeastern Virginia Chapter
Date completed: **10/18/2012**
The American Red Cross recognizes
this certificate is valid from
completion date for: **2 Years**

ATTACHMENT 4

ENVIRONMENTAL HEALTH AND SAFETY INSPECTION CHECKLIST

ENVIRONMENTAL HEALTH AND SAFETY INSPECTION CHECKLIST

Project Name: ____

Inspector: ____

Submit to: ____

Date: ______________________

THE WESTON SITE APPEARANCE

YES	NO		COMMENT
		Is the site secured to prevent inadvertent, unnecessary, or unauthorized access? Are gates closed and locked at any time that the access point is not occupied or visible to site workers?	
		Are access points posted with signs to indicate client and end-user client name, WESTON's name and logo, names of other contractors and sub-contractors, project name and location, and appropriate safety messages?	
		Are required postings in place (e.g., Labor Poster, Emergency Phone Numbers, Site Map, etc.)?	
		Are site trailers tied down per local code and provided with stairs that have a landing platform with guard and stair railings?	
		Is a Site Safety file system established in the office to maintain records required by applicable safety regulations	
		Is the Health and Safety Plan (HASP) or Accident Prevention Plan (APP) amended as scope of work changes, hazards are discovered or eliminated or if risk change?	
		Is the Site Safety Plan and the Safety Officers Field Manual on site?	
		Is new employee indoctrination provided?	
		Have site rules been provided, discussed and signed off on by all employees	
		Incident reporting procedure explained to all?	
		Is site management trained in the WESTON (and client as applicable) Incident Reporting system?	
		Are Notice of Intent (NOI) and Supplemental Report forms and Occupational Safety and Health Administration (OSHA) 300 Log available on site?	
		Is Site Management aware of the Case Management and Incident Investigation Procedures?	
		Is there a list of preferred provider medical facilities available?	
		Has the "Inspection By A Regulatory Agency" procedure been reviewed by all site management?	
		Will Competent Persons be required because of activities to be performed, equipment to be used or hazards to be encountered?	

POLICIES

YES	NO		COMMENT
		Each individual employee is aware that he or she responsible for complying with applicable safety requirements, wearing prescribed safety equipment and preventing avoidable accidents.	
		Do employees understand that they will wear clothing suitable for existing weather and work conditions and the minimum work uniform will include long pants, sleeved work shirts, protective footwear, hard hat, and safety glasses unless otherwise specified via the HASP.	
		Are employees provided safety and health training to enable them to perform their work safely? Is all training documented to indicate the date of the session, topics covered, and names of participants?	
		Safety meetings are conducted daily. The purpose of the meetings are to review past activities, review pertinent tailgate safety topics, and establish safe working procedures for anticipated hazards encountered during the day.	
		Training has been provided to all personnel regarding handling of emergency situations that may arise from the activity or use of equipment on the project.	
		Employees/contractors are informed and understand that they may not be under the influence of alcohol, narcotics, intoxicants or similar mind-altering substances at any time. Employees found under the influence of or consuming such substances will be immediately removed from the job site.	
		Site workers and operators of any equipment or vehicles are able to read and understand the signs, signals, and operating instructions of their use.	
		Have contractors performing work provided copies of relevant documentation (such as medical fit-for-duty, training certificates, fit-tests, etc.) prior to initiation of the project?	

SANITATION
29 CFR 1926 Subparts C, D. EM 385-1-1, Section 2

YES	NO		COMMENT
		Is an adequate supply of drinking water provided. Is potable/drinking water labeled as such? Are there sufficient drinking cups provided?	
		Is there a sufficient number of toilets?	
		Are washing facilities readily available and appropriate for the cleaning needs?	
		Are washing facilities kept sanitary with adequate cleansing and drying materials?	
		Waste is secured so as not to attract rodents, insects or other vermin?	
		Is an effective housekeeping program established and implemented?	

ACCIDENT PREVENTION SIGNS, TAGS, LABELS, SIGNALS, AND PIPING SYSTEM IDENTIFICATION
29 CFR 1926 Subpart G. EM 385-1-1, Section 8

YES	NO		COMMENT
		Are signs, tags, and labels provided to give adequate warning and caution of hazards and instruction/directions to workers and the public?	
		Are all employees informed as to the meaning of the various signs, tags and labels used in the workplace and what special precautions are required?	
		Are construction areas posted with legible traffic signs at points of hazard?	
		Are signs required to be seen at night lighted or reflectorized?	
		Tags contain a signal word (“danger” or “caution”) and a major message to indicate the specific hazardous condition or the instruction to be communicated to the employee. Tags follow requirements as outlined in 29 Code of Federal Regulation (CFR) 1926.200.	

MEDICAL SERVICES AND FIRST AID
29 CFR 1926 Subparts C, D. EM 385-1-1, Section 3

YES	NO		COMMENT
		Is a local medical emergency facility (LMEF) identified in the HASP or APP?	
		Has the LMEF been visited to verify the directions and establish contacts?	
		Has site management reviewed WESTON’s incident management procedures?	
		Have clinics and specialists that will help WESTON manage injuries and illnesses been identified?	
		Is there at least two (2) people certified in First Aid and cardiopulmonary resuscitation (CPR)?	
		Are first aid kits available at the command post and appropriate remote locations?	
		Are first aid kits and eyewash/safety showers inspected weekly?	
		Are 15 minute eyewash/safety showers in place if required?	

FIRE PREVENTION AND PROTECTION
29 CFR 1926 Subpart F. EM 385-1-1, Section 9

YES	NO		COMMENT
		Is an Emergency Response and Contingency Plan in place?	
		Are emergency phone numbers posted?	
		Are fire extinguishers selected and provided based on the types of materials and potential fire classes in each area?	
		Are fire extinguishers provided in each administrative and storage trailer, within 50 feet but no closer than 25 feet of any fuel or flammable liquids storage, on welding and cutting equipment, on mechanical equipment?	
		Are fire extinguishers checked daily and inspected monthly?	
		Do site personnel know the location of fire extinguishers and how to use them?	
		Are flammable and combustible liquids stored in approved containers?	
		Safety cans are used for dispensing flammable or combustible liquids in 5 gallon or less volumes.	
		Are flammable and combustible liquids stored in flammable storage cabinets or appropriate storage areas?	
		Are flammable materials separated from oxidizers by at least 20 feet (or 5 foot tall, ½-hour rated fire wall) when in storage?	
		Are fuel storage tanks double walled or placed in a lined berm?	
		Spills are cleaned up immediately and wastes are disposed of properly.	
		Combustible scrap, debris and waste material (oily rags) are stored in closed metal containers and disposed of promptly.	
		Vehicle fueling tanks are grounded and bonding between the tank and vehicle being fueled is provided?	
		Liquid propane gas (LPG) is stored, handled and used according to OSHA regulations 29 CFR 1926.	
		LPG cylinders are not stored indoors.	
		Is a hot work permit program in place? See WESTON FLD-36	
		Is smoking limited to specific areas, prohibited in flammable storage areas, and are signs posted to this effect?	

HAZARDOUS SUBSTANCES, AGENTS AND ENVIRONMENTS
29 CFR 1926 Subparts D, Z. EM 385-1-1, Sections 6, 28

YES	NO		COMMENT
		Are operations, materials, and equipment evaluated to determine the presence of hazardous contaminants or if hazardous agents could be released in the work environment?	
		Are material safety data sheets for substances made available at the worksite when any hazardous substance is procured, used, or stored?	
		Are all containers and piping containing hazardous substances labeled appropriately?	
		Is there an inventory of hazardous substances?	
		Is there a Site-specific Hazard Communication Program?	
		Spill kits appropriate for the hazardous materials present are on site and their location is known to spill responders.	
		Is disposal of excess hazardous chemicals performed according to WESTON's guidelines and Resource Conservation and Recovery Act (RCRA) regulations?	
		Before initiation of activities where there is an identified asbestos or lead hazard, is there a written plan detailing compliance with OSHA and United States (U.S.) Environmental Protection Agency (EPA) asbestos or lead abatement requirements? Does the plan comply with state and local authority, and U.S. Army Corps of Engineers (USACE) requirements, as applicable?	
		Are personnel trained and provided with protection against hazards from animals, poisonous plants, and insects?	

PERSONAL PROTECTIVE AND SAFETY EQUIPMENT, RESPIRATORY AND FALL PROTECTION
29 CFR 1926 Subparts D, E, M. EM 385-1-1, Section 5

YES	NO		COMMENT
		Do employees understand that the minimum personal protective equipment (PPE) is hard hat, safety glasses with side shields, safety shoes or boots, and that long pants and a sleeved shirt are required?	
		Has the SSHO reviewed the PPE requirements in the HASP against actual site conditions and certified that the PPE is appropriate? (see Field Manual, PPE Program)	
		The PPE is inspected, tested, and maintained in serviceable and sanitary condition as recommended by the manufacturer. Is defective or damaged equipment taken out of service and repaired or replaced?	
		Are workers trained in the use of the PPE required?	
		Are personnel exposed to vehicular or equipment traffic, including signal persons, spotters or inspectors required to vests or apparel marked with a reflective or high visibility material?	
		Is there a noise hazard? If yes, hearing protection will be required.	
		Is there a splash or splatter hazard? Face shields or goggles will be required.	
		Will personnel be working in or over water? Personnel floatation devices will be required.	
		Is there a welding hazard? Welding helmet and leathers will be required. Is there a cutting torch hazard? Goggles and protective clothing will be required.	
		Is each person on a walking/working surface with an unprotected side or edge which is 6 feet (1.8 m) or more above a lower level protected from falling by the use of guardrail systems, safety net systems or personal fall arrest systems? See WESTON FLD 25 (Note General Industry standard is 4 feet).	
		Guardrail systems are used as primary protection whenever feasible. Guardrail construction meets criteria in 29 CFR 1926.502(b).	
		Personal fall arrest systems (PFAS) are inspected and appropriate for use.	
		Ropes and straps (webbing) used in lanyards, lifelines, and strength components of body belts and body harnesses are from synthetic fibers.	
		Safety nets and safety net installations are constructed, tested, and used according to 29 CFR 1926.502.c	
		Is respirator use required? See WESTON Respiratory Protection Program	
		Persons using respiratory protection have been successfully medically cleared, trained, and fit tested.	
		Respirators are used according to the manufacturer's instructions, regulatory requirements, selection criteria, and health and safety plan provisions.	
		For Level C operations with organic vapor contamination, is the cartridge change-out schedule documented?	
		Is breathing certified as Grade D, or better, and certification available on-site?	

MACHINERY AND MECHANIZED EQUIPMENT
29 CFR 1926 Subparts N, O. EM 385-1-1, Sections 16, 17, 18

YES	NO		COMMENT
		Are inspections of machinery by a competent person established?	
		Is equipment inspected daily before its next use?	
		Equipment inspection reports are reviewed, followed-up on negative findings, and records of inspections are maintained?	
		Machinery or equipment found to be unsafe is taken out of service until the unsafe condition has been corrected.	
		Is there a preventive maintenance program established?	
		Are operators of equipment qualified and authorized to operate?	
		Is all self-propelled construction and industrial equipment equipped with a reverse signal alarm?	
		Are seats or equal protection provided for each person required to ride on equipment. Are seatbelts installed and worn on motor vehicles, as appropriate.	
		All equipment with windshields is equipped with powered wipers. If fogging or frosting is possible, operable defogging or defrosting devices are required.	
		Internal combustion engines are not operated in enclosed areas unless adequate ventilation are made. Air monitoring is conducted to assure safe working conditions.	
		Is each bulldozer, scraper, dragline, crane, motor grader, front-end loader, mechanical shovel, backhoe, or similar equipment equipped with at least one dry chemical or carbon dioxide fire extinguisher with a minimum rating of 5-B:C?	
		Will cranes or other lifting devices be used? If so, are the following documents available on site: 1) a copy of the operating manual, 2) load rating chart, 3) log book, 4) a copy of the last annual inspection, and 5) the initial on-site inspection?	
		Do operators have certificates of training to operate the type of crane(s) to be used?	
		Is a signal person provided when the point of operation is not in full view of the vehicle, machine or equipment operator? When manual (hand) signals are used, is only one person designated to give signals to the operator?	
		Signal persons back one vehicle at a time. While under the control of a signal person, drivers do not back or maneuver until directed. Drivers stop if contact with the signal person is lost.	
		Is a critical lift plan prepared by a competent person whenever: ▪ a lift is not routine, or a lift exceeds 75% of a crane's capacity, ▪ a lift results in the load being out of the operator's line of sight, or a lift involves more than one crane, ▪ a man basket is used, or the operator believes there is a need for a critical lift plan.	
		Fork Lifts (Powered Industrial Trucks) - Will forklifts be used on site?	
		All fork lifts meet the requirements of design, construction, stability, inspection, testing, maintenance and operation as indicated in ANSI/ASME B56.1 Safety Standards for Low Lift and High Lift Trucks.	
		Do forklift operators have certificates of training?	
		Are pile driving operations conducted according to EM 385-1-1, Section 16.L?	
		Is drilling equipment operated, inspected, and maintained as specified in the manufacturer's operating manual? Is a copy of the manual available at the worksite? See also the Drilling Safety Guide in the Safety Officers Field Manual.	
		Are flag persons provided when operations or equipment on or near a highway expose workers to traffic hazards? Do flag persons and persons working in proximity to a road wear high visibility vests? Are persons exposed to highway vehicle traffic protected by signs in all directions warning of the presence of the flag persons and the work? Do signs and distances from the work zone conform to federal and local regulations?	

MOTOR VEHICLES
29 CFR 1926 Subpart O. EM 385-1-1, Section 18

YES	NO		COMMENT
		Motor vehicle operators have a valid permit, license, or certification of ability for the equipment being operated.	
		Inspection, maintenance, and repair are according to manufacturer's requirements by qualified persons.	
		Vehicles are inspected on a scheduled maintenance program.	
		Vehicles not in safe operating condition are removed from service until defects are corrected.	
		Glass in windshields, windows, and doors are safety glass. Any cracked or broken glass is replaced.	
		Seatbelts are installed and worn.	
		The number of passengers in passenger-type vehicles does not exceed the number which can be seated.	
		Trucks used to transport personnel have securely anchored seating, a rear endgate, and a guardrail.	
		No person is permitted to ride with arms or legs outside of a vehicle body; in a standing position on the body; on running boards; seated on side fenders, cabs, cab shields, rear of the truck or on the load.	
		All-terrain vehicle (ATV) operators possess valid state drivers license, have completed an ATV training course prior to operation of the vehicle, and wear appropriate protective equipment such as helmets, boots, and gloves.	

EXCAVATING AND TRENCHING
29 CFR 1926 Subpart P. EM 385-1-1, Section 25

YES	NO		COMMENT
		Has the known or estimated location of utility installations such as sewer, telephone, fuel, electric, water lines, or any other underground installations that may be expected to be encountered during excavation been determined before excavation? Have utility locations been verified by designated state services according to state regulations? Has the client provided clearance where state jurisdiction doesn't apply?	
		Have overhead utilities in excavation areas been identified and either de-energized, shielded or barricaded so excavating equipment will not come within 10 feet?	
		Are inspections of the excavation, the adjacent areas, and protective systems made daily and as necessary by a competent person?	
		Are protective systems in place as prescribed by the competent person?	
		Is material removed from excavations managed so it will not overwhelm the protective systems?	
		Are barriers provided between excavations and walkways?	
		Are excavations by roadways barricaded to warn vehicles of presence or to prevent them from falling in?	
		Is there a means of exit from the excavation every 25 feet?	
		Is air monitoring required? If yes, Is it performed?	

CONFINED SPACES
29 CFR 1910 Subpart J. EM 385-1-1, Section 6

YES	NO		COMMENT
		Is there a Confined Space Entry Program in place?	
		Are the confined spaces identified and labeled?	
		Will the confined spaces be entered?	
		Is appropriate entry documentation used and on-file?	

ELECTRICAL
29 CFR 1926 Subpart K. EM 385-1-1, Section 11

YES	NO		COMMENT
		Are electrical installations made according to the National Electrical Code (NEC) and applicable local codes?	
		Qualified electricians make all connections and perform all work within 10 feet of live electric equipment.	
		Location of underground, overhead, under floor, behind wall electrical lines is known and communicated. Lines are documented by qualified person as de-energized where necessary.	
		Workers understand they must not work near live parts of electric circuits, unless they are qualified as required by OSHA or are protected by de-energizing and grounding the parts, guarding the parts by insulation, or other effective means?	
		Employees who regularly work on or around energized electrical equipment or lines are instructed in the CPR methods.	
		Workers are prohibited from working alone on energized lines or equipment over 600 volts.	
		Are Ground-fault circuit interrupters (GFCI's) or is ground fault circuit protection provided to protect employees from ground-fault hazards for all 115 – 120 volt, 15 and 20 amp receptacle outlets which are not a part of the permanent wiring of a building or structure at construction sites?	
		Circuit breakers are labeled.	
		Circuit breaker and all cabinets with exposed electric conductors are kept tightly closed.	
		Unused openings (including conduit knockouts) in electrical enclosures and fittings are closed with appropriate covers, plugs or plates.	
		Sufficient access and working space is provided and maintained about all electrical equipment to permit ready and safe operations and maintenance.	
		Motors are located within sight of their controllers or controller disconnecting means are capable of being locked in the pen position or is a separate disconnecting means installed in the circuit within sight of the motor.	
		Are visual inspections of extension cords and cord-and plug-connected equipment conducted daily? Is equipment found damaged or defective tagged and removed from service, and not used until repaired?	
		Wet Areas - Is portable lighting used in wet or conductive locations, such as tanks or boilers operated at no more than 12 volts and protected by GFCIs.	
		Are electrical installations in hazardous areas to NEC?	
		Metal ladders and tools including tape measures or fabric with metal thread are prohibited where contact with energized electrically parts is possible.	
		All extension cords are the three-wire type, designed, and rated for hard or extra hard usage?	
		Worn or frayed electrical cords or cables are taken out of service. Fastening with staples, hanging from nails, or suspending extension cords by wire is prohibited.	
		Electric wire/flexible cord passing through work areas is protected from damage such as foot traffic, vehicles, sharp corners, projections, and pinching? Flexible cords and cables passing through holes are protected by bushings or fittings?	
		Before an employee or contractor performs any service or maintenance on a system where the unexpected energizing, start up, or release of kinetic or stored energy could occur and cause injury or damage; the system is to be isolated. Only authorized persons may apply and remove lockouts and tags.	
		Contractors planning to use hazardous energy control procedures submit their hazardous energy control plan to the WESTON site safety officer or designee before implementing lockout/tagout procedures.	
		There is a Site-specific Hazardous Energy Control Plan that clearly and specifically outlines the scope, purpose, authorization, rules and techniques to be used for the control of hazardous energy.	
		Workers possess the knowledge and skills required for the safe application, usage, and removal of energy controls.	

WELDING AND CUTTING
29 CFR 1926 Subpart J. EM 385-1-1, Section 10

YES	NO		COMMENT
		Prior to performing welding, cutting, or any other heat or spark producing activity, an assessment of the area is made by a competent person to identify combustible materials and potential sources of flammable atmospheres.	
		Welders, cutters, and their supervisors are trained in the safe operation of their equipment, safe welding and cutting practices, hot work permit requirements, and fire protection.	
		Welding and cutting equipment is inspected daily before use. Unsafe equipment is taken out of use, replaced or repaired.	
		Workers and the public is shielded from welding rays, flashes, sparks, molten metal and slag.	
		Employees performing welding, cutting, or heating are protected by PPE appropriate for the hazards (e.g., respiratory, vision and skin protection).	
		Compatible fire extinguishing equipment is provided in the immediate vicinity of welding or cutting operations.	
		Drums, tanks, or other containers and equipment which have contained hazardous materials shall be thoroughly cleaned before welding or cutting. Cleaning shall be performed in accordance with NFPA 327, Cleaning or Safeguarding Small Tanks and Containers, ANSI/AWS F4.1, Recommended Safe Practices for the Preparation for Welding and Cutting of Containers That Have Held Hazardous Substances, and applicable health and safety plan requirements.	

HAND AND POWER TOOL SAFETY
29 CFR 1926 Subpart I. EM 385-1-1, Section 13

YES	NO		COMMENT
		Power tools are from a manufacturer listed by a nationally recognized testing laboratory for the specific application for which they are to be used.	
		Hand and power tools are inspected, maintained, tested, and determined to be in safe operating condition before use.	
		Tools found to be unsafe are not used, tagged, and repaired or destroyed.	
		Users of tools are trained in safe use.	
		Electrical tools have cords and plug connections in good repair.	
		Electrical tools are effectively grounded or approved double insulated.	
		Reciprocating, rotating, and moving parts of equipment are guarded if they may be accessed by employees or they otherwise create a hazard.	
		Safety clips/retainers are installed and maintained on pneumatic impact tool connections.	
		Chain saws have an automatic chain brake or anti-kickback device.	
		Pneumatic and hydraulic hoses and fittings are inspected regularly.	
		Employees who operate powder actuated tools are trained and carry valid operator cards.	
		Powder activated tools are stored in individual locked containers, when not in use and are not loaded until ready to use.	
		Powder actuated tools are inspected for obstructions or defects daily before use.	
		Powder actuated tool operators have appropriate PPE.	

RIGGING
29 CFR 1926 Subpart H. EM 385-1-1, Section 15

YES	NO		COMMENT
		Rigging equipment is inspected as specified by the manufacturer, by a qualified person, before use on each shift, and as necessary to assure that it is safe.	
		Defective equipment is removed from service.	
		Rigging not in use is removed from the work area, properly stored, and maintained in good condition.	
		Wire rope removed from service for defects is cut up or plainly marked as unfit for use as rigging.	
		The number of saddle clips used to form eyes in wire rope conforms with Table H-20, are spaced evenly and the saddles are on the live side.	
		Chain rigging has a tag clearly indicating load limits, is inspected before initial use, then weekly, and is of alloyed metal.	
		Fiber rope rigging is not used if it is frozen or has been subject to acids or excessive heat.	
		Slings and their fittings and fastenings are inspected before use on each shift and as needed during use.	
		Drums, sheaves, and pulleys on rigging hardware are smooth and free of surface defects that can damage rigging.	

MATERIAL HANDLING, STORAGE, AND DISPOSAL
29 CFR 1926 Subpart H. EM 385-1-1, Section 14

YES	NO		COMMENT
		Employees are trained in and use safe lifting techniques.	
		Materials are not moved or suspended over workers unless positive precautions have been taken to protect workers.	
		Conveyors are constructed, inspected, and maintained by qualified persons according to manufacturer’s recommendations.	
		All conveyors are to be equipped with emergency stopping devices.	
		Hazardous exposed moving machine parts are guarded mechanically, electrically, or by location.	
		Controls are clearly marked and/or labeled to indicate the function controlled.	
		Taglines are used for suspended loads where the movement may be hazardous to persons.	
		Material in storage is protected from falling or collapse by effective stacking, blocking, cribbing, etc.	
		Walkways and aisles are to be kept clear.	
		Materials are not stored on scaffolds or runways in excess of normal placement or in excess of safe load limits.	
		Work areas and means of access are maintained safe and orderly.	
		Tools, materials, extension cords, hoses, or debris do not cause tripping or other hazards.	
		Storage and construction sites are kept free from the accumulation of combustible materials.	
		Waste materials and rubbish are placed in containers or, if appropriate, in piles. Waste materials are disposed of in accord with applicable local, state, or federal requirements.	

FLOATING PLANT AND MARINE ACTIVITIES
29 CFR 1926 Subpart O. EM 385-1-1 Section 19

YES	NO		COMMENT
		Floating plants that are regulated by the U.S. Coast Guard have current inspections and certificates.	
		Before any floating plant is brought to the job site and placed in service, it is inspected and determined to be in safe operating condition	
		Periodic inspections are made such that safe operating conditions are maintained. Strict compliance with EM 385-1-1, Section 19 is expected.	
		Plans are in place for removing or securing the plant, and evacuation of personnel endangered by severe weather and other marine emergencies such as; fire, flooding, man overboard, hazardous materials incidents, etc..	
		Means of access are properly secured, guarded, and maintained free of slipping and tripping hazards.	
		Dredging operations follow guidelines as established in EM 385-1-1, Section 19.D.	

PRESSURIZED EQUIPMENT AND SYSTEMS
29 CFR 1926 Subparts I, F. EM 385-1-1, Section 20

YES	NO		COMMENT
		Pressurized equipment and systems are inspected before being placed into service.	
		Pressurized equipment or systems found to be unsafe are tagged “Out of Service-Do Not Use”.	
		Systems and equipment are operated, inspected, and maintained by qualified, designated personnel.	
		Safe clearance, lockout/tagout procedures are followed as appropriate during maintenance or repair.	
		Air hose, pipes, fittings are pressure-rated for the activity. Defective hoses are removed from service.	
		Hoses aren’t laid over ladders, steps, scaffolds, or walkways in a manner that creates a tripping hazard.	
		The use of compressed air for personal cleaning is prohibited. The use of compressed air for other cleaning is restricted to less than 30 psig.	
		Compressed gas cylinders are stored in well-ventilated locations.	
		Cylinders in storage are separated from flammable or combustible liquids and from easily ignitable materials by at least 40 feet or by a minimum 5 feet tall, ½-hour fire resistive partition.	
		Stored cylinders containing oxidizing gases are separated from fuel gas cylinders by at least 20 feet or by a minimum 5 feet tall, ½-hour fire resistive partition.	
		Cylinder valve caps are in place when cylinders are in storage, in transit, or a regulator is not in place.	
		Compressed gas cylinders in service are secured in substantial fixed or portable racks or hand trucks.	
		Oxygen cylinders and fittings are kept away from, and free from oil and grease.	
		Cylinder storage areas are posted with the names of the gases in storage and with signs indicating "No Smoking or Open Flame".	
		Cylinders are to be stored such that mechanical and corriosion damage is avoided. Cylinders are not to be stored in areas required as an egress path.	
		Cylinders may be stored in the open outdoors; however, they must be protected from the ground to prevent corrosion and must be protected from temperatures that may exceed 125 degrees F.	

WORK PLATFORMS/SCAFFOLDS
29 CFR 1926 Subparts L, M, N. EM 385-1-1 Sections 21, 22

YES	NO		COMMENT
		Work platforms are erected, used, inspected, tested, maintained, and repaired according to manufacturer's requirements.	
		Construction, inspection, and disassembly of scaffolds are under the direction of a competent person.	
		Workers on scaffolding have been trained by a qualified person.	
		Scaffolds are erected on a firm and level surface and are square and plumb.	
		Scaffolds are not loaded in excess of rated capacity.	
		Working levels of work platforms are fully planked or decked.	
		Planks are in good condition and free from obvious defects.	
		Fabricated frame scaffolding four times higher than the base width is secured to building/structure according to manufacturer's instruction and/or OSHA requirements.	
		Working platforms of scaffolding over 10 feet in height have guard rails meeting OSHA specifications. Fall protection is suggested at 4 feet or greater.	
		Scaffolding/work platforms are accessed by means of a properly secured ladder or equivalent. Built on ladders conform to scaffold ladder requirements. Climbing of braces is not allowed.	
		Crane supported work platforms are designed and used in accordance with OSHA standards.	
		Elevating work platforms are operated, inspected, and maintained according to the equipment operations manual.	
		Employees working in aerial lifts remain firmly on the floor of the basket. Employees use fall protection while in an aerial lift basket.	

WALKING AND WORKING SURFACES AND STAIRS
29 CFR 1926 Subparts L, M, X. EM 385-1-1, Sections 21, 22, 24

YES	NO		COMMENT
		Work areas are clean, sanitary, and orderly	
		Work surfaces are kept dry or appropriate means are taken to assure the surfaces are slip-resistant	
		Accumulations of combustible dust are routinely removed.	
		Aisles and passageways are kept clear and marked as appropriate.	
		There is safe clearance for walking in aisles where motorized or mechanical handling equipment is operating.	
		Materials or equipment is stored in such a way that sharp projections will not interfere with the walkway.	
		Changes of direction or elevation are readily identifiable.	
		Aisles or walkways that pass near moving or operating machinery, welding operations, or similar operations are arranged so employees will not be subjected to potential hazards.	
		Standard guardrails are provided wherever aisle or walkway surfaces are elevated more than 30 inches above any adjacent floor, or the ground and bridges provided where workers must cross over conveyors and similar hazards.	
		There are standard stair rails or handrails on all stairways having four or more risers or with an elevation of 30 or more inches.	
		Stairways are at least 22 inches wide. (General Industry Standard)	
		Stairs angle no more than 50 and no less than 30 degrees, risers are uniform from top to bottom (plus or minus 1/4 inch) and are provided with a surface that renders them slip resistant.	
		Stairway handrails are not less than 36 inches above the leading edge of stair treads and have at least 3 inches of clearance between the handrails and the wall or surface they are mounted on.	
		Where doors or gates open directly on a stairway, there is a platform provided so the swing of the door does not reduce the width of the platform to less than 20 inches.	
		Where stairs or stairways exit directly into any area where vehicles may be operated, there are adequate barriers and warnings provided to prevent employees stepping into the path of traffic.	
		Signs are posted showing the load capacity of elevated storage areas.	
		An appropriate means of access and egress is provided for surfaces with 19 or more inches of elevation change.	
		Material on elevated surfaces is minimized, with that necessary for immediate work requriements piled, stacked or racked in a manner to prevent it from tipping, falling, collapsing, rolling or spreading.	

FLOOR AND WALL HOLES AND OPENINGS
29 CFR 1926 Subpart M. EM 385-1-1, Section 24

YES	NO		COMMENT
		Floor and roof openings that persons can walk into or fall through are guarded by a physical barrier or covered.	
		Holes (defined as equal to or greater than 2 inches in least dimension) where person could trip must be covered/protected.	
		Unprotected sides and edges on a walking/working surface 6 feet or more (note four feet in General Industry) are protected by guardrail system, safety net or PFAS.	
		Unused portions of service pits and pits not actually in use are either covered or protected by guardrails or equivalent.	
		Coverings for holes or other openings must be constructed of sufficient strength to support any anticipated load, must be secured in place to prevent accidental removal or displacement and must be marked indicating purpose (e.g., stenciled "Hole" or painted contrasting color to surroundings).	

LADDERS
29 CFR 1926 Subpart X. EM 385-1-1, Section 21

YES	NO		COMMENT
		Portable ladders are used for their designed purpose only.	
		Portable ladders are examined for defects prior to, and after use.	
		Ladders found to be defective are clearly tagged to indicate "DO NOT USE" if repairable, or destroyed immediately if no repair is possible.	
		Workers are trained in hazards associated with ladder use and how to inspect ladders.	
		Ladders have secure footing provided by a combination of safety feet, top of ladder tie-offs and mud cills or a person holding the ladder to prevent slipping.	
		The handrails of a straight ladder used to get from one level to another extend at least 36 inches above the landing.	
		Ladders conform to construction criteria of ANSI Standards A-14.1 and A-14.2.	
		Wooden ladders are not painted with an opaque covering such that signs of flaws, cracks or drying are obscured.	
		Fixed ladders are constructed and used according to OSHA Standards, 29 CFR 1910.27 and ANSI A-14.3.	
		Rungs, cleats or steps, and side rails that may be used for handholds when climbing, offer adequate gripping surface and are free of splinters, slivers or burrs, and substances that could cause slipping.	
		Fixed ladders of greater than 24 feet have cages or other approved fall protection devices. (Note: General Industry is 20 feet).	
		Where fall protection is provided by ladder safety systems (body belts or harnesses, lanyards and braking devices with safety lines or rails), systems meet the requirements of and are used in accordance with WESTON Fall Protection Standard Practices and are compatible with construction of the ladder system.	

DEMOLITION
29 CFR 1926 Subpart T. EM 385-1-1, Section 23

YES	NO		COMMENT
		Prior to initiating demolition activities an engineering survey (by a competent person) and a demolition plan (by a competent person) is completed.	
		All employees engaged in demolition activities are instructed in the Demolition Plan.	
		It has been determined through the engineering survey and outlined in the plan, if any hazardous materials or conditions (e.g., asbestos, lead, utility connections, etc.) exist. Such hazards are controlled or eliminated before demolition is started.	
		Continued inspections, by a competent person, are conducted to ensure safe employee working conditions.	

TREE MAINTENANCE AND REMOVAL
29 CFR 1910 Subpart R. EM 385-1-1, Section 31

YES	NO		COMMENT
		Tree maintenance or removal is done is under the direction of a qualified person.	
		Tree work, in the vicinity of charged electric lines, is by trained persons qualified to work with electricity and tree work. Appropriate distances are maintained for all workers who are not qualified.	
		Equipment is inspected, maintained, repaired, and used in accordance with the manufacture's directions.	
		Prior to felling actions are planned to include clearing of the area to permit safe working conditions and escape.	
		Employees must be trained in the safe operation of all equipment.	
		All equipment and machinery is inspected and determined safe prior to use.	
		Work is performed under requirements of FLD 43.	

BLASTING
29 CFR 1926 Subpart U. EM 385-1-1, Section 29

YES	NO		COMMENT
		A blasting safety plan is developed prior to bringing explosives on-site.	
		The transportation, handling, storage, and use of explosives, blasting agents, and blasting equipment must be directed and supervised by a person with proven experience and ability in blasting operations. Licensing of person is verified.	
		Blasting operations in or adjacent to cofferdams, piers, underwater structures, buildings, structures, or other facilities must be carefully planned with full consideration to potential vibration and damage.	

HAZARDOUS, TOXIC, AND RADIOACTIVE WASTE AND UNDERGROUND STORAGE TANK (UST) ACTIVITIES
29 CFR 1926 Subpart D. EM 385-1-1, Section 28

YES	NO		COMMENT
		All construction activities performed with known or potential exposure to hazardous waste are conducted in accordance with Hazardous Waste Operations and Emergency Response requirements.	

CONCRETE and MASONRY CONSTRUCTION
29 CFR 1926 Subpart Q. EM 385-1-1, Section 27

YES	NO		COMMENT
		Construction loads are not placed on a concrete or masonry structure or portion of a concrete or masonry structure unless the employer determines, based on information from a person who is qualified in structural design, that the structure or portion of the structure is capable of supporting the loads.	
		Employees are not permitted to work above or in positions exposed to protruding reinforcing steel or other impalement hazards unless provisions have been made to control the hazard.	
		Sections of concrete conveyances and airlines under pressure are secured with wire rope (or equivalent material) in addition to the regular couplings or connections.	
		Structural and reinforcing steel for walls, piers, columns, and similar vertical structures is supported and/or guyed to prevent overturning or collapse.	
		All form-work, shoring, and bracing is designed, fabricated, erected, supported, braced, and maintained so it will safely support all vertical and lateral loads that may be applied until the loads can be supported by the structure.	
		Shoring equipment is inspected prior to erection to determine that it is specified in the shoring design. Any equipment found to be damaged is not used.	
		Erected shoring equipment is inspected immediately prior to, during, and immediately after the placement of concrete. Any shoring equipment that is found to be damaged, displaced, or weakened is immediately reinforced or re-shored.	
		Shoring, vertical slip forms, and jacks conform with requirements of Section 27.B.08-13 of USACE EM 385-1-1.	
		Forms and shores (except those on slab or grade and slip forms) are not removed until the individual responsible for forming and/or shoring determines that the concrete has gained sufficient strength to support its weight and all superimposed loads.	
		Precast concrete members are adequately supported to prevent overturning or collapse until permanent connections are complete.	
		No one is permitted under pre-cast concrete members being lifted or tilted into position except employees required for the erection of those members.	
		Lift slab operations are planned and designed by a registered engineer or architect.	
		Hydraulic jacks used in lift slab construction have a safety device that causes the jacks to support the load in any position if the jack malfunctions.	
		No one is permitted under the slab during jacking operations.	
		A limited access zone is established whenever a masonry wall is being constructed.	
		Fall protection is provided to masonry workers exposed to falls of 6 feet or more.	

STEEL ERECTION
29 CFR 1926 Subpart R. EM 385-1-1, Section 27

YES	NO		COMMENT
		Impact wrenches have a locking device for retaining the socket. Containers shall be provided for storing or carrying rivets, bolts, and drift pins, and secured against accidental displacement when aloft.	
		Structural and reinforcing steel for walls, piers, columns, and similar vertical structures shall be guyed and supported to prevent collapse.	
		No loading is placed upon steel joists until all bridging is completely and permanently installed.	
		Workers are provided fall protection whenever they are exposed to falls of 1.8 m (6 feet) or more (EM 385-1-1).	
		Temporary flooring in skeleton steel erection conforms with Section 27.F of USACE EM 385-1-1.	

ROOFING
29 CFR 1926 Subpart M. EM 385-1-1, Sections 21, 22, 24, 27

Yes	No		COMMENT
		In the construction, maintenance, repair, and demolition of roofs, fall protection systems is provided that will prevent personnel from slipping and failing from the roof and prevent personnel on lower levels from being struck by falling objects.	
		On all roofs greater than 4.8 m (16 feet) in height, a hoisting device, stairways, or progressive platforms are furnished for supplying materials and equipment.	
		Roofing materials and accessories that could be moved by the wind, including metal roofing panels, that are on the roof and unattached are secured when wind speeds are greater than, or are anticipated to exceed, 10 miles per hours.	
		Level, guarded platforms are provided at the landing area on the roof.	
		When their use is permitted, warning line systems comply with USACE Section 27.07 of EM 385-1-1.	
		Workers involved in roof-edge materials handling or working in a storage area located on a roof with a slope -/= to four vertical to twelve horizontal and with edges 6 feet or more above lower levels are protected by the use of a guardrail, safety net, or personal fall arrest system along all unprotected roof sides and edges of the area.	

ENVIRONMENTAL COMPLIANCE

YES	NO		COMMENT
		Environmental Compliance and Waste Management Plan on file.	
		Waste Determination Made.	
		Manifest and/or shipping papers prepared and filed.	
		Manifest Exception Reports Prepared, as necessary. Procedures to track manifests in place.	
		State annual and EPA Biennial Reporting Information available.	
		RCRA Personnel Training Records on file.	
		CAA Permits on file.	
		CWA Permits on file.	
		RCRA Permits on file.	
		State and/or Local Permits on file.	
		RCRA Inspections conducted and Documentation on file.	
		Transporter and TSD compliance information on file.	
		Waste Accumulation Areas Managed Properly.	
		Wetlands Areas Identified and Protected.	
		Endangered, Threatened or Special Concern Species or Areas Identified and Protective Methods Determined.	
		Runon and runoff concerns Identified and Managed.	
		Adjacent land areas protected as necessary.	
		Non-hazardous solid wastes managed properly.	

MISCELLANEOUS REGULATORY and POLICY COMPLIANCE

YES	NO		COMMENT
		Personnel Training Records for Department of Transportation materials handling on file.	
		Noise control Issues addressed and managed.	
		Site security issues identified and managed.	
		Known historical, archeological and cultural resources identified and managed.	
		WESTON EHS analysis checklist in use.	
		Safety observation and recognition program in place.	
		Weekly EHS Report Card System in place.	
		Federal, state and local required postings in place.	
		Site specific Lockout/Tagout Program is in place.	
		Site-specific Confined Space Program is in place.	
		Site Safety Officer filing system is in place and up to date.	

ATTACHMENT 5

DEFICIENCY TRACKING LOG

U.S. ARMY CORPS OF ENGINEERS
DEFICIENCY TRACKING LOG

Project Site: ____________________________

No.	Description	Risk Rating	Date Identified	Status/Date	Reference	Comments	Corrective Action/Date to be Completed	Responsible Party
Example	Personal Protective Equipment	IV	25 Jan 2011		EM 385 1-1.05.B	Several individuals not using glasses – forgotten, left on hardhat, or dangling from neck strap	Develop program to ensure PPE items specified are worn. Have supervisor lead by example.	Unexploded Ordnance Safety Officer
01								
02								
03								
04								
05								
06								
07								
08								
09								
10								

ATTACHMENT 6

USACE FORM 3394 ACCIDENT INVESTIGATION REPORT

(For safety staff only)	REPORT NO.	EROC CODE	**UNITED STATES ARMY CORPS OF ENGINEERS ACCIDENT INVESTIGATION REPORT** For use of this form, see Help Menu and USACE Supplement to AR 385-40 The proponent agency is CESO	REQUIREMENT CONTROL SYMBOL: CEEC-S-8 *(R2)*

1. ACCIDENT CLASSIFICATION

PERSONNEL CLASSIFICATION	INJURY/ILLNESS/FATAL	PROPERTY DAMAGE		MOTOR VEHICLE INVOLVED	DIVING
GOVERNMENT ☐ CIVILIAN ☐ MILITARY	☐	☐ FIRE INVOLVED	☐ OTHER	☐	☐
☐ CONTRACTOR	☐	☐ FIRE INVOLVED	☐ OTHER	☐	☐
☐ PUBLIC	☐ FATAL ☐ OTHER			☐	

2. PERSONAL DATA

a. NAME *(Last, First MI.)*	b. AGE	c. SEX ☐ MALE ☐ FEMALE	d. SOCIAL SECURITY NUMBER	e. GRADE

f. JOB SERIES/TITLE	g. DUTY STATUS AT TIME OF ACCIDENT	h. EMPLOYMENT STATUS AT TIME OF ACCIDENT
	☐ ON DUTY ☐ TDY ☐ OFF DUTY	☐ ARMY ACTIVE ☐ ARMY RESERVE ☐ VOLUNTEER ☐ PERMANENT ☐ FOREIGN NATIONAL ☐ SEASONAL ☐ TEMPORARY ☐ STUDENT ☐ OTHER *(Specify)* ________

3. GENERAL INFORMATION

a. DATE OF ACCIDENT *(YYYYMMDD)*	b. TIME OF ACCIDENT *(Military Time)* hrs.	c. EXACT LOCATION OF ACCIDENT	d. CONTRACTOR'S NAME (1) PRIME
e. CONTRACT NUMBER ________ ☐ CIVIL WORKS ☐ MILITARY ☐ OTHER *(Specify)* ________	f. TYPE OF CONTRACT ☐ CONSTRUCTION ☐ SERVICE ☐ A/E ☐ DREDGE ☐ OTHER *(Specify)* ________	g. HAZARDOUS/TOXIC WASTE ACTIVITY ☐ SUPERFUND ☐ DERP ☐ IRP ☐ OTHER *(Specify)*	(2) SUBCONTRACTOR

4. CONSTRUCTION ACTIVITIES ONLY *(Fill in line and corresponding code number in box from list - see help menu)*

a. CONSTRUCTION ACTIVITY	(CODE)	b. TYPE OF CONSTRUCTION EQUIPMENT	(CODE)
________	#	________	#

5. INJURY/ILLNESS INFORMATION *(Include name on line and corresponding code number in box for items e, f & g - see help menu)*

a. SEVERITY OF ILLNESS/INJURY	(CODE)	b. ESTIMATED DAYS LOST	c. ESTIMATED DAYS HOSPITALIZED	d. ESTIMATED DAYS RESTRICTED DUTY
________	#			

e. BODY PART AFFECTED	(CODE)	g. TYPE AND SOURCE OF INJURY/ILLNESS	(CODE)
PRIMARY ________	#	TYPE ________	#
SECONDARY ________	(CODE) #		
f. NATURE OF ILLNESS / INJURY ________	(CODE) #	SOURCE ________	(CODE) #

6. PUBLIC FATALITY *(Fill in line and correspondence code number in box - see help menu)*

a. ACTIVITY AT TIME OF ACCIDENT	(CODE)	b. PERSONAL FLOTATION DEVICE USED?
________	#	☐ YES ☐ NO ☐ N/A

7. MOTOR VEHICLE ACCIDENT					
a. TYPE OF VEHICLE	b. TYPE OF COLLISION	c. SEAT BELTS	USED	NOT USED	NOT APPLICABLE
☐☐ PICKUP/VAN ☐☐ AUTOMOBILE	☐ SIDE SWIPE ☐ HEAD ON ☐ REAR END				
☐☐ TRUCK ☐☐ OTHER *(Specify)*	☐ BROADSIDE ☐ ROLL OVER ☐ BACKING	(1) FRONT SEAT	☐	☐	☐
	☐ OTHER *(Specify)*	(2) REAR SEAT	☐	☐	☐

8. PROPERTY MATERIAL INVOLVED		
a. NAME OF ITEM	b. OWNERSHIP	c. AMOUNT OF DAMAGE
(1)		
(2)		
(3)		

9. VESSEL/FLOATING PLANT ACCIDENT *(Fill in line and correspondence code number in box from list - see help menu)*

a. ACTIVITY AT TIME OF ACCIDENT	(CODE)	a. ACTIVITY AT TIME OF ACCIDENT	(CODE)
	#		#

10. ACCIDENT DESCRIPTION *(Use additional paper, if necessary, see attached page 4.)*

11. CAUSAL FACTOR*(s) (Read instructions before completing)*

a. *(Explain YES answers in item 13)*	YES	NO
DESIGN: Was design of facility, workplace or equipment a factor?	☐	☐
INSPECTION/MAINTENANCE: Were inspection & maintenance procedures a factor?	☐	☐
PERSON'S PHYSICAL CONDITION: In your opinion, was the physical condition of the person a factor?	☐	☐
OPERATING PROCEDURES: Were operating procedures a factor?	☐	☐
JOB PRACTICES: Were any job safety/health practices not followed when the accident occurred?	☐	☐
HUMAN FACTORS: Did any human factors such as, size or strength of person, etc., contribute to accident?	☐	☐
ENVIRONMENTAL FACTORS: Did heat, cold, dust, sun, glare, etc., contribute to the accident?	☐	☐
CHEMICAL AND PHYSICAL AGENT FACTORS: Did exposure to chemical agents, such as dust, fumes, mists, vapors or physical agents, such as, noise, radiation, etc., contribute to accident?	☐	☐
OFFICE FACTORS: Did office setting such as, lifting office furniture, carrying, stooping, etc., contribute to the accident?	☐	☐
SUPPORT FACTORS: Were inappropriate tools/resources provided to properly perform the activity/task?	☐	☐
PERSONAL PROTECTIVE EQUIPMENT: Did the improper selection, use or maintenance of personal protective equipment contribute to the accident?	☐	☐
DRUGS/ALCOHOL: In your opinion, was drugs or alcohol a factor to the accident?	☐	☐
b. WAS A WRITTEN JOB/ACTIVITY HAZARD ANALYSIS COMPLETED FOR TASK BEING PERFORMED AT TIME OF ACCIDENT? *(If yes, attach a copy.)*	☐	☐

12. TRAINING		
a. WAS PERSON TRAINED TO PERFORM ACTIVITY/TASK?	b. TYPE OF TRAINING	c. DATE OF MOST RECENT FORMAL TRAINING *(YYYYMMDD)*
☐ YES ☐ NO	☐ CLASSROOM ☐ ON JOB	

13. FULLY EXPLAIN WHAT ALLOWED OR CAUSED THE ACCIDENT; INCLUDE DIRECT AND INDIRECT CAUSES *(See instruction for definition of direct and indirect causes.) (Use additional paper, if necessary)*

a. DIRECT CAUSE*(s) (Attach additional sheets as needed, See page 4)*

b. INDIRECT CAUSE*(s) (Attach additional sheets as needed, See page 5)*

14. ACTION*(s)* TAKEN, ANTICIPATED OR RECOMMENDED TO ELIMINATE CAUSE*(s)*		
DESCRIBE FULLY *(Attach additional sheets as necessary, See page 5)*		
15. DATES FOR ACTIONS IDENTIFIED IN BLOCK 14.		
a. BEGINNING *(YYYYMMDD)*		b. ANTICIPATED COMPLETION *(YYYYMMDD)*
c. DATE SIGNED *(YYYYMMDD)*	d. TITLE OF SUPERVISOR COMPLETING REPORT	e. CORPS SIGNATURE, SUPERVISOR COMPLETING REPORT
c. DATE SIGNED *(YYYYMMDD)*	d. TITLE OF SUPERVISOR COMPLETING REPORT	e. CONTRACTOR SIGNATURE, SUPERVISOR COMPLETING REPORT
f. ORGANIZATION IDENTIFIER *(Division, Branch, Section, etc.,)*		g. OFFICE SYMBOL
16. MANAGEMENT REVIEW *(1st)*		
a. ☐ CONCUR b. ☐ NONCONCUR c. COMMENTS		
DATE *(YYYYMMDD)*	TITLE	SIGNATURE
17. MANAGEMENT REVIEW *(2nd - Chief Operations, Construction, Engineering, etc.,)*		
a. ☐ CONCUR b. ☐ NONCONCUR c. COMMENTS		
DATE *(YYYYMMDD)*	TITLE	SIGNATURE
18. SAFETY AND OCCUPATIONAL HEALTH OFFICE REVIEW		
a. ☐ CONCUR b. ☐ NONCONCUR c. ADDITIONAL ACTIONS/COMMENTS		
DATE *(YYYYMMDD)*	TITLE	SIGNATURE
19. COMMAND APPROVAL		
COMMENTS		
DATE *(YYYYMMDD)*	COMMANDER SIGNATURE	

10. ACCIDENT DESCRIPTION *(Continuation)*

13a. DIRECT CAUSE*(s) (Continuation)*

13b. INDIRECT CAUSE*(s) (Continuation)*

14. ACTION*(s)* TAKEN, ANTICIPATED, OR RECOMMENDED TO ELIMINATE CAUSE*(s) (Continuation)*

GENERAL. Complete a separate report for each person who was injured, caused, or contributed to the accident *(excluding uninjured personnel and witnesses)*. Use of this form for reporting USACE employee first-aid type injuries not submitted to the Office of Workers' Compensation Programs *(OWCP)* shall be at the discretion of the FOA commander. Please type or print legibly. Appropriate items shall be marked with an "X" in box(es). If additional space is needed, provide the information on a separate sheet and attach to the completed form. Ensure that these instructions are forwarded with the completed report to the designated management reviewers indicated in sections 16 and 17.

INSTRUCTIONS FOR SECTION 1 - ACCIDENT CLASSIFICATION

(Mark All Boxes That Are Applicable)

a. GOVERNMENT. Mark "CIVILIAN" box if accident involved government civilian employee; mark "MILITARY" box if accident involved U.S. military personnel.

(1) INJURY/ILLNESS/FATALITY - Mark if accident resulted in any government civilian employee injury, illness, or fatality that requires the submission of OWCP Forms CA-1 *(injury)*, CA-2 *(illness)* or CA-6 *(fatality)* to OWCP; mark if accident resulted in military personnel lost-time or fatal injury or illness.

(2) PROPERTY DAMAGE - Mark the appropriate box if accident resulted in any damage of $1000 or more to government property *(including motor vehicles)*.

(3) VEHICLE INVOLVED - Mark if accident involved a motor vehicle, regardless of whether "INJURY/ILLNESS/FATALITY" or "PROPERTY DAMAGE" are marked.

(4) DIVING ACTIVITY - Mark if the accident involved an in-house USACE diving activity.

b. CONTRACTOR.

(1) INJURY/ILLNESS/FATALITY - Mark if accident resulted in any contractor lost-time injury/illness or fatality.

(2) PROPERTY DAMAGE - Mark the appropriate box if accident resulted in any damage of $1000 or more to contractor property *(including motor vehicles)*.

(3) VEHICLE INVOLVED - Mark if accident involved a motor vehicle, regardless of whether "INJURY/ILLNESS/FATALITY" or "PROPERTY DAMAGE" are marked.

(4) DIVING ACTIVITY - Mark if the accident involved a USACE Contractor diving activity.

c. PUBLIC.

(1) INJURY/ILLNESS/FATALITY - Mark if accident resulted in public fatality or permanent total disability. *(The "OTHER" box will be marked when requested by the FOA to report an unusual non-fatal public accident that could result in claims against the government or as otherwise directed by the FOA Commander).*

(2) VOID SPACE - Make no entry.

(3) VEHICLE INVOLVED - Mark if accident resulted in a fatality to a member of the public and involved a motor vehicle, regardless of whether "INJURY/ILLNESS/FATALITY" is marked.

(4) VOID SPACE - Make no entry.

INSTRUCTIONS FOR SECTION 2 - PERSONAL DATA

a. NAME - *(MANDATORY FOR GOVERNMENT ACCIDENTS. OPTIONAL AT THE DISCRETION OF THE FOA COMMANDER FOR CONTRACTOR AND PUBLIC ACCIDENTS)*. Enter last name, first name, middle initial of person involved.

b. AGE - Enter age.

c. SEX - Mark appropriate box.

d. SOCIAL SECURITY NUMBER - *(FOR GOVERNMENT PERSONNEL ONLY)* Enter the social security number *(or other personal identification number if no social security number issued)*.

e. GRADE - *(FOR GOVERNMENT PERSONNEL ONLY)* Enter pay grade. Example: 0-6; E-7; WG-8; WS-12; GS-11; etc.

f. JOB SERIES/TITLE - For government civilian employees enter the pay plan, full series number, and job title, e.g., GS-O810/Civil Engineer. For military personnel enter the primary military occupational specialty *(PMOS)*, e.g., 15A30 or 11G50. For contractor employees enter the job title assigned to the injured person, e.g., carpenter, laborer, surveyor, etc.

g. DUTY STATUS - Mark the appropriate box.

(1) ON DUTY - Person was at duty station during duty hours or person was away from duty station during duty hours but on official business at time of the accident.

(2) TDY - Person was on official business, away from the duty station and with travel orders at time of accident. Line-of-duty investigation required.

(3) OFF DUTY - Person was not on official business at time of accident.

h. EMPLOYMENT STATUS - *(FOR GOVERNMENT PERSONNEL ONLY)* Mark the most appropriate box. If "OTHER" is marked, specify the employment status of the person.

INSTRUCTION FOR SECTION 3 - GENERAL INFORMATION

a. DATE OF ACCIDENT - Enter the month, day, and year of accident.

b. TIME OF ACCIDENT - Enter the local time of accident in military time. Example: 1430 hrs *(not 2:30 p.m.)*.

c. EXACT LOCATION OF ACCIDENT - Enter facts needed to locate the accident scene, *(installation/project name, building number, street, direction and distance from closest landmark, etc.)*.

d. CONTRACTOR NAME

(1) PRIME - Enter the exact name *(title of firm)* of the prime contractor.

(2) SUBCONTRACTOR - Enter the name of any subcontractor involved in the accident.

e. CONTRACT NUMBER - Mark the appropriate box to identify if contract is civil works, military, or other: if "OTHER" is marked, specify contract appropriation on line provided. Enter complete contract number of prime contract, e.g., DACW 09-85-C-0100.

f. TYPE OF CONTRACT - Mark appropriate box. A/E means architect/engineer. If "OTHER" is marked, specify type of contract on line provided.

g. HAZARDOUS/TOXIC WASTE ACTIVITY *(HTW)* - Mark the box to identify the HTW activity being performed at the time of the accident. For Superfund, DERP, and Installation Restoration Program *(IRP)* HTW activities include accidents that occurred during inventory, predesign, design, and construction. For the purpose of accident reporting, DERP Formerly Used DoD Site *(FUDS)* activities and IRP activities will be treated separately. For Civil Works O&M HTW activities mark the "OTHER" box.

INSTRUCTIONS FOR SECTION 4 - CONSTRUCTION ACTIVITIES

a. CONSTRUCTION ACTIVITY - Select the most appropriate construction activity being performed at time of accident from the list below. Enter the activity name and place the corresponding code number identified in the box.

CONSTRUCTION ACTIVITY LIST

1. MOBILIZATION
2. SITE PREPARATION
3. EXCAVATION/TRENCHING
4. GRADING (EARTHWORK)
5. PIPING/UTILITIES
6. FOUNDATION
7. FORMING
8. CONCRETE PLACEMENT
9. STEEL ERECTION
10. ROOFING
11. FRAMING
12. MASONRY
13. CARPENTRY
14. ELECTRICAL
15. SCAFFOLDING/ACCESS
16. MECHANICAL
17. PAINTING
18. EOUIPMENT/MAINTENANCE
19. TUNNELING
20. WAREHOUSING/STORAGE
21. PAVING
22. FENCING
23. SIGNING
24. LANDSCAPING/IRRIGATION
25. INSULATION
26. DEMOLITION

b. TYPE OF CONSTRUCTION EQUIPMENT - Select the equipment involved in the accident from the list below. Enter the name and place the corresponding code number identified in the box. If equipment is not included below, use code 24, "OTHER", and write in specific type of equipment.

CONSTRUCTION EQUIPMENT

1. GRADER
2. DRAGLINE
3. CRANE *(ON VESSEL/BARGE)*
4. CRANE *(TRACKED)*
5. CRANE *(RUBBER TIRE)*
6. CRANE *(VEHICLE MOUNTED)*
7. CRANE *(TOWER)*
8. SHOVEL
9. SCRAPER
10. PUMP TRUCK *(CONCRETE)*
11. TRUCK *(CONCRETE/TRANSIT MIXER)*
12. DUMP TRUCK *(HIGHWAY)*
13. DUMP TRUCK *(OFF HIGHWAY)*
14. TRUCK *(OTHER)*
15. FORKLIFT
16. BACKHOE
17. FRONT-END LOADER
18. PILE DRIVER
19. TRACTOR *(UTILITY)*
20. MANLIFT
21. DOZER
22. DRILL RIG
23. COMPACTOR/VIBRATORY ROLLER
24. OTHER

INSTRUCTIONS FOR SECTION 5 - INJURY/ILLNESS INFORMATION

a. SEVERITY OF INJURY/ILLNESS - Reference paragraph 2-10 of USACE Supplement 1 to AR 385-40 and enter code and description from list below.

NOI	NO INJURY
FAT	FATALITY
PTL	PERMANENT TOTAL DISABILITY
PPR	PERMANENT PARTIAL DISABILITY
LWD	LOST WORKDAY CASE INVOLVING DAYS AWAY FROM WORK
NLW	RECORDABLE CASE WITHOUT LOST WORKDAYS
RFA	RECORDABLE FIRST AID CASE
NRI	NON-RECORDABLE INJURY

b. ESTIMATED DAYS LOST - Enter the estimated number of workdays the person will lose from work.

c. ESTIMATED DAYS HOSPITALIZED - Enter the estimated number of workdays the person will be hospitalized.

d. ESTIMATED DAYS RESTRICTED DUTY - Enter the estimated number of workdays the person, as a result of the accident, will not be able to perform all of their regular duties.

e. BODY PART AFFECTED - Select the most appropriate primary and when applicable, secondary body part affected from the list below. Enter body part name on line and place the corresponding code letters identifying that body part in the box.

GENERAL BODY AREA	CODE	BODY PART NAME
ARM/WRIST	AB	ARM AND WRIST
	AS	ARM OR WRIST
TRUNK, EXTERNAL MUSCULATURE	B1	SINGLE BREAST
	B2	BOTH BREASTS
	B3	SINGLE TESTICLE
	B4	BOTH TESTICLES
	BA	ABDOMEN
	BC	CHEST
	BL	LOWER BACK
	BP	PENIS
	BS	SIDE
	BU	UPPER BACK
	BW	WAIST
	BZ	TRUNK OTHER
HEAD, INTERNAL	C1	SINGLE EAR INTERNAL
	C2	BOTH EARS INTERNAL
	C3	SINGLE EYE INTERNAL
	C4	BOTH EYES INTERNAL
	CB	BRAIN
	CC	CRANIAL BONES
	CD	TEETH
	CJ	JAW
	CL	THROAT, LARYNX
	CM	MOUTH
	CN	NOSE
	CR	THROAT, OTHER
	CT	TONGUE
	CZ	HEAD OTHER INTERNAL
ELBOW	EB	BOTH ELBOWS
	ES	SINGLE ELBOW
FINGER	F1	FIRST FINGER
	F2	BOTH FIRST FINGERS
	F3	SECOND FINGER
	F4	BOTH SECOND FINGERS
	F5	THIRD FINGER
	F6	BOTH THIRD FINGERS
	F7	FOURTH FINGER
	F8	BOTH FOURTH FINGERS
TOE	G1	GREAT TOE
	G2	BOTH GREAT TOES
	G3	TOE OTHER
	G4	TOES OTHER
HEAD, EXTERNAL	H1	EYE EXTERNAL
	H2	BOTH EYES EXTERNAL
	H3	EAR EXTERNAL
	H4	BOTH EARS EXTERNAL
	HC	CHIN
	HF	FACE
	HK	NECK/THROAT
	HM	MOUTH/LIPS
	HN	NOSE
	HS	SCALP
KNEE	KB	BOTH KNEES
	KS	KNEE
LEG, HIP, ANKLE, BUTTOCKS	LB	BOTH LEGS/HIPS/ ANKLES/
BUTTOCK	LS	SINGLE LEG/HIP/ ANKLE/BUTTOCK
HAND	MB	BOTH HANDS
	MS	SINGLE HAND
FOOT	PB	BOTH FEET
	PS	SINGLE FOOT
TRUNK, BONES	R1	SINGLE COLLAR BONE
	R2	BOTH COLLAR BONES
	R3	SHOULDER BLADE
	R4	BOTH SHOULDER BLADES
	RB	RIB
	RS	STERNUM *(BREAST BONE)*
	RV	VERTEBRAE *(SPINE; DISC)*
	RZ	TRUNK BONES OTHER
SHOULDER	SB	BOTH SHOULDERS
	SS	SINGLE SHOULDER
THUMB	TB	BOTH THUMBS
	TS	SINGLE THUMB
TRUNK, INTERNAL ORGANS	V1	LUNG, SINGLE
	V2	LUNGS, BOTH
	V3	KIDNEY, SINGLE
	V4	KIDNEYS, BOTH
	VH	HEART
	VL	LIVER
	VR	REPRODUCTIVE ORGANS
	VS	STOMACH
	VV	INTESTINES
	VZ	TRUNK, INTERNAL; OTHER

f. NATURE OF INJURY/ILLNESS - Select the most appropriate nature of injury/illness from the list below. This nature of injury/illness shall correspond to the primary body part selected in 5e, above. Enter the nature of injury/illness name on the line and place the corresponding CODE letters in the box provided.
* The injury or condition selected below must be caused by a specific incident or event which occurred during a single work day or shift.

GENERAL NATURE CATEGORY	CODE	NATURE OF INJURY NAME
*TRAUMATIC INJURY OR DISABILITY	TA	AMPUTATION
	TB	BACK STRAIN
	TC	CONTUSION; BRUISE; ABRASION
	TD	DISLOCATION
	TF	FRACTURE
	TH	HERNIA
GENERAL NATURE CATEGORY	CODE	NATURE OF INJURY NAME
	TK	CONCUSSION
	TL	LACERATION, CUT
	TP	PUNCTURE
	TS	STRAIN, MULTIPLE
	TU	BURN, SCALD, SUNBURN
	TI	TRAUMATIC SKIN DISEASES/ CONDITIONS INCLUDING DERMATITIS
	TR	TRAUMATIC RESPIRATORY DISEASE
	TQ	TRAUMATIC FOOD POISONING
	TW	TRAUMATIC TUBERCULOSIS
	TX	TRAUMATIC VIROLOGICAL/INFECTIVE/ PARASITIC DISEASE
	T1	TRAUMATIC CEREBRAL VASCULAR CONDITION/STROKE
	T2	TRAUMATIC HEARING LOSS
	T3	TRAUMATIC HEART CONDITION
	T4	TRAUMATIC MENTAL DISORDER, STRESS; NERVOUS CONDITION
	T8	TRAUMATIC INJURY - OTHER *(EXCEPT DISEASE, ILLNESS)*

** A nontraumatic physiological harm or loss of capacity produced by systemic infection; continued or repeated stress or strain; exposure to toxins, poisons, fumes, etc.; or other continued and repeated exposures to conditions of the work environment over a long period of time. For practical purposes, an occupational illness/disease or disability is any reported condition which does not meet the definition of traumatic injury or disability as described above.

GENERAL NATURE CATEGORY	CODE	NATURE OF INJURY NAME
**NON-TRAUMATIC ILLNESS/DISEASE OR DISABILITY		
RESPIRATORY DISEASE	RA	ASBESTOSIS
	RB	BRONCHITIS
	RE	EMPHYSEMA
	RP	PNEUMOCONIOSIS
	RS	SILICOSIS
	R9	RESPIRATORY DISEASE, OTHER
VIROLOGICAL, INFECTIVE & PARASITIC DISEASES		
	VB	BRUCELLOSIS
	VC	COCCIDIOMYCOSIS
	VF	FOOD POISONING
	VH	HEPATITIS
	VM	MALARIA
	VS	STAPHYLOCOCCUS
	VT	TUBERCULOSIS
	V9	VIROLOGICAL/INFECTIVE/ PARASITIC - OTHER
DISABILITY, OCCUPATIONAL	DA	ARTHRITIS, BURSITIS
	DB	BACK STRAIN, BACK SPRAIN
	DC	CEREBRAL VASCULAR CONDITION; STROKE
	DD	ENDEMIC DISEASE *(OTHER THAN CODE TYPES R&S)*
	DE	EFFECT OF ENVIRONMENTAL CONDITION
	DH	HEARING LOSS
	DK	HEART CONDITION
	DM	MENTAL DISORDER, EMOTIONAL STRESS, NERVOUS CONDITION
	DR	RADIATION
	DS	STRAIN, MULTIPLE
	DU	ULCER
	DV	OTHER VASCULAR CONDITIONS
	D9	DISABILITY, OTHER
SKIN DISEASE OR CONDITION		
	SB	BIOLOGICAL
	SC	CHEMICAL
	S9	DERMATITIS, UNCLASSIFIED

g. TYPE AND SOURCE OF INJURY/ILLNESS *(CAUSE)* - Type and Source Codes are used to describe what caused the incident. The Type Code stands for an ACTION and the Source Code for an OBJECT or SUBSTANCE. Together, they form a brief description of how the incident occurred. Where there are two different sources, code the initiating source of the incident *(see example 1, below)*. Examples:

(1) An employee tripped on carpet and struck his head on a desk. TYPE: 210 *(fell on same level)* SOURCE: 0110 *(walking/working surface)*.

NOTE: This example would NOT be coded 120 *(struck against)* and 0140 *(furniture)*.

(2) A Park Ranger contracted dermatitis from contact with poison ivy/oak.

TYPE: 510 *(contact)* SOURCE: 0920 *(plant)*

(3) A lock and dam mechanic punctured his finger with a metal sliver while grinding a turbine blade.

TYPE: 410 *(punctured by)* SOURCE: 0830 *(metal)*

(4) An employee was driving a government vehicle when it was struck by another vehicle.

TYPE: 800 *(traveling in)* SOURCE: 0421 *(government-owned vehicle, as driver)*

NOTE: The Type Code 800, "Traveling In" is different from the other type codes in that its function is not to identify factors contributing to the injury or fatality, but rather to collect data on the type of vehicle the employee was operating or traveling in at the time of the incident.

Select the most appropriate TYPE and SOURCE identifier from the list below and enter the name on the line and the corresponding code in the appropriate box.

CODE	TYPE OF INJURY NAME
	STRUCK
0110	STRUCK BY
0111	STRUCK BY FALLING OBJECT
0120	STRUCK AGAINST
	FELL, SLIPPED, TRIPPED
0210	FELL ON SAME LEVEL
0220	FELL ON DIFFERENT LEVEL
0230	SLIPPED, TRIPPED *(NO FALL)*
	CAUGHT
0310	CAUGHT ON
0320	CAUGHT IN
0330	CAUGHT BETWEEN
	PUNCTURED, LACERATED
0410	PUNCTURED BY
0420	CUT BY
0430	STUNG BY
0440	BITTEN BY
	CONTACTED
0510	CONTACTED WITH *(INJURED PERSON MOVING)*
0520	CONTACTED BY *(OBJECT WAS MOVING)*
	EXERTED
0610	LIFTED, STRAINED BY *(SINGLE ACTION)*
0620	STRESSED BY *(REPEATED ACTION)*
	EXPOSED
0710	INHALED
0720	INGESTED
0730	ABSORBED
0740	EXPOSED TO
0800	TRAVELING IN

CODE	SOURCE OF INJURY NAME
0100	BUILDING OR WORKING AREA
0110	WALKING/WORKING SURFACE *(FLOOR, STREET, SIDEWALKS, ETC.)*
0120	STAIRS, STEPS
0130	LADDER
0140	FURNITURE, FURNISHINGS, OFFICE EQUIPMENT
0150	BOILER, PRESSURE VESSEL
0160	EQUIPMENT LAYOUT *(ERGONOMIC)*
0170	WINDOWS, DOORS
0180	ELECTRICITY

0200	ENVIRONMENTAL CONDITION	0631	CARBON MONOXIDE
0210	TEMPERATURE EXTREME *(INDOOR)*	0640	MIST, STEAM, VAPOR, FUME
0220	WEATHER *(ICE, RAIN, HEAT, ETC.)*	0641	WELDING FUMES
0230	FIRE, FLAME, SMOKE *(NOT TOBACCO)*	0650	PARTICLES *(UNIDENTIFIED)*
0240	NOISE	0700	CHEMICAL, PLASTIC, ETC.
0250	RADIATION	0711	DRY CHEMICAL - CORROSIVE
0260	LIGHT	0712	DRY CHEMICAL - TOXIC
0270	VENTILATION	0713	DRY CHEMICAL - EXPLOSIVE
0271	TOBACCO SMOKE	0714	DRY CHEMICAL FLAMMABLE
0280	STRESS *(EMOTIONAL)*	0721	LIQUID CHEMICAL - CORROSIVE
0290	CONFINED SPACE	0722	LIQUID CHEMICAL - TOXIC
0300	MACHINE OR TOOL	0723	LIQUID CHEMICAL - EXPLOSIVE
0310	HAND TOOL *(POWERED; SAW, GRINDER, ETC.)*	0724	LIQUID CHEMICAL - FLAMMABLE
0320	HAND TOOL *(NONPOWERED)*	0730	PLASTIC
0330	MECHANICAL POWER TRANSMISSION APPARATUS	0740	WATER
0340	GUARD, SHIELD *(FIXED, MOVEABLE, INTERLOCK)*	0750	MEDICINE
0350	VIDEO DISPLAY TERMINAL	0800	INAMINATE OBJECT
0360	PUMP, COMPRESSOR, AIR PRESSURE TOOL	0810	BOX, BARREL, ETC.
0370	HEATING EQUIPMENT	0820	PAPER
0380	WELDING EQUIPMENT	0830	METAL ITEM, MINERAL
0400	VEHICLE	0831	NEEDLE
0411	AS DRIVER OF PRIVATELY OWNED/RENTAL VEHICLE	0840	GLASS
0412	AS PASSENGER OF PRIVATELY OWNED/RENTAL VEHICLE	0850	SCRAP, TRASH
0421	DRIVER OF GOVERNMENT VEHICLE	0860	WOOD
0422	PASSENGER OF GOVERNMENT VEHICLE	0870	FOOD
0430	COMMON CARRIER *(AIRLINE, BUS, ETC.)*	0880	CLOTHING, APPAREL, SHOES
0440	AIRCRAFT *(NOT COMMERCIAL)*	0900	ANIMATE OBJECT
0450	BOAT, SHIP, BARGE	0911	DOG
0500	MATERIAL HANDLING EQUIPMENT	0912	OTHER ANIMAL
0510	EARTHMOVER *(TRACTOR, BACKHOE, ETC.)*	0920	PLANT
0520	CONVEYOR *(FOR MATERIAL AND EQUIPMENT)*	0930	INSECT
0530	ELEVATOR, ESCALATOR, PERSONNEL HOIST	0940	HUMAN *(VIOLENCE)*
0540	HOIST, SLING CHAIN, JACK	0950	HUMAN *(COMMUNICABLE DISEASE)*
0550	CRANE	0960	BACTERIA, VIRUS *(NOT HUMAN CONTACT)*
0551	FORKLIFT	1000	PERSONAL PROTECTIVE EQUIPMENT
0560	HANDTRUCK, DOLLY	1010	PROTECTIVE CLOTHING, SHOES, GLASSES, GOGGLES
0600	DUST, VAPOR, ETC.		
0610	DUST *(SILICA, COAL, ETC.)*	1020	RESPIRATOR, MASK
0620	FIBERS	1021	DIVING EQUIPMENT
0621	ASBESTOS	1030	SAFETY BELT, HARNESS
0630	GASES	1040	PARACHUTE

INSTRUCTIONS FOR SECTION 6 - PUBLIC FATALITY

a. ACTIVITY AT TIME OF ACCIDENT - Select the activity being performed at the time of the accident from the list below. Enter the activity name on the line and the corresponding number in the box. If the activity performed is not identified on the list, select from the most appropriate primary activity area *(water related, non-water related or other activity)*, the code number for "Other", and write in the activity being performed at the time of the accident.

WATER RELATED RECREATION

1. Sailing
2. Boating-powered
3. Boating-unpowered
4. Water skiing
5. Fishing from boat
6. Fishing from bank dock or pier
7. Fishing while wading
8. Swimming/supervised area
9. Swimming/designated area
10. Swimming/other area
11. Underwater activities *(skin diving, scuba, etc.)*
12. Wading
13. Attempted rescue
14. Hunting from boat
15. Other

NON-WATER RELATED RECREATION

16. Hiking and walking
17. Climbing *(general)*
18. Camping/picnicking authorized area
19. Camping/picnicking unauthorized area
20. Guided tours
21. Hunting
22. Playground equipment
23. Sports/summer *(baseball, football, etc.)*
24. Sports/winter *(skiing, sledding, snowmobiling etc.)*
25. Cycling *(bicycle, motorcycle, scooter)*
26. Gliding
27. Parachuting
28. Other non-water related

OTHER ACTIVITIES

29. Unlawful acts *(fights, riots, vandalism, etc.)*
30. Food preparation/serving
31. Food consumption
32. Housekeeping
33. Sleeping
34. Pedestrian struck by vehicle
35. Pedestrian other acts
36. Suicide
37. "Other" activities

b. PERSONAL FLOTATION DEVICE USED - If fatality was water-related was the victim wearing a person flotation device? Mark the appropriate box.

INSTRUCTIONS FOR SECTION 7 - MOTOR VEHICLE ACCIDENT

a. TYPE OF VEHICLE - Mark appropriate box for each vehicle involved. If more than one vehicle of the same type is involved, mark both halves of the appropriate box. USACE vehicle(s) involved shall be marked in left half of appropriate box.

b. TYPE OF COLLISION - Mark appropriate box.

c. SEAT BELT - Mark appropriate box.

INSTRUCTIONS FOR SECTION 8 - PROPERTY/MATERIAL INVOLVED

a. NAME OF ITEM - Describe all property involved in accident. Property/material involved means material which is damaged or whose use or misuse contributed to the accident. Include the name, type, model; also include the National Stock Number *(NSN)* whenever applicable.

b. OWNERSHIP - Enter ownership for each item listed. *(Enter one of the following: USACE; OTHER GOVERNMENT; CONTRACTOR; PRIVATE)*

c. $ AMOUNT OF DAMAGE - Enter the total estimated dollar amount of damage *(parts and labor)*, if any.

INSTRUCTIONS FOR SECTION 9 - VESSEL/FLOATING PLANT ACCIDENT

a. TYPE OF VESSEL/FLOATING PLANT - Select the most appropriate vessel/floating plant from list below. Enter name and place corresponding number in box. If item is not listed below, enter item number for "OTHER" and write in specific type of vessel floating plant.

VESSEL/FLOATING PLANTS

1. ROW BOAT
2. SAIL BOAT
3. MOTOR BOAT
4. BARGE
5. DREDGE/HOPPER
6. DREDGE/SIDE CASTING
7. DREDGE/DIPPER
8. DREDGE/CLAMSHELL, BUCKET
9. DREDGE/PIPE LINE
10. DREDGE/DUST PAN
11. TUG BOAT
12. OTHER

b. COLLISION/MISHAP - Select from the list below the object*(s)* that contributed to the accident or were damaged in the accident.

COLLISION/MISHAP

1. COLLISION W/OTHER VESSEL
2. UPPER GUIDE WALL
3. UPPER LOCK GATES
4. LOCK WALL
5. LOWER LOCK GATES
6. LOWER GUIDE WALL
7. HAULAGE UNIT
8. BREAKING TOW
9. TOW BREAKING UP
10. SWEPT DOWN 0N DAM
11. BUOY/DOLPHIN/CELL
12. WHARF OR DOCK
13. OTHER

INSTRUCTIONS FOR SECTION 10 - ACCIDENT DESCRIPTION

DESCRIBE ACCIDENT - Fully describe the accident. Give the sequence of events that describe what happened leading up to and including the accident. Fully identify personnel and equipment involved and their role*(s)* in the accident. Ensure that relationships between personnel and equipment are clearly specified. Continue on blank sheets if necessary and attach to this report.

INSTRUCTIONS FOR SECTION 11 - CAUSAL FACTORS

a. Review thoroughly. Answer each question by marking the appropriate block. If any answer is yes, explain in item 13 below. Consider, as a minimum, the following:

(1) DESIGN - Did inadequacies associated with the building or work site play a role? Would an improved design or layout of the equipment or facilities reduce the likelihood of similar accidents? Were the tools or other equipment designed and intended for the task at hand?

(2) INSPECTION/MAINTENANCE - Did inadequately or improperly maintained equipment, tools, workplace, etc. create or worsen any hazards that contributed to the accident? Would better equipment, facility, work site or work activity inspections have helped avoid the accident?

(3) PERSON'S PHYSICAL CONDITION - Do you feel that the accident would probably not have occurred if the employee was in "good" physical condition? If the person involved in the accident had been in better physical condition, would the accident have been less severe or avoided altogether? Was over exertion a factor?

(4) OPERATING PROCEDURES - Did a lack of or inadequacy within established operating procedures contribute to the accident? Did any aspect of the procedures introduce any hazard to, or increase the risk associated with the work process? Would establishment or improvement of operating procedures reduce the likelihood of similar accidents?

(5) JOB PRACTICES - Were any of the provisions of the Safety and Health Requirements Manual *(EM 385-1-1)* violated? Was the task being accomplished in a manner which was not in compliance with an established job hazard analysis or activity hazard analysis? Did any established job practice *(including EM 385-1-1)* fail to adequately address the task or work process? Would better job practices improve the safety of the task?

(6) HUMAN FACTORS - Was the person under undue stress *(either internal or external to the job)*? Did the task tend toward overloading the capabilities of the person; i.e., did the job require tracking and reacting to many external inputs such as displays, alarms, or signals? Did the arrangement of the workplace tend to interfere with efficient task performance? Did the task require reach, strength, endurance, agility, etc., at or beyond the capabilities of the employee? Was the work environment ill-adapted to the person? Did the person need more training, experience, or practice in doing the task? Was the person inadequately rested to perform safely?

(7) ENVIRONMENTAL FACTORS - Did any factors such as moisture, humidity, rain, snow, sleet, hail, ice, fog, cold, heat, sun, temperature changes, wind, tides, floods, currents, dust, mud, glare, pressure changes, lightning, etc., play a part in the accident?

(8) CHEMICAL AND PHYSICAL AGENT FACTORS - Did exposure to chemical agents *(either single shift exposure or long-term exposure)* such as dusts, fibers *(asbestos, etc.)*, silica, gases *(carbon monoxide, chlorine, etc.,)*, mists, steam, vapors, fumes, smoke, other particulates, liquid or dry chemicals that are corrosive, toxic, explosive or flammable, by products of combustion or physical agents such as noise, ionizing radiation, non-ionizing radiation *(UV radiation created during welding, etc.)* contribute to the accident/incident?

(9) OFFICE FACTORS - Did the fact that the accident occurred in an office setting or to an office worker have a bearing on its cause? For example, office workers tend to have less experience and training in performing tasks such as lifting office furniture. Did physical hazards within the office environment contribute to the hazard?

(10) SUPPORT FACTORS - Was the person using an improper tool for the job? Was inadequate time available or utilized to safely accomplish the task? Were less than adequate personnel resources *(in terms of employee skills, number of workers, and adequate supervision)* available to get the job done properly? Was funding available, utilized, and adequate to provide proper tools, equipment, personnel, site preparation, etc.?

(11) PERSONAL PROTECTIVE EQUIPMENT - Did the person fail to use appropriate personal protective equipment *(gloves, eye protection, hard-toed shoes, respirator, etc.)* for the task or environment? Did protective equipment provided or worn fail to provide adequate protection from the hazard*(s)*? Did lack of or inadequate maintenance of protective gear contribute to the accident?

(12) DRUGS/ALCOHOL - Is there any reason to believe the person's mental or physical capabilities, judgment, etc., were impaired or altered by the use of drugs or alcohol? Consider the effects of prescription medicine and over the counter medications as well as illicit drug use. Consider the effect of drug or alcohol induced "hangovers".

b. WRITTEN JOB/ACTIVITY HAZARD ANALYSIS - Was a written Job/Activity Hazard Analysis completed for the task being performed at the time of the accident? Mark the appropriate box. If one was performed, attach a copy of the analysis to the report.

INSTRUCTIONS FOR SECTION 12 - TRAINING

a. WAS PERSON TRAINED TO PERFORM ACTIVITY/TASK? - For the purpose of this section "trained" means the person has been provided the necessary information *(either formal and/or on-the-job (OJT) training)* to competently perform the activity/task in a safe and healthful manner.

b. TYPE OF TRAINING - Mark the appropriate box that best indicates the type of training; *(classroom or on-the-job)* that the injured person received, before the accident happened.

c. DATE OF MOST RECENT TRAINING - Enter YYYYMMDD of the last formal training completed that covered the activity task being performed at the time of the accident.

INSTRUCTIONS FOR SECTION 13 - CAUSES

a. DIRECT CAUSES - The direct cause is that single factor, which most directly lead to the accident. See examples below.

b. INDIRECT CAUSES - Indirect causes are those factors which contributed to but did not directly initiate the occurrence of the accident.

Examples for section 13:

a. Employee was dismantling scaffold and fell 12 feet from unguarded opening.

Direct cause: failure to provide fall protection at elevation. Indirect causes: failure to enforce USACE safety requirements; improper training/motivation of employee *(possibility that employee was not knowledgeable of USACE fall protection requirements or was lax in his attitude towards safety)*; failure to ensure provision of positive fall protection whenever elevated; failure to address fall protection during scaffold dismantling in phase hazard analysis.

b. Private citizen had stopped his vehicle at intersection for red light when vehicle was struck in rear by USACE vehicle. *(Note: USACE vehicle was in proper/safe working condition).*

Direct cause: failure of USACE driver to maintain control of and stop USACE vehicle within safe distance.

Indirect cause: failure of employee to pay attention to driving *(defensive driving).*

INSTRUCTIONS FOR SECTION 14 - ACTION TO ELIMINATE CAUSE*(s)*

DESCRIPTION - Fully describe all the actions taken, anticipated, and recommended to eliminate the cause(s) and prevent reoccurrence of similar accidents/ illnesses. Continue on blank sheets of paper if necessary to fully explain and attach to the completed report form.

INSTRUCTIONS FOR SECTION 15 - DATES FOR ACTION

a. **BEGIN DATE** - Enter the date YYYYMMDD when the corrective action(s) identified in section 14 will begin.

b. **COMPLETE DATE** - Enter the date YYYYMMDD when the corrective action(s) identified in section 14 will be completed.

c. **DATE SIGNED** - Enter YYYYMMDD that the report was signed by the responsible supervisor.

d.e.. **TITLE AND SIGNATURE** - Enter the title and signature of supervisor completing the accident report. For a GOVERNMENT employee accident/illness the immediate supervisor will complete and sign the report. For PUBLIC accidents the USACE Project Manager/Area Engineer responsible for the USACE property where the accident happened shall complete and sign the report. For CONTRACTOR accidents the Contractor's project manager shall complete and sign the report and provide to the USACE supervisor responsible for oversight of that contractor activity. This USACE supervisor shall also sign the report. Upon entering the information required in 15c., 15d., 15e., 15f. and 15g. below, the responsible USACE supervisor shall forward the report for management review as indicated in section 16.

f. **ORGANIZATION NAME** - For GOVERNMENT employee accidents enter the USACE organization name *(Division, Branch, Section, etc.)* of the injured employee. For PUBLIC accidents enter the USACE organization name for the person identified in block 15d. For CONTRACTOR accidents enter the USACE organization name for the USACE office responsible for providing contract administration oversight.

g. **OFFICE SYMBOL** - Enter the latest complete USACE Office Symbol for the USACE organization identified in block 15f.

INSTRUCTIONS FOR SECTION 16 - MANAGEMENT REVIEW (1st)

1ST REVIEW - Each USACE FOA shall determine who will provide 1st management review. The responsible USACE supervisor in section 15d. shall forward the completed report to the USACE office designated as the 1st Reviewer by the FOA. Upon receipt, the Chief of the Office shall review the completed report, mark the appropriate box, provide substantive comments, sign, date, and forward to the FOA Staff Chief *(2nd review)* for review and comment.

INSTRUCTIONS FOR SECTION 17 - MANAGEMENT REVIEW (2nd)

2ND REVIEW - The FOA Staff Chief *(i .e., FOA Chief of Construction, Operations, Engineering, Planning, etc.)* shall mark the appropriate box, review the completed report, provide substantive comments, sign, date, and return to the FOA Safety and Occupational Health Office.

INSTRUCTIONS FOR SECTION 18 - SAFETY AND OCCUPATIONAL HEALTH REVIEW

3RD REVIEW - The FOA Safety and Occupational Health Office shall review the completed report, mark the appropriate box, ensure that any inadequacies, discrepancies, etc. are rectified by the responsible supervisor and management reviewers, provide substantive comments, sign, date and forward to the FOA Commander for review, comment, and signature.

INSTRUCTION FOR SECTION 19 - COMMAND APPROVAL

4TH REVIEW - The FOA Commander shall *(to include the person designated Acting Commander in his absence)* review the completed report, comment if required, sign, date, and forward the report to the FOA Safety and Occupational Health Office. Signature authority shall not be delegated.

ATTACHMENT 7

EMS/RESCUE CONFIRMATION AND EVALUATIONS

EVALUATION OF EMS PROVIDERS **Date: 12 Nov 2012**

Name of Responding Group or Agency: _Station 20 Oak Hall Rescue_______

Name of Individual(s) Contacted: _Tom Copenhaver_

Confirmation of Authority to commit to supporting WESTON: ____________________

Contact Information: Non-Emergency Phone Number: 757-824-3370

Emergency Phone Number: ___-___-_911

Address: 30057 Ambulance Road
Oak Hall, VA 23416
____

Distance in miles and time from EMS provider to site(s): Miles: 6 Time: 15 min

Note: Time to be able to institute rescue operation must be determined and documented based on known or perceived hazards. In the event of hazardous atmospheres typical response times should be 5 minutes or less.

Hours of availability: ___ AM to _____ PM or 24 Hours __x__

Staffing: Volunteer __x___ Full-time___x___

Confirmation of services and other specialized rescues that may be associated with field work such as:

Type of service: BLS ____ ALS __x___

High Angle Rescue (Rescue at elevation): Yes ___; NO __x_; WFF does this

Excavation Rescue: Yes ___; NO _x__; WFF does this

Fall Arrest System Rescue: Yes ___; NO _x__; WFF does this

Confined Space Rescue: Yes ___; NO __x__; WF does this

Ability to respond to more than one emergency at a time: Yes _x_____; NO______ (2 ambulances)

If "NO", provisions must be made for other rescue options or entry operations must cease until responders are available again.

If "NO" what mechanism(s) will be in place to verify when responders are both unavailable and when they are available to respond again (e.g., phone call, radio to responder channel, etc.).

EVALUATION OF FIRE/RESCUE PROVIDERS **Date: 12 Nov 2012**

Name of Responding Group or Agency: Station 20 Oak Hall Rescue

Name of Individual(s) Contacted: Tom Copenhaver

Confirmation of Authority to commit to supporting WESTON:

Contact information: Non-Emergency Phone Number: 757-824-3370

Emergency Phone Number: ___-___-_911

Address: 30057 Ambulance Road
Oak Hall, VA 23416
____

Distance in miles and time from EMS provider to site(s): Miles: 6 Time: _15 minutes

Note: Time to be able to institute rescue operation must be determined and documented based on known or perceived hazards. In the event of hazardous atmospheres typical response times should be 5 minutes or less.

Hours of availability: ___ AM to _____ PM or 24 Hours ___x__

Staffing: Volunteer __x____ Full-time___x__

Confirmation of services and other specialized rescues that may be associated with field work such as:

Type of service: BLS _____ ALS ____x__

High Angle Rescue (Rescue at elevation): Yes ___; NO _x__; WFF does this

Excavation Rescue: Yes ___; NO _x__; WFF does this

Fall Arrest System Rescue: Yes ___; NO _x__; WFF does this

Confined Space Rescue: Yes ___; NO __x__; WFF does this

Ability to respond to more than one emergency at a time: Yes ___x___; NO______ (2 ambulances)

If "NO", provisions must be made for other rescue options or entry operations must cease until responders are available again.

If "NO" what mechanism(s) will be in place to verify when responders are both unavailable and when they are available to respond again (e.g., phone call, radio to responder channel, etc.).

EVALUATION OF FIRE/RESCUE PROVIDERS **Date: 12 Nov 2012**

Name of Responding Group or Agency: NASA Wallops Flight Facility Fire Department

Name of Individual(s) Contacted: Captain David Allen

Confirmation of Authority to commit to supporting Weston:

Contact information: Non-Emergency Phone Number: 757-824-1300

Emergency Phone Number: ___-___-_911

Address: Building B 129 Fire Station #1
Wallops Island, VA
____

Distance in miles and time from EMS provider to site(s): Miles: 6 Time: _10 minutes

Note: Time to be able to institute rescue operation must be determined and documented based on known or perceived hazards. In the event of hazardous atmospheres typical response times should be 5 minutes or less.

Hours of availability: ___ AM to _____ PM or 24 Hours ___x__

Staffing: Volunteer _____ Full-time___x__

Confirmation of services and other specialized rescues that may be associated with field work such as:

Type of service: BLS _____ ALS ____x__

High Angle Rescue (Rescue at elevation): Yes _x__; NO ___;

Excavation Rescue: Yes ___; NO _x__;

Fall Arrest System Rescue: Yes _x__; NO ___;

Confined Space Rescue: Yes _x__; NO ____;

Ability to respond to more than one emergency at a time: Yes ___x___; NO______ (2 stations)

If "NO", provisions must be made for other rescue options or entry operations must cease until responders are available again.

If "NO" what mechanism(s) will be in place to verify when responders are both unavailable and when they are available to respond again (e.g., phone call, radio to responder channel, etc.).

EVALUATION OF FIRE/RESCUE PROVIDERS **Date: 12 Nov 2012**

Name of Responding Group or Agency: Station 4 Atlantic Volunteer Fire and Rescue

Name of Individual(s) Contacted: N/A

Confirmation of Authority to commit to supporting Weston:

Contact information: Non-Emergency Phone Number: 757-824-4844

Emergency Phone Number: ___-___-_911

Address: 10071 Atlantic Road
Atlantic, VA 23303
____

Distance in miles and time from EMS provider to site(s): Miles: 7 Time: _15 minutes

Note: Time to be able to institute rescue operation must be determined and documented based on known or perceived hazards. In the event of hazardous atmospheres typical response times should be 5 minutes or less.

Hours of availability: _6__ AM to _6_ PM or 24 Hours ___

Staffing: Volunteer ___x__ Full-time_____

Confirmation of services and other specialized rescues that may be associated with field work such as:

Type of service: BLS ___x__ ALS _____

High Angle Rescue (Rescue at elevation): Yes ___; NO _x__;

Excavation Rescue: Yes ___; NO _x__;

Fall Arrest System Rescue: Yes ___; NO _x__;

Confined Space Rescue: Yes ___; NO __x__;

Ability to respond to more than one emergency at a time: Yes ______; NO___x___

If "NO", provisions must be made for other rescue options or entry operations must cease until responders are available again.

If "NO" what mechanism(s) will be in place to verify when responders are both unavailable and when they are available to respond again (e.g., phone call, radio to responder channel, etc.).

Medical Facility **Date:** 12 Nov 2012

Name of Responding Group or Agency: Peninsular Regional Medical Center

Name of Individual(s) Contacted: Ms. Karen Price

Confirmation of Authority to commit to supporting Weston:

Contact information: Non-Emergency Phone Number: 410-546-6400

Emergency Phone Number: 911

Address: 100 East Carroll Street
Salisbury, MD 21801
____

Distance in miles and time to Medical Facility from site(s): Miles: 41 Time: 1 hour

Hours of availability: ___ AM to _____ PM or 24 Hours ___x__

Does the Facility have capabilities to deal with:

Chemical Exposure Yes _x___ No _____

Trauma: Yes _x___ No _____ If yes, Level: _______

If no, nearest Trauma Center: ________________________________

ATTACHMENT 8

BLOODBORNE PATHOGEN EXPOSURE PLAN

BLOODBORNE PATHOGENS EXPOSURE CONTROL PLAN – FIRST AID PROVIDERS

SCOPE

WESTON personnel do not provide medical assistance as a primary job duty; however, this Bloodborne Pathogen Exposure Control Plan (ECP) is applicable to designated first aid providers. WESTON workers expected to administer first aid must have a basic understanding of bloodborne pathogens in order to protect themselves effectively from any hazards. At a minimum, this Bloodborne Pathogen ECP for First Aid Providers will be on site

WESTON personnel may deliver First Aid and CPR in a nonclinical setting. First Aid and CPR duties are often performed in uncontrolled environments, which, due to a lack of time and other factors, do not allow for application of a complex decision-making process to the emergency at hand.

This ECP is intended to assist personnel in making decisions concerning the use of personal protective equipment (PPE) and resuscitation equipment, as well as for decontamination, labeling, containerizing and disposal procedures.

Information Program

Identification and assessment of risk from exposure to biological hazards is conducted as part of the development of the APP and SSHP. This ECP deals with forms of infection that are of concern to workers who can come in contact with bodily fluids associated with blood.

WESTON training programs provide information on bloodborne pathogens and the Occupational Exposure to Bloodborne Pathogens Standard to all field personnel with special emphasis on those employees who are certified and called upon to perform First Aid.

Exposure Control

This ECP is designed to eliminate or minimize employee exposure to bloodborne pathogens through information and training, use of PPE, safe handling procedures, decontamination, and proper disposal methods.

<u>Exposure Determination</u>

Employees certified in First Aid and CPR may be at risk from bloodborne pathogens when these services are rendered. Attachment 1 identifies tasks in which occupational exposure may occur, potential contact, and required protective measures for First Aid providers.

METHODS OF COMPLIANCE

Universal Precautions

When treating a victim for an injury, conducting CPR, or handling potentially infectious waste, the use of universal precautions is the recommended approach to infection control. Universal precautions assume all human blood and certain human body fluids are infectious for HIV, HBV and other bloodborne pathogens. Other body substances, including feces, urine, or vomit are not included, unless they contain visible blood. Under circumstances in which differentiation between body fluid types is difficult or impossible, all body fluids shall be considered potentially infectious materials.

Work Practice Controls

Work practice controls reduce the likelihood of exposure by formalizing the manner in which a task is performed.

- All first aid procedures involving blood or other potentially infectious materials shall be performed in a manner that minimizes splashing, spraying, spattering, and generation of droplets of these substances.
- Mouth suctioning of blood or other infectious materials is prohibited.
- When handling sharps such as needles used for bee stings or diabetes, do not recap, purposely bend, break by hand, remove from disposable syringes, or otherwise manipulate by hand.
- As soon as possible after use, contaminated sharps are to be placed in puncture proof/leak proof containers until they can be disposed.
- Broken glassware which may be contaminated shall not be picked up directly with the hands unless gloves are used to protect the hands against cuts. It is best to use mechanical means, such as a brush and dust pan then place contaminated broken glass in a puncture proof/leak proof container.
- When handling red bag waste, hold the top end of the bag rather than the bottom.
- Containers of potentially infectious waste should be labeled with a biohazard label.
- All PPE should be inspected prior to use. PPE should not be worn if the PPE barrier is compromised.
- Hands and other skin surfaces should be washed immediately and thoroughly if contaminated with blood, other body fluids to which universal precautions apply, or their potentially contaminated articles. Hands should always be washed after gloves are removed even if the gloves appear intact.
- Where hand washing facilities are not readily accessible, an antiseptic hand cleaner along with clean cloth/paper towels or antiseptic towelettes should be used. When antiseptic hand cleaners or towelettes are used hands shall be washed with soap and running water as soon as feasible.

Engineering Controls

Engineering controls isolate or remove the bloodborne pathogen hazard from the workplace.

- Proper containerizing, labeling and disposal of contaminated items are required for all potentially infectious waste.
- Minimizing needle sticks by placing them in a puncture proof container.
- Limiting access or close off areas which contain potentially infectious materials.

Administrative Controls

Administrative controls reduce or eliminate bloodborne pathogen hazards from the workplace by program development (i.e., ECP), auditing to ensure these programs are in place and implemented, and providing information and training.

Personal Protective Equipment (PPE)

PPE is specialized clothing or equipment worn by an employee for protection against a hazard. Attachment 1 provides examples of recommendations for PPE in the nonclinical setting; the list is not intended to be all-inclusive.

First-aid kits will be supplemented with bloodborne pathogen kits or supplies and will be readily accessible at all times.

If the chance of being exposed to blood is high, the caregiver should put on protective attire before beginning CPR or First Aid. Protective barriers should be used in accordance with the level of exposure encountered.

Under rare or extraordinary circumstances, a responding employee may decide, based on his or her judgment, that use of PPE would prevent delivery of care or pose an increased hazard to safety of the employee or co-worker. When this judgment has been made, an investigation of the event will be initiated and documented in order to determine what changes in procedures or protective equipment is needed.

Resuscitation Equipment

No transmission of HBV or HIV infection during mouth to mouth resuscitation has been documented. However, because of the risk of salivary transmission of other infectious diseases and the theoretical risk of HIV and HBV transmission during artificial ventilation of trauma victims, disposable mouth to mouth resuscitation masks (one-way valve type only) should be used. These devices are designed to isolate emergency response personnel from contact with victim's blood and blood-contaminated saliva, respiratory secretions, and vomit. Disposable resuscitation equipment and devices should be disposed of once they have been used.

Decontamination and Disposal

All PPE will be removed prior to leaving a contaminated area and secured properly for decontamination or proper disposal.

Decontamination uses physical or chemical means to remove, inactivate, or destroy bloodborne pathogens on a surface or item to the point where they are no longer capable of transmitting infectious particles and the surface or item is rendered safe for handling, use, or disposal. All spills of blood and blood-contaminated fluids should be promptly cleaned up. The area should be decontaminated with a commercial disinfectant solution or a 1:100 solution of household bleach. Soiled cleaning equipment should be cleaned and decontaminated with the disinfectant solution.

If a victim's clothes become soiled with blood during First Aid or CPR, the soiled material (i.e., clothes, resuscitation equipment or disposable towels) should be placed in a red or orange plastic bag. If possible this bag should accompany the victim to the hospital or ambulance. Where on-site emergency care is given and additional medical treatment is not likely, soiled material should be placed in a red or orange plastic bag and then pick-up should be arranged by a local medical waste disposal company. Containers must be identified prior to transport or pick-up.

Any questions regarding the disposal or management of soiled garments or materials should be directed to Federal Team Health and Safety Officer or Division Environmental Health and Safety Officer.

Containerizing

The potentially contaminated materials and sharps container generated from giving First Aid and CPR will be placed in a red or orange container/bag. When PPE is removed it shall be placed in an appropriate designated area for containerization. If the outside contamination of the primary container occurs, the primary container shall be placed within a second container which prevents leakage during handling processing storage, transport or shipping and is labeled or color coded.

Sharps such as needles used for bee stings or diabetes should be placed in a puncture proof/leak proof color coded or labeled container. If other contents could puncture the primary container, the primary container shall be placed within a secondary container which is puncture resistant. The liquid generated from the decontamination process should be contained in a leak proof container until a local medical waste disposal company can provide information on proper disposal based on local, state and federal regulations.

Labeling and Hazard Communication

Biohazard warning labels required by the Standard [29 CFR 1910.1030(g)(1)(i)(B)] must be attached to containers of regulated wastes or other containers of potentially infectious materials during storage, transport or shipment. Red or orange bags may be substituted for labeling requirements, otherwise, a biohazard label with lettering or symbols should be affixed to the outside of each bag or container generated. Consequently, any container so labeled or any red or orange bagged waste or materials shall be considered to contain either blood or other infectious material.

Incident Reporting

When an employee gives First Aid or CPR, or is potentially exposed to a bloodborne pathogen, a Notification of Incident (NOI) Report must be completed. The report must indicate "Potential Exposure to Bloodborne Pathogens

<u>Vaccination and Post-Exposure Evaluation and Follow-up</u>

The pre-work Hepatitis B Vaccination for First Aid providers is not required, it will therefore, be offered post-exposure.

Hepatitis B vaccines are effective in preventing hepatitis B following a documented exposure when given within 1 week after HBV exposure. The vaccine may be more effective when combined with HBIG, a preparation of immune globulin with high levels of antibody to HBV (anti-HBs). The U.S. Public Health Service and Center for Disease Control guidelines should be accessed for current information.

Upon suspicion or verification of exposure to blood or infectious materials, Hepatitis vaccine will be made available to the exposed individual(s) at no cost to the employee. The employee will immediately be referred to WESTON's Occupational Medical Consultant (OMC) for counseling and management.

Upon learning of exposure to a source or source individual found to be positive for HBV or HIV, WESTON's OMC will provide direction on case management. The OMC, after discussion of the exposure situation with the medical clinic or hospital where the victim was evaluated and treated for injury, will determine whether the exposed employee should be tested for HBV or HIV prior to the status of the source being known (or in the case where the source is unknown).

HBV and HIV testing of the source individual should be done at the local offices' medical clinic or at the hospital where the victim was treated for injury. Local laws may apply for testing source individuals in situations where consent cannot be obtained because the source refuses testing or cannot be identified (i.e., an unconscious patient). If the job location does not allow access to the local offices' medical clinic then a new WESTON OMC will be consulted for guidance. The alternate clinic/hospital must offer pretest counseling, post test counseling and referral for treatment.

Consult with WESTON's OMC to determine if the exposed employee should be given the HBV post-exposure vaccination.

Collection and testing of blood for HBV and HIV serological status shall be performed as soon as feasible on the exposed employee’s blood (after consent) where the source is found to be positive for HIV or HBV. Results of the source individual’s testing shall be made available to the exposed employee, and the employee shall be informed by the Medical Safety Officer of applicable laws and regulations concerning disclosure of the identity and infectious status of the source individual. When the source individual is already known to be infected with HBV or HIV testing of the source individual known HBV or HIV status need not be repeated (Center for Disease Control, 1985).

If the source of the exposure is a needle stick or bloodstained material (i.e., blood stained material contacted an open wound on a field team member) the source should be placed in an appropriate container (i.e., sharps container for needles and red bag for blood tainted material). The container should be given to the WESTON medical clinic for analysis. If the source is found to be HBV or HIV positive, the incident report must be updated to change the status from suspected to confirmed exposure. At this point the NOI Report will be placed in a limited control access portion of incident filing system to maintain confidentiality.

Human Immunodeficiency Virus Post Exposure Management

For any exposure to a source or source individual who has AIDS, who is found to be positive for HIV infection or who refuses testing, the worker should be counseled regarding the risk of infection and evaluated clinically and serologically for evidence for the HIV infection as soon as possible after the exposure. WESTON's OMC will provide direction on the case management.

If the source individual was tested and found to be seronegative, follow-up will be determined by WESTON's OMC.

If the source or source individual cannot be identified, decisions regarding appropriate follow-up should be individualized. Serological testing will be made available to all workers who may be concerned they have been infected with HIV through an occupational exposure. WESTON's OMC will provide direction on the case management.

Communication of Hazards to Employees

<u>Training Schedule</u>

WESTON ensures that employees, who are certified to provide First Aid and CPR, are trained in all components of the bloodborne pathogen standard upon assignment and at the annual refresher training. All First Aid providers must be aware of task modifications or procedure changes which might affect occupational exposure.

<u>Training Contents</u>

A training sign-up sheet will be completed to include course title, date, attendees' names, signatures, job classifications, instructor's name, and duration of the class. Training content will include the following information:

- Where an accessible copy of the regulatory text and the WESTON's ECP can be found.
- An explanation of WESTON's ECP and the means by which employees can obtain a copy of the written plan.
- A general explanation of the epidemiology and symptoms of bloodborne diseases.
- An explanation of the appropriate methods for recognizing tasks and other activities that may involve exposure to blood and other potentially infectious materials.
- An explanation of the use and limitations of methods that will prevent or reduce exposure including appropriate engineering controls, work practices, and PPE.
- Information on the types, proper use, location, removal, handling, decontamination and disposal of PPE.

- An explanation of the basis for selection of PPE.
- Information on the Hepatitis B vaccine (or any new vaccines), including information on its efficacy, safety, method of administration, the benefits of being vaccinated.
- An explanation of the procedure to follow if an exposure incident occurs, including the method of reporting the incident and the medical follow-up that will be made available.
- Information on the post-exposure evaluation and follow-up that WESTON is required to provide for the employee following an exposure incident.
- An explanation of the signs and labels and/or color coding for disposal of infectious materials.
- An opportunity for interactive questions and answers with the person conducting the training session.

Recordkeeping

When an employee gives First Aid or CPR and in doing so becomes subject to this ECP, he/she will verbally report the incident within 1 hour and complete a WESTON NOI Report within 24 hours. As part of a medical record, the circumstances of exposure will be kept confidential. Relevant information includes the activities in which the worker was engaged at the time of exposure, the extent to which appropriate work practices and PPE were used, and a description of the source of exposure (USHHS and NIOSH, 1989). When the source is tested for HIV or HBV, the incident report is updated and placed in a confidential file.

ATTACHMENT 1
TASK IDENTIFICATION, POTENTIAL CONTACT, AND PROTECTION

CPR AND FIRST AID			
EMERGENCY SITUATION	**SERVICE**	**POTENTIAL CONTACT**	**PPE SUGGESTED**
Victim is lying on the ground	Primary survey of victim and opening victims airway	Skin to skin contact	Gloves
Victims breathing has ceased	Rescue breathing	Skin to skin contact Mouth to mouth contact	Gloves Resuscitation mouthpiece
No pulse	CPR	Skin to skin contact	Gloves Resuscitation mouthpiece
Victim is lying on the ground	Secondary survey of victim	Skin to skin contact	Gloves
Choking without stoppage of breathing	Heimlich maneuver	Skin to skin contact	None required if skin is intact Non-intact skin requires gloves
Heart Attack	Comfort victim	Skin to skin contact	Gloves
Bleeding with spurting blood	External control	Skin to skin contact	Gloves Gown or coveralls Apron (option) Mask or face protection Eyewear
Minimal bleeding	External control	Skin to skin contact	Gloves
Compound fractures	External control	Skin to skin contact	Gloves
Burns	External control	Skin to skin contact	Gloves
Poisoning	If induced vomiting is needed	Skin to skin contact	Gloves Eyewear
Diabetic shock	Giving an injection	Sharps from needle could cause direct injection	Gloves Sharps container
Bites and stings	Giving an injection	Sharps from needle could cause direct injection	Gloves Sharps container
Seizures	External control	Eyes and skin contact	Gloves Eyewear

CPR AND FIRST AID			
EMERGENCY SITUATION	**SERVICE**	**POTENTIAL CONTACT**	**PPE SUGGESTED**
Stroke	Provide comfort	None	Gloves
Heat Stress/Cold Stress	External control	Skin to skin contact	Gloves
Victim has fainted	Raise legs for shock	Skin to skin contact	Gloves
Victim falls down in hazardous atmosphere	Rescue victim from area	Skin to skin contact	Gloves
Soiled clothes handling	Place soiled clothing and materials in red/orange bag	Skin contact with bloodborne pathogens in clothing fabrics	Gloves Gown or apron (as needed)
Decontamination	Scrub with disinfectant	Skin contact with bloodborne pathogens in clothing fabrics	Gloves Gown or apron (as needed)
Containerization	Place contaminated clothing into bags	Potential skin contact with residual bloodborne pathogen on bags	Gloves Gown or apron (as needed)

ATTACHMENT 9

HAZARD ASSESSMENT CERTIFICATION FORM

HAZARD ASSESSMENT CERTIFICATION FORM

Date: **Location:**

Assessment Conducted By:

Specific Tasks Performed at this Location:

I. Overhead Hazards Identified (Check all that apply):

☐Suspended loads that could fall
☐Overhead beams or loads that could be hit against
☐Energized wires or equipment that could be near enough to arc or hit against
☐Employees work at elevated site who could drop objects on others below
☐Sharp objects or corners at head level
☐Other (Describe/List) ____________________________________

Head Protection

Hard Hat: ☐Yes ☐No

II. Eye and Face Hazards Identified (Check all that apply):

☐Chemical splashes
☐Dust
☐Smoke and fumes
☐Welding operations
☐Lasers/optical radiation
☐Projectiles
☐Other (Describe/List) ____________________________________

Eye Protection

Safety glasses: ☐Yes ☐No
Goggles: ☐Yes ☐No
Face Shield: ☐Yes ☐No
Tinted Lens: ☐Yes ☐No
(If yes, Degree of Filtering: ______)

III. Hand Hazards Identified (Check all that apply):

☐Chemicals
☐Sharp edges, splinters, etc.
☐Temperature extremes
☐Biological agents
☐Exposed electrical wires
☐Sharp tools, machine parts, etc.
☐Other (Describe/List) ____________________________________

Hand Protection

Gloves: ☐Yes ☐No
☐Chemical resistant
☐Temperature resistant
☐Abrasion resistant
☐Electrical protective
☐Other (Describe/List)

IV. Foot Hazards Identified (Check all that apply):

☐Heavy materials handled by employees
☐Sharp edges or points (puncture risk)
☐Exposed electrical wires
☐Unusually slippery conditions
☐Wet conditions
☐Construction/demolition
☐Other (Describe/List) ____________________________________

Foot Protection

Safety Shoes: ☐Yes ☐No
Types: ☐Toe protection
☐Metatarsal protection
☐Puncture resistant
☐Electrical insulation
☐Non-static
Other (Describe/List)

V. Hazards to Body Identified (Check all that apply):

☐Chemical contact
☐Fire or flash
☐Temperature extremes
☐UXO
☐Radiation (Ionizing)
☐Radiation (Non-Ionizing)
☐Other (Describe/List) ____________________________________

Body Protection

☐Chemical-resistant coveralls
☐Thermal protection
☐Welding —Leathers||
☐Ballistic shields for UXO operations
☐Flash protection (e.g., Nomex or equivalent)
☐Ballistic or cut-resistant chaps

VI. Noise Hazards Identified: Noise Source(s):

Noise Protection (List):

VII. Other Identified Safety and/or Health Hazards (list):

Recommended Protection (List):

I certify that the above inspection was performed to the best of my knowledge and ability, based on the hazards present on (date)_____________________ .

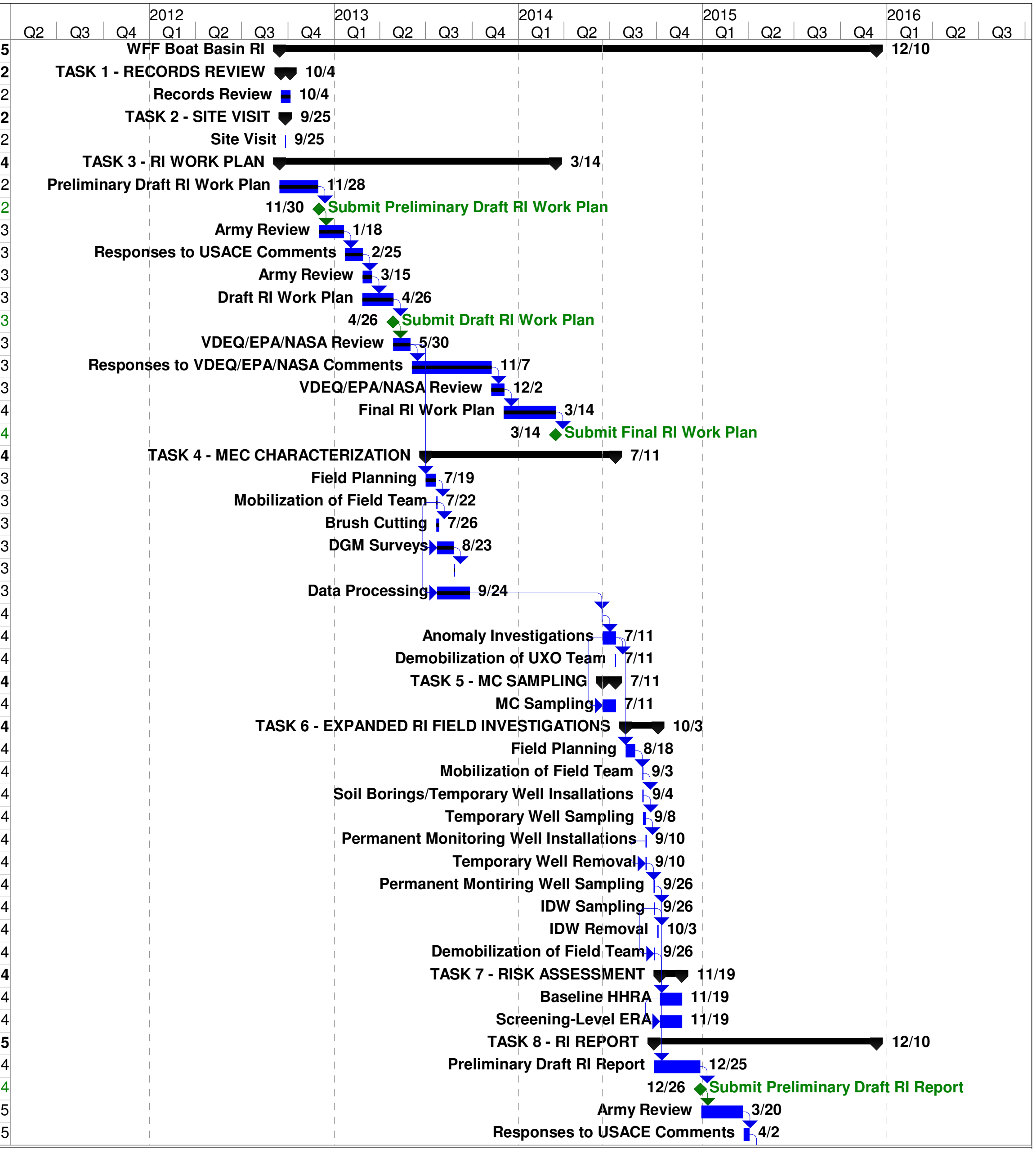
____

Signature

APPENDIX F

PROJECT SCHEDULE

ID	Task Name	Duration	Start	Finish
1	**WFF Boat Basin RI**	**839 days**	**9/14/2012**	**12/10/2015**
2	**TASK 1 - RECORDS REVIEW**	**14 days**	**9/17/2012**	**10/4/2012**
3	Records Review	14 days	9/17/2012	10/4/2012
4	**TASK 2 - SITE VISIT**	**1 day**	**9/25/2012**	**9/25/2012**
5	Site Visit	1 day	9/25/2012	9/25/2012
6	**TASK 3 - RI WORK PLAN**	**384 days**	**9/14/2012**	**3/14/2014**
7	Preliminary Draft RI Work Plan	52 days	9/14/2012	11/28/2012
8	Submit Preliminary Draft RI Work Plan	1 day	11/30/2012	11/30/2012
9	Army Review	49 days	12/1/2012	1/18/2013
10	Responses to USACE Comments	25 days	1/22/2013	2/25/2013
11	Army Review	18 days	2/26/2013	3/15/2013
12	Draft RI Work Plan	45 days	2/25/2013	4/26/2013
13	Submit Draft RI Work Plan	1 day	4/26/2013	4/26/2013
14	VDEQ/EPA/NASA Review	34 days	4/27/2013	5/30/2013
15	Responses to VDEQ/EPA/NASA Comments	112 days	6/3/2013	11/7/2013
16	VDEQ/EPA/NASA Review	25 days	11/8/2013	12/2/2013
17	Final RI Work Plan	75 days	12/2/2013	3/14/2014
18	Submit Final RI Work Plan	1 day	3/14/2014	3/14/2014
19	**TASK 4 - MEC CHARACTERIZATION**	**271 days**	**7/1/2013**	**7/11/2014**
20	Field Planning	14 days	7/1/2013	7/19/2013
21	Mobilization of Field Team	1 day	7/22/2013	7/22/2013
22	Brush Cutting	5 days	7/22/2013	7/26/2013
23	DGM Surveys	24 days	7/23/2013	8/23/2013
24	Demobilzation of Field Team	1 day	8/26/2013	8/26/2013
25	Data Processing	45 days	7/23/2013	9/24/2013
26	Remobilze Field Team	1 day	6/15/2014	6/15/2014
27	Anomaly Investigations	20 days	6/16/2014	7/11/2014
28	Demobilization of UXO Team	1 day	7/11/2014	7/11/2014
29	**TASK 5 - MC SAMPLING**	**20 days**	**6/16/2014**	**7/11/2014**
30	MC Sampling	20 days	6/16/2014	7/11/2014
31	**TASK 6 - EXPANDED RI FIELD INVESTIGATIONS**	**46 days**	**8/1/2014**	**10/3/2014**
32	Field Planning	12 days	8/1/2014	8/18/2014
33	Mobilization of Field Team	1 day	9/3/2014	9/3/2014
34	Soil Borings/Temporary Well Insallations	2 days	9/3/2014	9/4/2014
35	Temporary Well Sampling	2 days	9/5/2014	9/8/2014
36	Permanent Monitoring Well Installations	2 days	9/9/2014	9/10/2014
37	Temporary Well Removal	2 days	9/9/2014	9/10/2014
38	Permanent Montiring Well Sampling	2 days	9/25/2014	9/26/2014
39	IDW Sampling	1 day	9/26/2014	9/26/2014
40	IDW Removal	1 day	10/3/2014	10/3/2014
41	Demobilization of Field Team	1 day	9/26/2014	9/26/2014
42	**TASK 7 - RISK ASSESSMENT**	**31 days**	**10/8/2014**	**11/19/2014**
43	Baseline HHRA	31 days	10/8/2014	11/19/2014
44	Screening-Level ERA	31 days	10/8/2014	11/19/2014
45	**TASK 8 - RI REPORT**	**315 days**	**9/26/2014**	**12/10/2015**
46	Preliminary Draft RI Report	65 days	9/26/2014	12/25/2014
47	Submit Preliminary Draft RI Report	1 day	12/26/2014	12/26/2014
48	Army Review	60 days	12/29/2014	3/20/2015
49	Responses to USACE Comments	9 days	3/23/2015	4/2/2015



Weston Calendar is in Business Days
Government Reviews are in Calendar Days

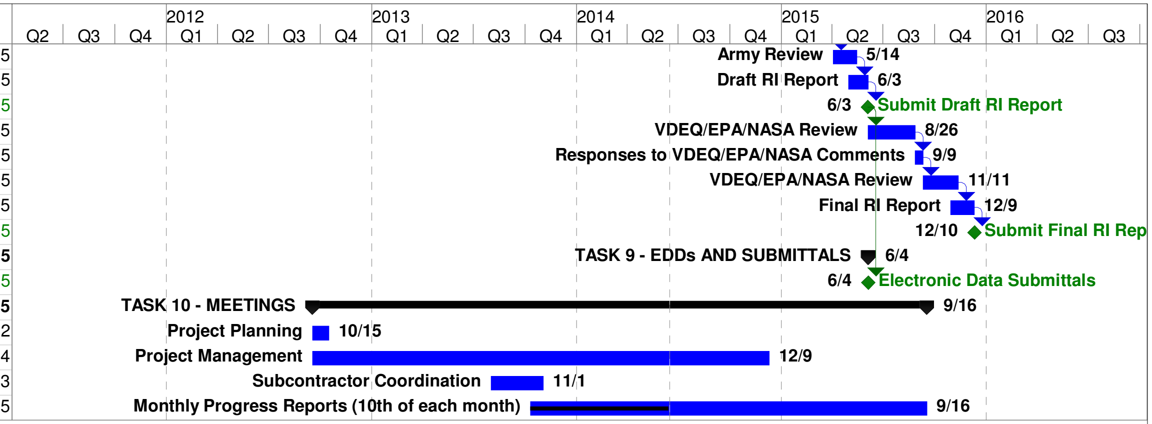
Task	Milestone	Project Summary	External Milestone
Split	Summary	External Tasks	

WESTON SOLUTIONS

Wallops Flight Facility Boat Basin RI, Wallops Island, VA

Date: 6/16/2014

ID	Task Name	Duration	Start	Finish
50	Army Review	30 days	4/3/2015	5/14/2015
51	Draft RI Report	25 days	4/30/2015	6/3/2015
52	Submit Draft RI Report	1 day	6/3/2015	6/3/2015
53	VDEQ/EPA/NASA Review	60 days	6/4/2015	8/26/2015
54	Responses to VDEQ/EPA/NASA Comments	10 days	8/27/2015	9/9/2015
55	VDEQ/EPA/NASA Review	45 days	9/10/2015	11/11/2015
56	Final RI Report	30 days	10/29/2015	12/9/2015
57	Submit Final RI Report	1 day	12/10/2015	12/10/2015
58	**TASK 9 - EDDs AND SUBMITTALS**	**1 day**	**6/4/2015**	**6/4/2015**
59	Electronic Data Submittals	1 day	6/4/2015	6/4/2015
60	**TASK 10 - MEETINGS**	**777 days**	**9/17/2012**	**9/16/2015**
61	Project Planning	21 days	9/17/2012	10/15/2012
62	Project Management	576 days	9/17/2012	12/9/2014
63	Subcontractor Coordination	66 days	8/1/2013	11/1/2013
64	Monthly Progress Reports (10th of each month)	508 days	10/10/2013	9/16/2015



Weston Calendar is in Business Days
Government Reviews are in Calendar Days

Task | Milestone | Project Summary | External Milestone
Split | Summary | External Tasks

APPENDIX G

DIVE OPERATIONS PLAN

DIVE OPERATIONS PLAN
for
BOAT BASIN MRS RI
WALLOPS FLIGHT FACILITY
WALLOPS ISLAND, VIRGINIA

REPARED FOR:

WESTON

PREPARED BY:

VRHabilis, LLC
11124 Kingston Pike, Suite 119-404
Knoxville, TN 37934

May 22, 2014

Boat Basin Wallops Flight Facility
Wallops Island, VA

Dated 22 May 2014

Submitted ______________________
Scott Alogna, Diving Program Manager

Reviewed ______________________
Elliott Adler, COO VRHabilis, LLC

Approved ______________________
Tom Rancich, CEO VRHabilis, LLC

Approval for Contract

Name: ______________________

Title: ______________________

Signature: ______________________

LIST OF ACRONYMS

ACDE	Association of Commercial Diving Educators
ADCI	Association of Diving Contractors International
AHA	Activity Hazard Analysis
ANSI	American National Standards Institute
BC	Buoyancy Compensator
CFR	Code of Federal Regulations
CO2	Carbon Dioxide
CPR	Cardiopulmonary Resuscitation
DAN	Divers Alert Network
DDC	District Diving Coordinator
DMO	Diving Medical Officer
DOP	Dive Operations Plan
EAC	Emergency Assistance Checklist
EGS	Emergency Gas Supply
EMI	Emergency Management Institute
EMP	Emergency Management Plan
EMS	Emergency Medical Service
EMT	Emergency Medical Technician
EOD	Explosive Ordnance Disposal
FPM	Feet Per Minute
FSW	Feet of Sea Water
FUDS	Formerly Used Defense Sites
GPS	Global Positioning System
HP	High Pressure
IAW	In Accordance With
KMB	Kirby Morgan
KTS	Knots
LP	Low Pressure
MEC	Munitions and Explosives of Concern
OSHA	Occupational Safety & Health Administration
PMS	Planned Maintenance Systems
PSI	Pound Per Square Inch
PSIG	Pound Per Square Inch Gauge
RCC	Rescue Coordination Center
RIFS	Remedial Investigation / Feasibility Study
ROV	Remotely Operated Vehicle
SAE	Society Automotive Engineers
SCUBA	Self Contained Underwater Breathing Apparatus
SPM	Safe Practices Manual
SSA	Surface Supplied Air
SSDS	Surface Supplied Diving Systems
USACE	United States Army Corp of Engineers
USCG	United States Coast Guard

USNDM	United States Navy Dive Manual
UXO	Unexploded Ordnance
VRH	VRHabilis, LLC

Dive Operations Plan

This dive operations plan is a general overview of the underwater diving and search tasks to be performed while conducting, a remedial investigation (RI) to reacquire, investigate and remediate underwater munitions and explosives of concern (MEC) at the Boat Basin MRS, Wallops Flight Facility, Wallops Island, Virginia. This plan describes the dive modes, equipment, and procedures.

****WARNING****

If for any reason the dive plan is altered in mission, depth, personnel, or equipment, the DDC will be contacted in order to review and accept the alteration prior to actual operation.

Date of dive plan submission:

22 May 2014

Name and contact information for Diving Supervisor preparing the dive plan:

Plan prepared by:

Scott Alogna
404 Cripple Creek Road
Cedar Park, TX 78613
Telephone: (512) 573-1525

Plan reviewed by:

Tom Rancich
47 Stonebridge
West Tisbury, MA 02575
Telephone: (508) 410-1306

Elliott Adler
11626 Loblolly Lane
Knoxville, TN 37934
Telephone: (865) 806-6689

Names and duties of on-site dive team members, including Diving Supervisor*:

*Note: Dive stations will be manned by no less than a Diving Supervisor, Diver, Standby Diver, and Tender. Scott Alogna is the primary Diving Supervisor for this operation; however, other qualified Diving Supervisors are listed below, who may relieve Mr. Alogna during brief periods.

NAME	DUTIES
Tom Rancich	Chief Executive Officer, Diving Supervisor, Diver, Standby Diver, Tender, UXO Technician
Elliott Adler	Chief Operations Officer, Diving Supervisor, Diver, Standby Diver, Tender, UXO Technician
Scott Alogna	Diving Program Manager, Diving Supervisor
Kim Heckhausen	Equipment Manager, Diving Supervisor
Max O'Meara	Diver, Standby Diver, Tender, UXO Technician
Alternate Lonnie Stephen Pratt	Diver, Standby Diver, Tender, UXO Technician
Alternate Nathan Marez	Diver, Standby Diver, Tender, UXO Technician

Note: All qualification packages will be made available on FTP site.

List of diving equipment to be used:

Surface Supplied Diving Helmets	KMB 27 and/or 47 and or EXO
Primary Air Supply	Tested Grade D Breathing Air and/or LP Compressor (Quincy 325 or equivalent)
Emergency Air Supply	Tested Grade D Breathing Air
30-gal Air Receiver w/Two Stage Filters (If diving LP Compressor Mode)	
Two Diver Air Control Console/Two Diver Radio	Divers Radio – Divers Supply Model TDR
Divers Bailout Bottle*	Minimum 30 cu ft
Wetsuit	Wetsuit, T-shirt, shorts as required
Chase boat (RHIB) (as required)	RHIB

*Divers Bailout Bottle - Surface Supplied Diver "Emergency Air Supply (EGS)" 30 SCF is provided by the bailout bottle secured to the Diver's harness. The bailout bottle is equipped with a 1st stage regulator to reduce the HP air to a safe working pressure. The bailout bottle whip is connected to the emergency air supply fitting on the helmet side-block assembly.

Type of diving platform to be used:

Dive Boat, capable of supporting surface supplied diving operations.

Detailed description of the mission—Identify how/if work will be divided into separate tasks or phases of work:

The overall object of this project is to conduct, a remedial investigation (RI) to reacquire, investigate and remediate underwater munitions and explosives of concern (MEC) at the Boa Basin MRS, Wallops Flight Facility, Wallops Island, Virginia.

The VRH Reacquisition Team will obtain RTK GPS coordinates and bathometric data from the Weston Solutions Geophysicist and, based on project priorities, will reacquire anomalies as directed by Weston.

The dive boat will be positioned adjacent to target coordinates (prepositioned buoys) and a single EOD or UXO-qualified Diver will conduct a one meter circle search of the target site to locate the anomaly. Once the object is located, qualified EOD/UXO Technicians will view the video feed and assist the Diver in confirming a positive identification of the item and its condition. Items of MPPEH will then be determined as MDAS or MDAH, acceptable or unacceptable to move. If unacceptable to move the item will be marked and left for underwater demolition. All items will be categorized and logged with a unique number for identification and future reference.

Date(s), time(s), duration, and location of operation:

Project, diving operation dates are expected to be 23 Jun 2014 to 25 June 2014.

Diving operations may be conducted seven days per week to allow for work schedule adjustments, as may be required due to inclement weather.
In general, it is anticipated that operations will be conducted Monday through Wednesday, approximately 10 hours per day and during daylight hours.

Night diving is not allowed.

The location of the diving operations will be Boat Basin, Wallops Flight Facility, Wallops Island, VA.

Diving mode used, including a description of the backup air supply, as required:

Surface Supplied Air, HP, K-bottles

Surface Supplied Divers' Primary and Secondary air supply is Tested Grade D Breathing Air supplied by a local vendor (typically, "AirGas"). The Diver's Air Console receives either high-pressure air directly from the bottle or LP air from two breathing air regulators placed on the bottles.

Nature of work to be performed by the Divers, including tools used and materials to be handled or installed:

Surface Supplied Diving to conduct bottom inspections.

Visual and magnetometer inspections of target site anomalies for MEC.

Shallow excavation by hand, hand tools or jet pump

Anticipated surface and underwater conditions, to include visibility, temperature, currents, etc. Thermal protection will be considered as appropriate:

Variable, dependent on season and weather conditions.

Ref; http://ocsdata.ncd.noaa.gov/BookletChart/12210_BookletChart.pdf

Surface conditions – No diving will be performed if the surface conditions do not permit the Diver to maintain depth control, effectively search and inspect, or safely handle explosives, or if the conditions are to hazardous for topside personnel to manage dive station.

Underwater conditions – Current, surf conditions and sea state are anticipated to have little affect on these dives. Depth will vary up to approximately 20 FSW and, as such, the underwater conditions will be slightly influenced by operating conditions. As stated above, no dives will be performed if conditions do not permit the Diver to maintain depth control or effectiveness.

Visibility – From 1-2 ft to 10-15 ft

Temperature – 65 degrees Fahrenheit or greater, water temperatures are not expected to be a factor as VRH has experience in this area in all water temperatures. Thermal protection for the Divers will be provided by wetsuit or clothing as required.

Currents – Observed currents are zero during slack tide and increase to a maximum of <0.5 kts during tidal shifts. Currents greater than approx. 1.5 kts may require postponement until conditions improve. Currents commonly are as detrimental to diving conditions as wave action, and it is incumbent on the Diver to report to the Diving Supervisor if he is having difficulty in maintaining position or depth control. Should either of these circumstances exist, the dive will be aborted and not resumed until the conditions subside.

Maximum single dive bottom time for the planned depth of dive for each Diver. Altitude adjustments to dive tables will be calculated for dives made at altitudes of 1,000 ft (304.8 m) or more above sea level:

Altitude correction for dives is not applicable to this project.

Maximum Depth:
<20 FSW

No Decompression Limit for:
<20 FSW Unlimited

Maximum single dive bottom times will be no greater than the No Decompression limit for that depth. Company policy is; no bottom times will exceed 5 hours.

Identification of topside assistance/support to the dive team (i.e., crane operator, lock operator, etc.):

One to two additional personnel may be assigned to the dive site to support operations, should the need arise.

Means of direct communication between the dive site and the project office, the Lockmaster/NSWC Project Manager, and the Contracting Officer (if applicable):

Direct communications between the dive site, project office, NSWC Project Manager, and other involved personnel will be by radio with cell phone backup at the numbers listed below:

USACE Baltimore District Diving Coordinator	John Houvener
USACE Baltimore District Project Team	TBD
VRHabilis, LLC Project Manager	Scott Alogna 512.573.1525
VRHabilis, LLC Diving Supervisor (Team Leader)	Scott Alogna 512.573.1525

Plans submitted for contractor operations shall also include the name of Contractor (and diving subcontractor, if applicable), contract number, and names and contact information for key personnel:

Diving Subcontractor:
VRHabilis, LLC
11124 Kingston Pike, Suite 119-404
Knoxville, TN 37934

President and CEO
Tom Rancich
47 Stonebridge
West Tisbury, MA 02575
Telephone: (508) 410-1306

Chief Operations Officer
Elliott Adler
11626 Loblolly Lane
Knoxville, TN 37934
Telephone: (865) 806-6689

Diving Program Manager
Scott Alogna
404 Cripple Creek Road
Cedar Park, TX 78613
Telephone: (512) 573-1525

Equipment Manager
Kim Heckhausen
1213 Galewood Road
Knoxville, TN 37919
Telephone: (508) 496-7749

Veteran-run work

DRAFT

Emergency Management Plan

for

Wallops Flight Facility

Wallops Island, Virginia

14 November 2012

Wallops Flight Facility

Wallops Island, Virginia

Dated 14 November 2012

Submitted

Scott Alogna, Diving Program Manager

Reviewed

Elliott Adler, COO VRHabilis, LLC

Approved

Tom Rancich, CEO VRHabilis, LLC

Approval for Contract

Name: ______________________

Title: ______________________

Signature: ______________________

EMERGENCY MANAGEMENT PLAN FOR WALLOPS FLIGHT FACILITY

This EMP is to be utilized in all diving operations, and maintained in each vehicle.

Nearest Operational Recompression Chamber: TT 5 and TT6

Hyperbaric Medical Unit
Inova Mount Vernon Hospital
Alexandria, Virginia
703.664.7218

Divers Alert Network (DAN):

(919) 684-8111

Nearest Operational Recompression Chamber: All Other Treatment Tables

University of Maryland, Shock Trauma Unit, Baltimore, MD

Emergency Transportation to Recompression Chamber:

Wallops Island Ambulance (911)
Life Flight (Air flight) 911

Nearest Hospital:

Everest Medical Center
1604 Market Street
Pocomoke City, Maryland
410.957.9488

Rescue Coordination Center:

USCG RCC Portsmouth
(757) 398-6390

EMERGENCY VICTIM TRANSPORTATION PLAN

911 Local Emergency Medical Services will be called in all instances.

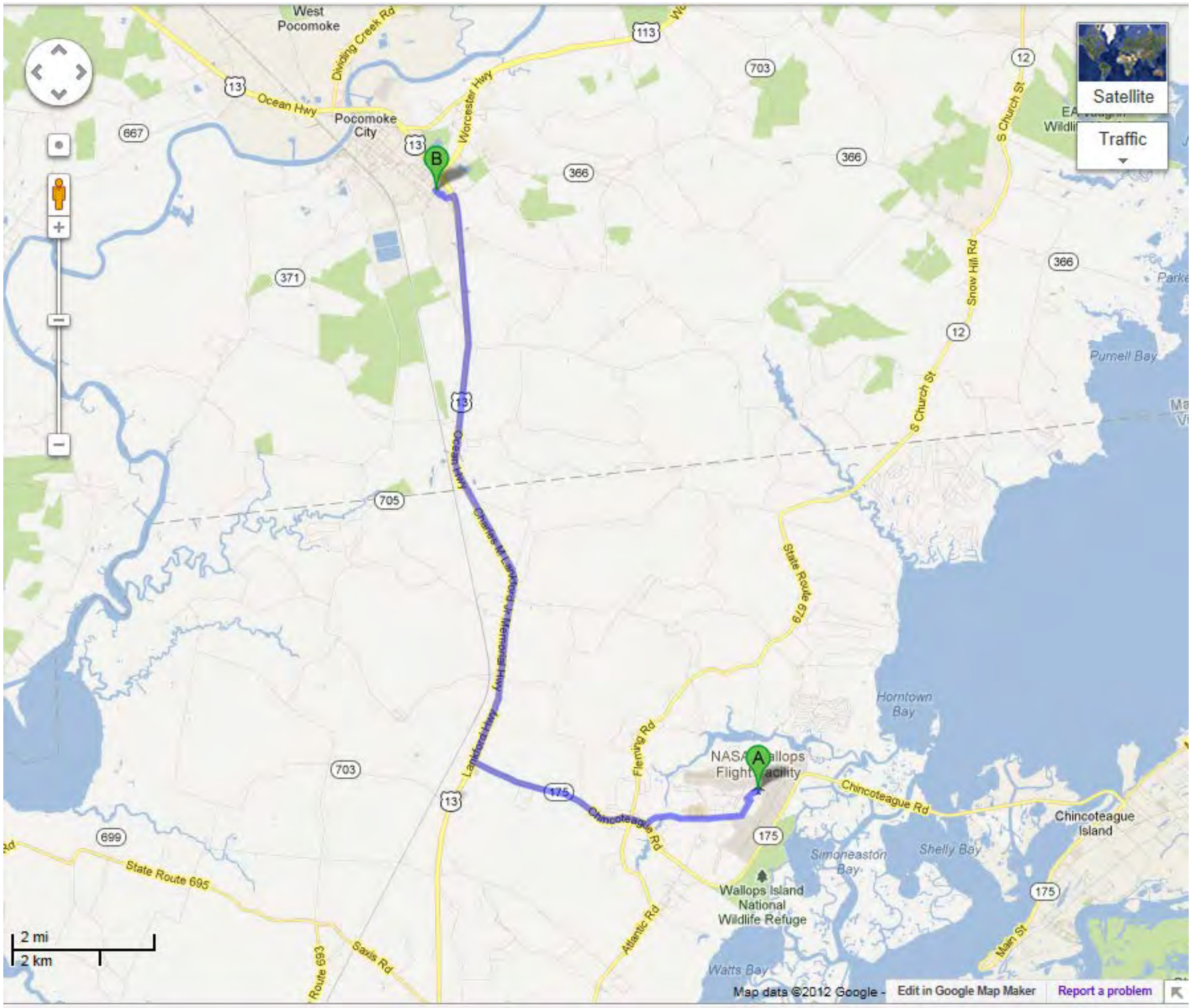
EMS will be the fastest means of getting a Diver into professional medical care for all emergencies.

- Transportation of the Diver will be determined based on the severity of the diving illness (airlift or ambulance) while in communication with EMS.
- The Diver will be transported by low-level flight to recompression chamber via "Life Flight" helicopter, or to shore and transported by ambulance to hospital or recompression chamber as required.
- Diver will be placed on oxygen by VRH qualified personnel while awaiting transportation.

Overall driving detail from Wallops Flight Facility to Everest Medical Center, Pocomoke City, MD

1.	Head north toward VA-175 E/Chincoteague Rd	413 ft
2.	Turn left onto VA-175 W/Chincoteague Rd	5.8 mi
3.	Turn right onto US-13 N/Charles M Lankford Jr Memorial Hwy/Lankford Hwy Continue to follow US-13 N Entering Maryland	8.3 mi
4.	Turn left onto MD-366 W/Stockton Rd Continue to follow MD-366 W	0.2 mi
5.	Turn right onto Market St Destination will be on the left	0.1 mi

Everest Medical Center 1604 Market Street Pocomoke City, MD 21851



Route to Everest Medical Center

COMMUNICATIONS PLAN TO ACTIVATE EMERGENCY SERVICES

The Diving Supervisor will assign a person to initiate emergency calls. Two fully charged cell phones will be on site anytime dive operations are underway. The site has been tested and verified for reliable cell phone continuity.

- 911 will be called in the case of emergencies.

Diver Rescue Procedures

Generic emergency/rescue procedures for multiple scenarios are found in the Safe Practices Manual.

Afloat; Wallops Flight Facility MRS
Upon the Diver exiting/removal from the water the Diving Supervisor will assess the Diver. If he determines that an emergency or problem exists, he will immediately call a halt to all work on the site and commence an appropriate response.

The Diving supervisor is overall responsible for the emergency/casualty response. The Diving Supervisor will:

- Determine the level of the urgency - critical, serious, or mild
- Assign a team member to call 911 and or the recompression chamber if required
- Assign a team member to apply first aid/CPR, including the immediate application of oxygen
- Rendezvous with ambulance/helicopter at recovery point

Standby Diver
If the Standby Diver was used in the recovery of the Diver, the Standby Diver will:

- Un-hat and de-rig with the assistance of the Tender
- Move out of the way of rescue operations
- Remain uninvolved until clear of the 10 minute observation period
- Report to the Diving supervisor upon completion of the observation period
- Complete tasks as assigned

If the Standby Diver was not used in the recovery of the Diver, the Standby Diver will:

- Un-hat and de-rig with the assistance of the Tender
- Report to the Diving supervisor
- Complete tasks as assigned

Tender
If the Standby Diver was used in the recovery of the Diver, the Tender will:

- Un-hat and de-rig the Standby Diver
- Move the Standby Diver out of the way of rescue operations
- Observe the Standby Diver for ten minutes, watching for any signs of dive illness
- Report to the Diving supervisor upon completion of the observation period
- Complete tasks as assigned

If the Standby Diver was not used in the recovery of the Diver, the Tender will:

- Un-hat and de-rig the Standby Diver
- Report to the Diving supervisor
- Complete tasks as assigned

Safe Practices Manual

Dive Operations

Wallops Flight Facility
Wallops Island, VA

Dated 14 November 2012

Submitted ______________________________
Scott Alogna, Diving Program Manager

Reviewed ______________________________
Elliott Adler, COO VRHabilis, LLC

Approved ______________________________
Tom Rancich, CEO VRHabilis, LLC

Approval for USACE Contract

Name: ______________________________

Title: ______________________________

Signature: ______________________________

Table of Contents

List of Appendices

1. PERSONNEL REQUIREMENTS

A. VRHabilis, LLC is a veteran-run company and, as such, only employs USN trained EOD, SCUBA, and Surface-Supplied Deep-Sea Divers who have completed one or more of the approved Diver curriculums.

B. All Divers are required to have a complete Hazmat/Diving physical examination every year certified by a license physician and cleared for diving operations.

C. All Divers will meet the Medical/Physical Requirements contained within Reference E.

D. All Divers will be fully trained and qualified for the position they are assigned. Divers shall be fully knowledgeable of prescribed safety procedures including the use of all equipment and tools necessary for the safe completion of assigned tasks.

E. All Divers will maintain a level of physical conditioning required to safely complete the assigned tasks.

F. All Divers will have at least four working dives with particular equipment, techniques, and similar decompression as prescribed by the scope of work.

G. Requalification Dives consist of:

  a. Two working/training dives per year in SCUBA

  b. Two working/training dives per year in Surface Supplied Apparatus

  c. Or four working/training dives per year in Surface Supplies Apparatus.

  Note: One dive will have been within the last six months of contract award.

H. All Divers will maintain a current certification in First Aid, CPR, and be knowledgeable in the use of Emergency Oxygen on the surface and in transport.

I. After any serious diving injury or illness, Divers shall be re-examined by a physician and approved for diving.

J. Any dive resulting in injury or illness of any type (regardless how minor) to any dive team member will be reported immediately to the Diving Supervisor. The Diving Supervisor and Project Manager will investigate and document the incident in accordance with Reference A.

K. All Divers shall maintain a Personal Log Book to detail hyperbaric exposures (Reference E).

L. The Diving Supervisor(s) for every diving evolution shall be designated in writing and a copy contained within this document for presentation to competent authority as necessary (Appendix L).

2. DRUG-FREE WORKPLACE POLICY

VRHabilis is committed to providing a safe work environment and to fostering the well-being and health of its employees. That commitment is jeopardized when any VRHabilis employee illegally uses drugs or alcohol on the job, comes to work with these substances present in his/her body, or possesses, distributes, or sells drugs in the workplace. Therefore, VRHabilis has established the following policy:

1. It is a violation of company policy for any employee to possess, sell, trade, or offer for sale illegal drugs or otherwise engage in the illegal use of drugs or alcohol on the job.
2. It is a violation of company policy for anyone to report to work under the influence of illegal drugs or alcohol – that is with illegal drugs or alcohol in his or her body.
3. It is a violation of the company policy for anyone to use prescription drugs illegally.
4. Violations of this policy are subject to disciplinary action up to and including termination.

It is the responsibility of the company's supervisors to counsel employees whenever they see changes in performance or behavior that suggests an employee is under the influence of alcohol or other drugs. Although it is not the supervisor's job to diagnose personal problems, the supervisor should encourage such employees to seek help and advise them about available resources for getting help.

The goal of this policy is to balance our respect for individuals with the need to maintain a safe, productive, and drug-free environment. The intent of this policy is to offer a helping hand to those who need it, while sending a clear message that illegal drug use and alcohol abuse are incompatible with employment at VRHabilis.

3. OPERATING PROCEDURES – GENERAL

VRHabilis will conduct all diving operations in accordance with OSHA 29 CFR 1910, Subpart T; ACOE Publication 385-1-1; and the USNDM.

Every dive station will have on-hand and available for each member of the dive team the following items: OSHA 29 CFR 1910, Subpart T, EM385-1-1 Section 30, Safe Practices Manual, Diving operations Plan, Emergency Management Plan, Activity Hazard Analysis's, Emergency Assistance Checklist, USN Diving Manual, ADCI Consensus Standards, Material Safety Data Sheets, Kirby Morgan helmet repair manual and at least one cell phone.

All diving operations will be conducted in accordance with Figure 6-16 (Reference D) Minimum Manning Levels for Air Diving and Reference B, Appendix O.

All diving operation s will be conducted utilizing the Air supply requirements contained in Table 4-2 and 4-3 (Reference D).

All dive stations will maintain a portable Oxygen breathing supply for use as Emergency Surface Oxygen capable of delivering 30 minutes minimum or until emergency medical assistance can be administered.

All Divers will have a Diver carried reserve breathing gas supply of sufficient duration to terminate the dive and recover the Diver.

Standby Diver, At least one member of every dive team shall be designated the Standby Diver and should be suitably prepared to enter the water, and when directed by the Diving Supervisor. Prior to commencement of the operation, the Standby Diver's equipment shall be fully verified as functioning correctly and thereafter maintained in that condition until completion of the dive. Should the Standby Diver be required to enter the water, a surface check shall be completed to ensure proper breathing gas supply, bailout function, and effective communications before the Diver leaves the surface.

All dive stations will maintain a complete First Aid Kit American Red Cross Standard First Aid Handbook (or equivalent) and Bag type Resuscitator, a stokes litter or backboard, with flotation capability.

Code Alpha and Civilian Dive Flag signaling diving operations underway will be displayed throughout every diving evolution. Constructed of rigid Material 1 meter in height visible from all directions and illuminated at night.

All efforts to dive during non-sonar windows shall be taken. When necessary, safe distances from sonar will be maintained in accordance with Reference D Appendix 1A.

All personnel employed by VRH or engaged in diving activities will wear appropriate personnel protective equipment as required by Reference A and Appendix B.

When performing diving operations at altitudes of 1000 ft (304.8 m) or more of elevation above sea level, Dive Supervisors shall use appropriate high altitude decompression tables that compensate for the increased elevation.

Divers will wait at least 12 hours before flying after any dive. This interval will be extended to 24 hours following multiple days of repetitive dives.

VRHabilis Project Managers and Diving Supervisors will use the following Safety Procedures and Equipment Procedures Checklists as minimum guidelines for every diving evolution as appropriate (Appendix A).

4. SAFETY PROCEDURES CHECKLIST

Safe Practices/Operations Manual

- Operating procedures
- Team member assignments and responsibilities
- Equipment procedures and checklist
- Emergency procedures
- Specific individual procedures for tools, equipment, and associated systems
- Available at the dive site to all team members
- Copy to the Person in Charge of the vessel or facility

Emergency Aid

- Decompression chamber (off-site)
- Nearest hospital/medical treatment facility
- Air or ground emergency transportation
- On-call physician
- U.S. Coast Guard, other National Rescue Coordination Centers, or other responding authority
- Emergency rescue source other than U.S. Coast Guard
- Two-way communications available on site and where practical, tested to emergency response link

First Aid

- First aid kit
- First aid manual
- Bag-type manual resuscitator
- Emergency Surface Oxygen Supply
- Floatable Backboard/Stretcher

Planning and Assessment

- Job Safety Analysis
- Site Assessment
- Evaluate environmental pollution containment and response readiness where applicable
- Diving model/equipment system(s)

- Means of water entry and exit
- Breathing gas supplies including reserves (set up and tested)
- Thermal protection (all dive team members)
- Dive team assignments/briefing and fitness to dive
- ROV team assignments/briefing and readiness to conduct operations
- Inert gas status of dive team members (repet dive designations)
- Decompression and/or treatment procedures (including altitude)
- Communications procedures and methods for all personnel involved in the operation
- Emergency procedures
- Dive station setup
- Any necessary modifications to the Safe Practices/Operations Manual
- Written designation of the Diving or ROV Supervisor given to the Person in Charge of the vessel or facility
- Report on the nature and planned times of the intended operation, and the involvement of the vessel or facility's equipment and personnel to the Person in Charge

Hazards to Diving Operations

- Surface vessel, vehicular traffic, or aircraft operations
- Overhead crane/gantry operations
- Pedestrian traffic
- Displayed Diver signals
- Vessel and dive equipment weather limitations

Underwater Hazardous Conditions

- Umbilical fouling and/or entrapment
- Differential pressures
- Lockout/Tagout
- Contaminated or toxic liquid
- Limited access/confined space/penetration
- Use of explosives or seismic activities
- Underwater sonar
- Cathodic protection
- Marine life
- High currents/severe tidal conditions
- Foreign waterborne materials, such as logs, ice floe, etc.

Record Keeping

- Project description/accomplishment records completion
- Diving and treatment records, accident reports
- Individual dive and ROV logbook entries appropriate to the intended operation

5. OPERATING PROCEDURES AND CHECKLISTS – SCUBA

Prior to the commencement of any diving operation, a Job Safety Analysis/AHA and EAC shall be completed and all members of the dive team together with other involved personnel shall be present at the pre-dive briefing.

All diving and support personnel shall adhere to the Minimum Rest policy contained in Reference E, as directed by the Diving Supervisor.

The following are minimum requirements for SCUBA diving operations.

- The planned time of the diving operation shall not exceed either the No-Decompression limits or the air supply duration of the cylinders excluding the reserve supply. Cylinder pressures shall be determined immediately prior to each dive and recorded by the Diving Supervisor.
- Audio communications are not required for a Diver who is accompanied by another Diver or who is tended on the surface with a safety line using line pull signals.
- SCUBA Divers will be line-tended from the surface unless accompanied by another Diver in the water in continuous visual contact during the dive. Loss of visual contact is cause for termination of the dive.
- Dive depths shall not exceed 100 FSW.
- SCUBA dives are not permitted in enclosed or physically confining spaces.
- SCUBA dives will not be conducted in currents exceeding (1) knot.
- Every Diver shall have a Diver carried reserve breathing gas supply.
- During all SCUBA dives, a Standby Diver will be available while the Diver is in the water.
- Each tethered SCUBA Diver shall wear a safety harness with a positive buckling device, attachment point for the safety line, and a lifting point to distribute the pull force of the line over the Diver's body while maintaining the body in a heads-up vertical position when unconscious or inert.
- Each SCUBA Diver shall be equipped with a bailout bottle with a minimum of 30 ft3 (0.85 m3) of air and separate regulator. An octopus is not considered an alternate air source.
- SCUBA diving cylinders shall be visually inspected internally and externally for corrosion and pitting annually and hydrostatically tested every 5 years.

Diving ladders and stages shall:

- Be capable of supporting the weight of two Divers plus their gear.
- Be made of corrosion-resistant material or be maintained free of corrosion.
- Be suitable for the purpose intended.
- Ladders must extend a minimum of three feet below surface where installed.
- Be provided with a safety chain and internal handholds for dive safety during launch and recovery (Stages).
- Make provisions for mounting of breathing gas cylinder and regulator for emergency breathing at all depths of intended operation (Stages).

6. PREDIVE PROCEDURES

Prior to any dive, all Divers must carefully inspect their own equipment for signs of deterioration, damage, or corrosion. The equipment must be tested for proper operation.

Each Diver will inspect his own mandatory equipment, for every dive.

Air Cylinders

- Inspect air cylinder exterior and valves for rust, cracks, dents, and any evidence of weakness.
- Inspect the O-ring.
- Verify the reserve mechanism is closed (lever in up position) signifying a filled cylinder ready for use.

Gauge the cylinders according to the following procedure:

1. Attach pressure gauge to O-ring seal face of the on/off valve.
2. Close gauge bleed valve and open air reserve mechanism (lever in down position). Slowly open the cylinder on/off valve, keeping a cloth over the face of the gauge.
3. Read pressure gauge. The cylinder must not be used if the pressure is not sufficient to complete the planned dive.
4. Close the cylinder on/off valve and open the gauge bleed valve.
5. When the gauge reads zero, remove the gauge from the cylinder.
6. Close the air reserve mechanism (lever in up position).
7. If the pressure in cylinders is 50 psi or greater over rating, open the cylinder on/off valve to bleed off excess and regauge the cylinder.

Harness Straps and Backpack

- Check for signs of rot and excessive wear.
- Adjust straps for individual use and test quick-release mechanisms.
- Check backpack for cracks and other unsafe conditions.

Breathing Hoses

- Check the hoses for cracks and punctures.

- Test the connections of each hose at the regulator and mouthpiece assembly by tugging on the hose. Check the clamps for corrosion and damage; replace as necessary and in accordance with PMS procedures.

Regulator and Pressure Gauge

1. Ensure over-bottom pressure of first stage regulator has been set to a minimum of 135 psig or in accordance with manufacturer's recommendations within the past year.
2. Attach regulator to the cylinder manifold, ensuring that the O-ring is properly seated.
3. Crack the cylinder valve open and wait until the hoses and gauges have equalized.
4. Next open the cylinder valve completely and then close (back off) one-quarter turn.
5. Check for any leaks in the regulator by listening for the sound of escaping air. If a leak is suspected, determine the exact location by submerging the valve assembly and the regulator in a tank of water and watch for escaping bubbles. Frequently the problem can be traced to an improperly seated regulator and is corrected by closing the valve, bleeding the regulator, detaching, and reseating. If the leak is at the O-ring and reseating does not solve the problem, replace the O-ring and check again for leaks.

Life Preserver/Buoyancy Compensator (BC)

- Orally inflate preserver to check for leaks and then squeeze out all air. The remaining gas should be removed after entry into the water by rolling onto the back and depressing the oral inflation tube just above the surface. Never suck the air out, as it may contain excessive carbon dioxide.
- Inspect the carbon dioxide cartridges to ensure they have not been used (seals intact) and are the proper size for the vest being used and for the depth of dive.
- The cartridges shall be weighed in accordance with the manufacturer's recommendations.
- The firing pin should not show wear and should move freely.

- The firing lanyards and life preserver straps must be free of any signs of deterioration.
- When the life preserver inspection is completed, place it where it will not be damaged. Life preservers should never be used as a buffer, cradle, or cushion for other gear.

Face Mask

- Check the seal of the mask and the condition of the head strap.
- Check for cracks in the skirt and faceplate.

Swim Fins

- Check straps for signs of cracking.
- Inspect blades for signs of cracking.

Dive Knife

- Test the edge of the knife for sharpness.
- Ensure the knife is fastened securely in the scabbard.
- Verify that the knife can be removed from the scabbard without difficulty, but will not fall out.

Snorkel

- Inspect the snorkel for obstructions.
- Check the condition of the mouthpiece.

Weight Belt

- Check the condition of the weight belt.
- Make sure that the proper number of weights are secure and in place.
- Verify that the quick-release buckle is functioning properly.

Submersible Wrist Watch

- Ensure wristwatch is wound and set to the correct time.
- Inspect the pins and strap of the watch for wear.

Depth Gauge and Compass

- Inspect pins and straps.

- If possible, check compass with another compass.
- Make comparative checks on depth gauges to ensure depth gauges read zero fsw on the surface.

Miscellaneous Equipment

- Inspect any other equipment that will be used on the dive as well as any spare equipment that may be needed during the dive including spare regulators, cylinders, and gauges.
- Check all protective clothing, lines, tools, flares, and other optional gear.

Diver Preparation and Brief

When the Divers have completed inspecting and testing their equipment, they shall report to the Diving Supervisor. The Divers shall be given a predive briefing of the dive plan. This briefing is critical to the success and safety of any diving operation and shall be concerned with only the dive about to begin. All personnel directly involved in the dive should be included in the briefing. Minimum items to be covered are:

- Clear, brief statement of the mission/dive objectives
- Time and depth limits for the dive
- Dive station assignments and responsibilities
- Review of all tasks required to complete the mission
- Review of diving phases from water entry to post dive
- Anticipated conditions expected throughout the dive both underwater and topside
- Review of Job Safety Analysis/AHA
- Any changes to operating procedures due to specific underwater operations
- Specific signals to be used
- Question the health of each Diver instruct them to report any physical conditions, problems or adverse physiological effects that may render the Diver unfit to dive
- Conditions that will cause the termination of the dive
- Review the Emergency Assistance Checklist
- Review all Emergency Procedures

When the Diving Supervisor determines all requirements for the dive have been met, the Divers may dress for the dive.

Donning Gear

Although SCUBA Divers should be able to put on all gear themselves, the assistance of a Tender is encouraged. Dressing sequence is important as the weight belt must be outside of all backpack harness straps and other equipment in order to facilitate its quick release in the event of an emergency. The following is the recommended dressing sequence to be observed:

- Protective clothing; ensure adequate protection is provided with a wet suit.
- Booties and hood
- Dive knife
- Life preserver, with inflation tubes in front and the actuating lanyards exposed and accessible
- SCUBA—most easily donned with the Tender holding the cylinders in position while the Diver fastens and adjusts the harness. The SCUBA should be worn centered on the Diver's back as high up as possible but not high enough to interfere with head movement. All quick-release buckles must be positioned so that they can be reached by either hand. At this time, the cylinder on/off valve should be opened fully and then backed off one-quarter turn.
- Buoyancy compensator whip is connected to the buoyancy compensator
- Accessory equipment (diving wrist watch, depth gauge, snorkel)
- Weight belt
- Gloves
- Swim fins
- Face mask or full face mask

VRH SCUBA Predive Checklist (Appendix D)

The Divers must report to the Diving Supervisor for a final inspection. During this final predive inspection, the Diving Supervisor must:

1. Ensure that the Divers are physically and mentally ready to enter the water.
2. Verify that all Divers have all minimum required equipment (SCUBA, facemask, life preserver or buoyancy compensator, weight belt, dive

knife, scabbard, swim fins, watch and depth gauge). When diving SCUBA and a buddy line is used, only one depth gauge and one watch per dive team are required.

3. Verify that the cylinders have been gauged and that the available volume of air is sufficient for the planned duration of the dive.
4. Ensure that all quick-release buckles and fastenings can be reached by either hand and are properly rigged for quick release.
5. Verify that the weight belt is outside of all other belts, straps, and equipment and will not become pinched under the bottom edge of the cylinders.
6. Verify that the life preserver or buoyancy compensator is not constrained and is free to expand, and that all air has been evacuated.
7. Check position of the knife to ensure that it will remain with the Diver no matter what equipment is left behind.
8. Ensure that the cylinder valve is open fully and backed off one-quarter to one-half turn.
9. Ensure that the hose supplying air passes over the Diver’s right shoulder and the exhaust hose on the double-hose unit passes over the left shoulder. Double-hose regulators are attached so that the exhaust ports face up when the tank is standing upright.
10. With mouthpiece or full-face mask in place, breathe in and out for several breaths, ensuring that the demand regulator and check valves are working correctly.
11. With a single-hose regulator, depress and release the purge button at the mouthpiece and listen for any sound of leaking air. Breathe in and out several times ensuring valves are working correctly.
12. Give the breathing hoses and mouthpiece a final check; ensure that none of the connections have been pulled open during the process of dressing.
13. Check that the air reserve mechanism lever is up (closed position).
14. Conduct a brief final review of the dive plan.
15. Verify that dive signals are displayed and personnel and equipment are ready to signal other vessels in the event of an emergency.

7. WATER ENTRY AND DESCENT

Divers enter the water via the safest method determined previously. Once Divers are in the water they will perform pre-descent surface checks on each other, themselves or with the Tender if only single Diver. These checks include the following:

- Make a breathing check of the SCUBA. Breathing should be easy with no resistance and no evidence of water leaks.
- Visually check dive partner's equipment for leaks, especially at all connection points. Ensure manifold is underwater.
- Check partner for loose or entangled straps; ensure quick releases are properly rigged.
- Check dive mask face seal; ensure the mask can be cleared through normal methods.
- Check buoyancy. Neutral to slightly negative is preferred. Excessively heavy should be investigated and corrected.
- If wearing a dry suit, check for leaks. Adjust buoyancy as needed.

Orient the Diver(s) with descent line, compass, or other fixed point as necessary.

When satisfied that all equipment checks out properly, the Divers report their ready to the Diving Supervisor. The Diving Supervisor directs the Divers to zero their watches and gives a signal to leave the surface.

Divers may swim down or they may use a descending line to pull themselves down. The rate of descent will be governed by the ease with which the Diver(s) are able to equalize their ears and sinuses but should never exceed 75 feet per minute (fpm).

If either Diver has trouble in clearing, both Divers must stop and ascend until the situation is resolved. If after several attempts the problem persists, the dive shall be aborted and both Divers will return to the surface.

Upon reaching the bottom or operating depth, the Divers must orient themselves to their surroundings, verify the site, and check underwater conditions. If conditions appear to be radically different from those anticipated and seem to pose a hazard, the dive should be aborted and the conditions reported to the Diving Supervisor.

The dive will be aborted if the observed conditions call for any major change in the dive plan. Divers will surface and discuss the situation with the Diving Supervisor.

If for any reason the dive plan is altered in mission, depth, personnel, or equipment, the DDC will be contacted in order to review and accept the alteration prior to actual operation.

8. UNDERWATER PROCEDURES

In SCUBA diving, bottom time is at even more of a premium than surface supplied diving because of the limited supply of air.

Divers must maintain situational awareness, and keep constant visual check of the condition of the diving partner, their bottom time and maximum depth, air pressure, and conditions on the bottom.

Divers need to maintain a controlled pace of work and breathing rate. The rate of work should be paced to maintain a slow rhythm of steady breathing.

Skip-breathing leads to hypercapnia and is prohibited.

Common methods of Diver communications are through-water communication systems, hand signals, slate boards, and line-pull signals.

Termination of Dive

The working interval of a dive shall be terminated when:

- Directed by the Diving Supervisor or Project Manager.
- The Diver requests termination.
- The Diver fails to respond correctly to communications or signals from a dive team member.
- Communications are lost and cannot be quickly reestablished between the Divers, the Tender/Diver, and the Diving Supervisor.
- The Diver goes on reserve air supply.

Ascent

When it is time to return to the surface, either Diver may signal the end of the dive. When the signal has been acknowledged, the Divers shall ascend to the surface together at a rate not to exceed 30 feet per minute.

For a normal ascent, the Divers will breathe steadily and naturally. Divers must never hold their breath during ascent, because of the danger of an air embolism. While ascending, Divers must keep an arm extended overhead to watch for obstructions and should spiral slowly while rising to obtain a full 360-degree scan of the water column.

9. POSTDIVE PROCEDURES

Surfacing and Leaving the Water

When approaching the surface, Divers must not come up under the support craft or any other obstruction. They should listen for the sound of propellers and delay surfacing until satisfied that there is no obstruction. On the surface, the Diver should scan immediately in all directions and check the location of the support craft, other Divers, and any approaching surface traffic. If they are not seen by the support personnel they should attempt to signal with hand signals, whistle, or flare.

As the Divers break the surface, the Tender and other personnel must keep them in sight constantly and be alert for any signs of trouble. While one Diver is being recovered, attention must not be diverted from the Diver remaining in the water. The dive is completed when all Divers are safely aboard.

Getting into a boat will be easier if the Divers remove the weight belts and SCUBA and then hand them to the Tenders. If the boat has a ladder, swim fins should also be removed. Without a ladder, the swim fins will help to give the Diver an extra push to get aboard. A small boat may be boarded over the side or over the stern depending on the type of craft and the surface conditions.

Divers will be assisted in undressing and monitored closely for the10 minute clean time. During this time, the Diving Supervisor will question the Divers to ascertain their condition, maximum depth and bottom time, and any problems during the dive.

The Diving Supervisor will ensure all the required information is recorded in the diving log.

The Diving Supervisor should debrief each returning Diver while the experience of the dive is still fresh. The Diving Supervisor should determine if the assigned tasks were completed, if any problems were encountered, if any changes to the overall dive plan are indicated and if the Divers have any suggestions for the next team.

When satisfied with their physical condition, the Divers' first responsibility after the dive is to check their equipment for damage and get it properly cleaned and stowed. Each Diver is responsible for the immediate post-dive maintenance and proper disposition of the equipment used during the dive.

10. ASSIGNMENTS AND RESPONSIBILITIES OF DIVE TEAM MEMBERS – SCUBA

All diving operations will be conducted in accordance with Figure 6-16 (Reference D) Minimum Manning Levels for Air Diving.

Project Manager

The Project Manager will ensure the required documents are on hand and up to date, and where required have been approved.

The Project Manager will be available to the Diving Supervisor to answer questions and liaison with and communicate progress to competent authorities.

The Project Manager will conduct random visual inspections of the dive side and proceedings.

Diving Program Manager

The Diving Program Manager will maintain all required publications for diving and ensure their accuracy. He shall be responsible to the COO, for updates, or changes to the diving program, and notify the Project Manager for any updates affecting their projects.

The Diving Program Manager will be responsible for the training and qualifications of each dive team member and the certification of Diving Supervisors.

The Diving Program Manager will be responsible for conducting refresher training courses and Diver requalification/training dives.

The Diving Program Manager shall conduct complete inspections of all equipment, personnel, and documentation prior to commencement of diving operations. In his absence, the assigned Diving Supervisor shall perform the inspections.

The Diving Program Manager will conduct a detailed investigation and document his findings for presentation to the COO and Project Manager for any mishap, near mishap or diving injury that occurs during the course of a dive, ensuring all details are recorded as required in Ref. A.

Diving Supervisor

The Diving Supervisor will be designated in writing and in charge of the actual diving operation for a particular dive or series of dives. Diving operations shall not be conducted without the presence of the Diving Supervisor. The Diving Supervisor has the authority and responsibility to discontinue diving operations in the event of unsafe diving conditions.

The Diving Supervisor shall be included in preparing the operational plans. The Diving Supervisor shall consider contingencies, determine equipment requirements, recommend diving assignments, and establish back-up requirements for the operation. The Diving Supervisor shall be familiar with all Divers on the team and shall evaluate the qualifications and physical fitness of the Divers selected for each particular job. The Diving Supervisor will inspect all equipment and conduct pre-dive briefings of personnel prior to every dive.

While the operation is underway, the Diving Supervisor monitors progress; debriefs Divers; updates instructions to subsequent Divers; and other personnel as necessary are advised of progress and of any changes to the original plan.

The Diving Supervisor will terminate the dive and report any unsafe conditions, actions, or events that may occur to the VRH Project Manager and Diving Program Manager as soon as possible for resolution and documentation.

When the mission has been completed, the Diving Supervisor gathers appropriate data, analyzes the results of the mission, prepares reports to be submitted to higher authority, and ensures that required records are completed. These records may range from equipment logs to individual diving records.

Diver(s)

While working, the Diver shall keep topside personnel informed of conditions on the bottom, progress of the task, and of any developing problems that may indicate the need for changes to the plan or a call for assistance from other Divers. To ensure safe conduct of the dive, the Diver shall always obey a signal from the surface and repeat all commands when using vice communications. The Diver is responsible for the diving gear worn and shall ensure that it is complete and in good repair.

When using externally powered tools with SCUBA, the Diver must have voice communications with the Diving Supervisor.

Buddy Diver

A buddy Diver is the Diver's partner for a SCUBA operation. The buddy Divers are jointly responsible for the assigned mission. Each Diver keeps track of depth and time during the dive. Each Diver shall watch out for the safety and well-being of his buddy and shall be alert for symptoms of nitrogen narcosis, decompression sickness, and carbon dioxide build-up. A Diver shall keep his buddy an emergency. If visibility is limited, a buddy line shall be used to maintain contact and communication. If SCUBA Divers get separated and cannot locate each other, both Divers shall surface immediately.

Dive partners operating in pairs are responsible for both the assigned task and each other's safety. The basic rules for buddy diving are:

- Always maintain contact with the dive partner. In good visibility, keep the partner in sight. In poor visibility, use a buddy line.
- Know the meaning of all hand and line-pull signals.
- If a signal is given, it must be acknowledged immediately. Failure of a dive partner to respond to a signal must be considered an emergency.
- Monitor the actions and apparent condition of the dive partner. Know the symptoms of diving ailments. If at any time the dive partner appears to be in distress or is acting in an abnormal manner, determine the cause immediately and take appropriate action.
- Never leave a partner unless the partner has become trapped or entangled and cannot be freed without additional assistance. If surface assistance must be sought, mark the location of the distressed Diver with a line and float or other locating device. Do not leave a partner if voice communications or line-pull signals are being used; contact the surface and await assistance or instructions.
- Establish a lost-Diver plan for any dive. If partner contact is broken, follow the plan.
- If one member of a dive team aborts a dive, for whatever reason, the other member also aborts and both must surface.
- Know the proper method of buddy breathing.

Standby Diver

The Standby Diver with a Tender is required for all diving operations, the Standby Diver is a fully qualified Diver, assigned to provide emergency assistance, and is ready to enter the water immediately.

The Standby SCUBA Diver shall don all equipment and be checked by the Diving Supervisor.

The Standby Diver may then remove the mask and fins and have them ready to don immediately for quick deployment. For safety reasons at the discretion of the Diving Supervisor, the Standby Diver may remove the tank.

The Standby Diver receives the same briefings and instructions as the working Diver, monitors the progress of the dive, and is fully prepared to respond if called upon for assistance. The SCUBA Standby Diver shall be equipped with an octopus rig.

Diver Tender

The Tender works closely with the Diver on the bottom. At the start of a dive, the Tender checks the Diver's equipment and topside air supply for proper operation and dresses the Diver. Once the Diver is in the water the Tender constantly tends the lines to eliminate excess slack or tension. The Tender exchanges line-pull signals with the Diver, keeps the Diving Supervisor informed of the line-pull signals and amount of diving hose/tending line over the side, and remains alert for the any signs of an emergency.

Tending with a Surface or Buddy Line

When a Diver is being tended by a line from the surface or a buddy line, several basic considerations apply.

- Lines should be kept free of slack.
- Line signals must be given in accordance with the procedures given in Table 8-3.
- Any signals via the line must be acknowledged immediately by returning the same signal.
- The Tender should signal the Diver with a single pull every 2 or 3 minutes to determine that the Diver is all right. A return signal of one pull indicates that the Diver is all right.

- If the Diver fails to respond to line-pull signals after several attempts, the Standby Diver must investigate immediately.
- The Diver must be particularly aware of the possibilities for the line becoming snagged or entangled.
- If a surface line is not being used, the Tender must keep track of the general location of the Divers by observing the bubble tracks or the float or locating device (such as a pinger or strobe light). When tending a single Diver, the Tender shall continually monitor the Diver float for Diver location and line pull signals.

Support Personnel

Other support personnel may include almost any member of the company and when assigned to duties that support diving operations will be properly indoctrinated and trained for the position assigned.

Small-Boat operators shall understand general diving procedures, know the meanings of signals, and be aware of the mission objectives.

Other personnel, such as winch operators or deck crew, might interact with the operation directly, but only when under the control of the Diving Supervisor.

11. EMERGENCY PROCEDURES – SCUBA

Equipment Failure

With well-maintained SCUBA equipment that is thoroughly inspected and tested before each dive, operational failure is rarely a problem. When a failure does occur, the correct procedures will depend upon the type of failure. As with most emergencies, the training and experience of the Diver, and buddy Diver will be the most important factor in resolving the situation safely.

Loss of Gas Supply

Usually, when a SCUBA Diver loses breathing gas it should be increasingly obvious.

- Divers noticing resistance to breathing will check their pressure gauge and go on reserve as necessary.
- Notify their buddy and terminate the dive.
- Upon arrival on the surface Divers will notify the Diving Supervisor immediately of having gone on reserve air, their maximum depth, and bottom time.

Surfacing Divers may be suffering from hypoxia, hypercapnia, missed decompression, or a combination of the three, and should be diagnosed and treated accordingly.

Emergency Free-Ascent Procedures

If a Diver is suddenly without air or if the SCUBA is entangled and the dive partner cannot be reached quickly, a free ascent must be made. Guidelines for a free ascent are:

1. Drop any tools or objects being carried by hand.
2. Abandon the weight belt.
3. If the SCUBA has become entangled and must be abandoned, actuate the quick-release buckles on the waist, chest, shoulder, and crotch straps. Slip an arm out of one shoulder strap and roll the SCUBA off the other arm.
4. If the reason for the emergency ascent is a loss of air, drop all tools and the weight belt and actuate the life preserver to surface immediately. Do not drop the SCUBA unless it is absolutely necessary.
5. If a Diver is incapacitated or unconscious and the dive partner anticipates difficulty in trying to swim the injured Diver to the surface, the partner should activate the life preserver or inflate the buoyancy compensator.

The weight belt may have to be released also. However, the partner should not lose direct contact with the Diver.

6. Exhale continuously during ascent to let the expanding air in the lungs escape freely.

Fouling and Entrapment

1. Upon receiving information of a trapped Diver, alert the dive team and Standby Diver.
2. Determine Divers remaining air supply provide new apparatus or air source if required.
3. Determine what tools, equipment and personnel are required.
4. Deploy Standby Diver if required.
5. If the situation cannot be readily, resolved call for assistance.
6. Alert medical authorities and recompression chamber.

Once the Diver has been freed and returns to the surface, the Diver shall be examined and treated, bearing in mind the following considerations:

- The Diver will probably be overtired and emotionally exhausted.
- The Diver may be suffering from or approaching hypothermia.
- The Diver may have a physical injury.
- The SCUBA Diver may be suffering from asphyxia. If a free ascent has been made, gas embolism may have developed.
- Significant decompression time may have been missed.

Loss of Communication

If audio communications are lost with SCUBA, the system may have failed or the Diver could be in trouble. If communications are lost:

- Use line-pull signals at once. Depth, current, bottom or work site conditions may interfere.
- Check the rising bubbles of air. A cessation or marked decrease of bubbles could be a sign of trouble.
- Listen for sounds from the diving helmet. If no sound is heard, the circuit is probably out of order. If the flow of bubbles seems normal, the Diver may be all right.

- If sounds are heard and the Diver does not respond to signals, assume the Diver is in trouble.
- Have Divers already on the bottom investigate, or send down the Standby Diver to do so.

Lost Diver

- In planning for an operation using SCUBA, lost Diver procedures shall be included in the dive plan and dive brief. Losing contact with a SCUBA Diver can be the first sign of a serious problem.
- If contact between Divers is lost, each Diver shall surface. If the Diver is not located quickly, or not found at the surface, the Diving Supervisor shall initiate search procedures immediately.
- When notified of a lost Diver, a search shall be conducted by a tended Diver in the area where the lost Diver was last seen.
- At the same time, medical personnel should be notified and the recompression chamber team alerted.
- A lost Diver is often disoriented and confused and may have left the operating area. Nitrogen narcosis or other complications involving the breathing mixture, which can result in confusion, dizziness, anxiety, or panic, are common in recovered lost Divers. The Diver may harm the rescuers unknowingly. When the Diver is located, the rescuer should approach with caution to prevent being harmed and briefly analyze the stricken Diver’s condition.

If the Diver is found unconscious, attempts should be made to resupply breathing gas and restore consciousness. If this cannot be accomplished, the Diver shall be brought to the surface immediately. Gas Embolism may occur during ascent and significant decompression may be missed and immediate recompression may be required. If it is possible to provide the Diver with an air supply such as a single-hose demand SCUBA, the rescuer should do so during the ascent.

Injured Diver

1. A Diver surfacing with an injury shall be recovered as rapidly as possible and assessed for treatment.

2. Administer First Aid/CPR as required, and ascertain depth and bottom time profile to determine if decompression was missed.
3. Recover any other Divers and terminate the dive.
4. Once all Divers have been recovered, conduct neurological exam if warranted.

Diver Blow Up/Exceeded Ascent Rate to Surface

The following rules apply for correcting variations in rate of ascent. The normal rate of ascent is 30 fsw/min. Minor variations in the rate of travel between 20 and 40 fsw/min are acceptable and do not require correction.

If a Diver makes an uncontrolled ascent to the surface at a rate greater than 30 fsw/minute, but the dive itself is within no-decompression limits, the Diver should be observed on the surface for one hour to ensure that symptoms of decompression sickness or arterial gas embolism do not develop. Recompression is not necessary unless symptoms develop. If a Diver appears on the surface unexpectedly, quickly determine if the Diver is okay, depth and bottom time and the cause for surfacing. Terminate the dive and recover all Divers. Monitor all Divers thorough clean time and one hour.

If the Diver surfaces with an over-inflation syndrome, recover the Diver as soon as possible, and place on emergency oxygen.

Activate the Emergency Assistance Checklist, and then notify and transport to the nearest recompression facility.

Diver Loss of Consciousness

As a basic rule, any Diver who has obtained a breath of compressed gas from any source at depth, whether from diving apparatus or from a diving bell, and who surfaces unconscious, loses consciousness, or has any obvious neurological symptoms within 10 minutes of reaching the surface, must be assumed to be suffering from arterial gas embolism.

1. Alert dive team and deploy Standby Diver if necessary.
2. Recover Diver to dive station and check for vital signs; administer CPR if required.
3. Notify emergency services and transport to recompression chamber.

4. Recompression treatment shall be started immediately. A Diver who surfaces unconscious and recovers when exposed to fresh air shall receive a neurological evaluation to rule out arterial gas embolism.

Victims of near drowning who have no neurological symptoms should be carefully evaluated by a DMO for pulmonary aspiration.

Injury/Illness of Topside Personnel with Diver in Water

1. Evaluate effect on Diver.
2. Inform Diver of problem and action planned if possible.
3. Alert Standby Diver.
4. Alert deck crew.
5. The Diving Supervisor will direct first Aid/CPR as necessary, determine the course of action, utilize the EAC, and terminate the dive if required.

Adverse Weather Conditions

1. Evaluate effect on Diver.
2. Inform Diver of problem and action planned.
3. Alert Standby Diver.
4. Alert deck crew.
5. Activate plan, terminate dive.

Conditions for topside personnel shall be considered as well as Divers. Lightning is cause for termination of the dive and will not be resumed for 30 minutes post last sighting.

Fire

1. Extinguish fire; secure equipment.
2. Determine damage and effect on Diver.
3. If required, terminate dive; commence decompression.
4. Each chamber must have a means of extinguishing a fire in the interior.

12. EQUIPMENT CERTIFICATIONS AND INSPECTION CHECKLISTS – SCUBA

VRH Equipment modifications, repairs, tests, calibrations, or maintenance shall be recorded by means of a tagging and logging system, and include the date and nature of work performed and the signed and printed name of the individual performing the work.

All equipment will be maintained in accordance with manufacturer's recommendations.

All equipment will be inspected in accordance with Appendix C, contained herein.

Air Compressor(s) VRH or leased air compressors will have air sampling certification documents meeting the requirements contained within Reference D.

Air storage flasks; Leased air storage flasks will have air sampling certification documents meeting the requirements contained within Reference D.

Oxygen storage flasks; Leased oxygen storage flasks will have oxygen sampling certification documents meeting the requirements contained within Reference D.

SCUBA Bottles shall be hydrostatically tested every 5 years and visually inspected every year.

Charging Whips shall SCUBA charging lines shall be fabricated using SAE 100R7 hose for 3,000-psi service and SAE 100R8 hose for 5,000-psi service.

The use of strain reliefs made from cable, chain, 21-thread, or 3/8-inch nylon, married at a minimum of every 18 inches and at the end of the hose, is a required safety procedure to prevent whipping in the event of hose failure under pressure. Marrying cord shall be 1/8-inch nylon or material of equivalent strength. Tie wraps, tape, and marlin are not authorized for this purpose.

Regulators shall be maintained, tested, and inspected in accordance with the manufactures recommendations and prior to every diving mission commencement.

Buoyancy Compensators shall be inspected in accordance with the manufacturers recommendations, Co2 Cartridges shall be weighed prior to every mission and inspected daily prior to diving.

13. OPERATING PROCEDURES AND CHECKLISTS – SURFACE SUPPLIED AIR

Prior to the commencement of any diving operation, a Job Safety Analysis/AHA and EAC shall be completed and all members of the dive team together with other involved personnel shall be present at the pre-dive briefing.

All diving and support personnel shall adhere to the Minimum Rest policy contained in Reference E, as directed by the Diving Supervisor.

The following are minimum requirements for Surface Supplied Air diving operations:

- Surface Supplied Air (SSA) operations will not be conducted at depths greater than 190 ft except dives with bottom times of 30 minutes or less may be conducted to 220 ft.
- Exceptional Exposure dives will not be conducted except in emergency lifesaving situations.
- Recompression chambers shall be available and ready for use at the dive location, for any dive outside the no-decompression limits or deeper than 100 ft.
- Each Diver will be continuously tended while in the water with one Diver per Tender, regardless of depth.
- A Standby Diver who meets all the requirements of the primary Diver is required for all surface supplied dives and will be dressed and ready to deploy.
- An underwater Diver/Tender shall be stationed at the point of entry when any penetration diving is conducted, or diving in enclosed/physically confining spaces.
- Each diving operation shall have an identified **Primary air** supply sufficient to support Divers for the duration of the planned dive, including decompression;
- Each dive operation shall have an identified **Secondary air** supply integral or in-line with the primary air source sufficient to safely terminate the dive and recover the Diver(s) in the event of loss of the primary air supply;
- Each Diver must have an **Emergency Gas Supply** (EGS) available that can be turned on immediately by the Diver in the event of loss of air. The reserve breathing air supply shall be of sufficient capacity to recover the

Diver and complete emergency decompression (if required) in the event of loss of primary air but no less than 30 ft^3.

- An EGS is mandatory at depths deeper than 60 fsw and when diving inside a wreck or enclosed space.
- The EGS system consists of an adequately charged SCUBA cylinder with either a K- or J- valve (with reserve turned down) or a first stage regulator set at manufacturer’s recommended pressure, but not lower than 135 psig. A relief valve set at 180 ± 5 psig over bottom pressure must be installed on the first stage regulator to prevent rupture of the low pressure hose should the first stage regulator fail.
- An adequately charged SCUBA cylinder is defined as the pressure that provides sufficient air to bring the Diver to his first decompression stop or the surface for no-decompression dives.
- For enclosed-space diving, an extended EGS whip 50 to 150 feet in length may be used. If the diving scenario requires the EGS topside, adjust the first stage regulator to 150 psi over bottom pressure.
- Electronic communication systems with an external speaker shall be incorporated in all SSA diving operations so the entire dive team can monitor communications. Communications devices shall be tested prior to each dive, maintained in an operable condition, and protected from damage during use and storage.
- All dive operations will be terminated in a safe, orderly fashion using line-pull signals if voice communications are lost. Defective electronic communication equipment shall not prevent a Standby Diver from deploying in an emergency if the dive supervisor determines it is safe for the Diver to deploy and line-pull signals are used.
- The KMB-27and KMB 47 are open circuit, demand, diving helmets The maximum working depth for air diving operations is 190 fsw.
- The KMB-27 and KMB 47 May be used up to 60 fsw without an Emergency Gas Supply (EGS).
- All valves and electrical switches that directly influence the air supply shall be labeled: **“DIVER’S AIR SUPPLY – DO NOT TOUCH”**.

Predive Procedures

Appendix A, The Diving Safety and Planning Checklist, should be referenced and incorporated into the predive setup.

Appendix E, The Surface Supplied Equipment Inspection Checklist, should then be utilized.

- The diving station is neatly organized with all diving and support equipment placed in an assigned location. Deck space must not be cluttered with gear; items that could be damaged are placed out of the way (preferably off the deck). A standard layout pattern should be established and followed.
- The primary and secondary air supply systems are checked to ensure that adequate air is available. Air compressors of the Divers' air system are started and checked for proper operation. The pressure in the accumulator tanks is checked. If HP air cylinders are being used, the manifold pressure is checked. If a compressor is being used as a secondary air supply, it is started and kept running throughout the dive.
- Depth soundings are taken and descent line, stage, stage lines, and connections are checked.
- When the Diving Supervisor is satisfied that all equipment is on station and in good operating condition, the next step is to dress the Divers.

Dressing the Divers

Dressing the Divers is the responsibility of the Tender.

- Don diving dress (such as a wet suit, dry suit, hot-water suit, or chaffing garment).
- Don Diver's harness, secure, and adjust.
- If weighted diving shoes or ankle weights are used, they are placed on the Diver by the Tender and secured.
- Don neck ring and secure if helmet is to be used.
- Don and adjust weight belt.
- Secure knife to belt, leg, or arm per Diver's preference.
- With the Diver or a second dive-team member holding the mask or helmet, open the emergency gas cylinder (when used).
- Don mask or helmet and secure mask harness or helmet clamp.

- Secure the umbilical assembly to harness.
- After properly dressing the Diver, ensure that all equipment is functioning properly, and inform the Diving Supervisor that the Diver is ready.

Predive Checklist

The Diving Supervisor must always perform predive checks on all Divers prior to water entry, using Appendix F.

Water Entry and Descent

Divers will enter the water utilizing the safest method determined by the JSA/AHA.

Diving ladders and stages shall:

- Be capable of supporting the weight of two Divers plus their gear.
- Ladders must extend a minimum of three feet below surface where installed.
- Be provided with a safety chain and internal handholds for dive safety during launch and recovery. (Stages)
- Make provisions for mounting of breathing gas cylinder and regulator for emergency breathing at all depths of intended operation. (Stages)

Pre-Descent Surface Check

In the water and prior to descending to operating depth, the Diver makes a final equipment check.

The Diver immediately checks for leaks in the air connections and suit.

If two Divers are being employed, both Divers perform as many checks as possible on their own rigs and then check their dive partner's rig. The Tender or another Diver can be of assistance by looking for any telltale bubbles.

A communications check is made and malfunctions or deficiencies not previously noted are reported at this time.

When satisfied that the Divers are ready in all respects to begin the dive, they notify the Diving Supervisor and the Tenders move the Divers to the descent line. When in position for descent, the Diver adjusts for negative buoyancy and signals readiness to the Diving Supervisor.

Descent

Descent may be accomplished with the aid of a descent line or stage.

While descending, the Diver adjusts the air supply so that breathing is easy and comfortable.

Some specific guidelines for descent are as follows:

- With a descent line, the Diver locks the legs around the line and holds on to the line with one hand.
- In a current or tideway, the Diver descends with back to the flow in order to be held against the line and not be pulled away. If the current measures more than 1.5 knots, the Diver wears additional weights or descends on a weighted stage, so that descent is as nearly vertical as possible.
- When the stage is used for descent, it is lowered with the aid of a winch and guided to the site by a shackle around the descent line. Upon reaching the bottom, the Diver exits the stage as directed by the Diving Supervisor.
- The maximum allowable rate of descent, by any method, normally should not exceed 75 feet per minute (fpm).

Underwater Procedures

Upon reaching the bottom and before leaving the area of the stage or descent line, the Diver checks equipment and makes certain that the air supply is adequate, and report conditions on the bottom.

The Diver is now ready to move to the work site and begin the assignment.

Divers should follow these guidelines for movement on the bottom areas:

- Before leaving the descent line or stage, ensure that the umbilical is not fouled.

- Loop one turn of the lifeline and air hose over an arm; this acts as a buffer against a sudden surge or pull on the lines.
- Proceed slowly and cautiously to increase safety and to conserve energy.
- If obstructions are encountered, pass over the obstruction, not under or around.
- If the current is strong, stoop or crawl to reduce body area exposed to the current.
- Avoid unnecessary movements that stir up the bottom and impair visibility.

Deploying the Standby Diver as a Worker Diver

The Standby Diver may be deployed as a working Diver, provided all of the following conditions are met:

- Surface-supplied no-decompression dive of 60 fsw or less.
- Same job/location, e.g., working on port and starboard propellers on the vessel:
  - Prior to deploying the Standby Diver, the work area shall be determined to be free hazards (i.e., suctions, discharges) by the first Diver on the job site.
  - When working in ballast tanks or confined spaces, the Standby Diver may deploy as a working Diver, but both Divers shall be tended by a third Diver who is outside the confined space.

Ascent and Decompression Procedures

Follow these ascent procedures when it is time for the Divers to return to the surface:

1. To prepare for a normal ascent, the Diver clears the job site of tools and equipment.
2. Readings from the pneumofathometer are taken as the primary depth measurements.
3. Communicate to the Diver prepare to leave bottom. When all tools and extra lines have been cleared away, and the Diver is ready, he reports "ready to leave bottom".
4. The Diving Supervisor informs Divers leaving bottom and Divers report actually leaving bottom.

5. If, during the ascent, while using a descent line, the Diver becomes too buoyant and rises too quickly, the Diver checks the ascent by clamping his legs on the descent line.
6. The rate of ascent is a critical factor in decompressing the Diver. Ascent must be carefully controlled and directed at 30 feet per minute by the Diving Supervisor. The ascent is monitored with the pneumofathometer. As the Diver reaches the stage and climbs aboard, topside is notified of arrival.
7. While ascending and during the decompression stops, the Diver must be satisfied that no symptoms of physical problems have developed. If the Diver feels any pain, dizziness, or numbness, the Diver immediately notifies topside. During this often lengthy period of ascent, the Diver also checks to ensure that his umbilical is not fouled.
8. Upon arrival at the surface, topside personnel, timing the movement as dictated by any surface wave action, coordinate bringing the Diver and or stage and umbilical up and over the side.
9. If the Diver exits the water via the ladder, the Tenders provide assistance. The Diver will be tired, and a fall back into the water could result in serious injury. Under no conditions is any of the Diver's gear to be removed before the Diver is firmly on deck.

Post Dive Procedures

1. Diver's clean time begins upon arrival on the surface. Divers will be continuously monitored during this time by an assigned individual.
2. During this time, the Diving Supervisor will check the condition of all Divers.
3. Question regarding any physical problems or adverse physiological effects and instruct the Diver to report all problems.
4. Advise the Diver of the location of the nearest recompression chamber.
5. Advise the Diver of the VRH policy of flying after diving.
6. Instruct the Diver to remain awake and in the vicinity of the recompression chamber for one hour after any dive deeper than 100 ft. or outside the no-decompression limits.

14. ASSIGNMENTS AND RESPONSIBILITIES OF DIVE TEAM MEMBERS – SURFACE SUPPLIED AIR

All diving operations will be conducted in accordance with Figure 6-16 (Reference D) Minimum Manning Levels for Air Diving.

Project Manager

The Project Manager will ensure the required documents are on hand and up to date, and where required have been approved.

The Project Manager will be available to the Diving Supervisor to answer questions and liaison with and communicate progress to competent authorities.

The Project Manager will conduct random visual inspections of the dive side and proceedings.

Diving Program Manager

The Diving Program Manager will maintain all required publications for diving and ensure their accuracy. He shall be responsible to the Project Manager for updates, or changes to the diving program.

The Diving Program Manager will be responsible for the training and qualifications of each dive team member and the certification of Diving Supervisors.

The Diving Program Manager will be responsible for conducting refresher training courses and Diver requalification/training dives.

The Diving Program Manager shall conduct complete inspections of all equipment, personnel, and documentation prior to commencement of diving operations.

The Diving Program Manager will conduct a detailed investigation and document his findings for presentation to the Project Manager for any mishap, near mishap or diving injury that occurs during the course of a dive.

Diving Supervisor

The Diving Supervisor will be designated in writing and in charge of the actual diving operation for a particular dive or series of dives. Diving operations shall not be conducted without the presence of the Diving Supervisor. The Diving Supervisor has the authority and responsibility to discontinue diving operations in the event of unsafe diving conditions.

The Diving Supervisor shall be included in preparing the operational plans. The Diving Supervisor shall consider contingencies, determine equipment requirements, recommend diving assignments, and establish back-up requirements for the operation. The Diving Supervisor shall be familiar with all Divers on the team and shall evaluate the qualifications and physical fitness of the Divers selected for each particular job. The Diving Supervisor will inspect all equipment and conduct pre-dive briefings of personnel prior to every dive.

While the operation is underway, the Diving Supervisor monitors progress; debriefs Divers; updates instructions to subsequent Divers; and other personnel as necessary are advised of progress and of any changes to the original plan.

The Diving Supervisor will terminate the dive and report any unsafe conditions, actions, or events that may occur to the VRH Project Manager and Diving Program Manager as soon as possible for resolution and documentation.

When the mission has been completed, the Diving Supervisor gathers appropriate data, analyzes the results of the mission, prepares reports to be submitted to higher authority, and ensures that required records are completed. These records may range from equipment logs to individual diving records.

Diver(s)

The Diver is responsible for the diving gear worn and shall ensure that it is complete, in good repair and tested.

To ensure safe conduct of the dive, the Diver shall always obey a signal from the surface and repeat all commands when using vice communications.

Accomplish all tasks assigned by the Diving Supervisor. In the event the Diver is assigned a task for which he does not consider himself competent by either training and/or experience, the Diver shall immediately inform the Diving Supervisor.

Read, understand, and comply with all employer's policies and with applicable governmental regulations as they relate to their qualifications or performance while engaging in diving operations.

While working, the Diver shall keep topside personnel informed of conditions on the bottom, progress of the task, and of any developing problems that may indicate the need for changes to the plan or a call for assistance from other Divers.

Ensure that the deepest depth attained during their dive has been established before their ascent.

Maintain a Diver's logbook that details all dives, medical examinations, courses taken, certification level achieved, and personal equipment maintenance.

Ensure that medical certificates are up-to-date and recorded in their Diver's logbook. Present their logbook to the Diving Supervisor on every job for his signature.

Maintain certification in first aid and CPR.

Standby Diver

The Standby Diver in the carrying out of his duties and responsibilities shall:

- Be capable and qualified to carry out all of the duties and responsibilities of the Diver as set forth above.
- Have fitted his diving helmet or mask to the Standby Diver's umbilical in a wrench-tight status and then shall check for proper flow of breathing medium and for adequate communications.
- The diving helmet or mask shall be ready to be donned by the Standby Diver when directed by the Diving Supervisor.
- He shall remain in the immediate vicinity of the Diver water entry location, and be ready to enter the water when directed by the Diving Supervisor.

Diver Tenders

The duties of a Tender are to:

- Assist the Diver with donning and checking equipment;

- Continuously tend the Diver's umbilical during water entry/exit;
- Continuously tend the Diver's umbilical and be aware of the Diver's depth and location at all times while the Diver is in the water;
- Assist the Diver in undressing; and
- Continually monitor the Diver after completion of the dive as directed by the Diving Supervisor.

Specifically the Tender

- Assists the Diver in donning Diver-worn equipment.
- After properly dressing the Diver, ensure that all equipment is functioning properly, and inform the Diving Supervisor that the Diver is ready.
- When the Diver is ready to dive, the Tender directs and assists the Diver from the dressing area to the water-entry point. The Tender always keeps one hand on the umbilical close to the Diver, and the other hand on the Diver's helmet or body harness, while assisting the Diver during water entry.
- As the Diver enters the water, the Tender handles the umbilical. The Tender must be careful to keep the Diver's umbilical away from sharp edges, rotating machinery, and other hazards that could result in damage to or fouling of the umbilical.
- When a descending line is used by the Diver, the Tender should handle the umbilical from a point at least ten feet from the descending line.
- During the dive, the Tender must be alert for, and immediately report to the Diving Supervisor, conditions or situations that may be hazardous or unsafe to the diving operations.
- The Tender also must assist the Diver in controlling his rate of descent by keeping excess slack out of the umbilical, and track the Diver's relative position by continuously monitoring the tautness and location of the umbilical, direction and movement of surface bubbles.
- Throughout the dive, the Tender must keep slack out of the umbilical while at the same time holding it taut therefore, the Tender must always hold the Diver's umbilical firmly with at least one hand to receive the line-pull signals.

- When the dive is complete and the Diver is ready to leave the water, the Tender assists the Diver to the water-exit point and keeps a taut-tension on the umbilical while the Diver climbs the ladder; and provides assistance as directed when the Diver exits by other means.
- When the Diver returns to the bench or staging area the Tender always keeps his/her hands on the umbilical close to the Diver and on the Diver's helmet or body harness maintaining positive control of the Diver while assisting the Diver to the derigging/undressing area.

Support Personnel

- Other support personnel may include almost any member of the company and when assigned to duties that support diving operations will be properly indoctrinated and trained for the position assigned.
- Small-Boat operators shall understand general diving procedures, know the meanings of signals, and be aware of the mission objectives.
- Other personnel, such as winch operators or deck crew, might interact with the operation directly, but only when under the control of the Diving Supervisor.

15. EMERGENCY PROCEDURES; SURFACE SUPPLIED AIR

Fire

1. Extinguish fire; secure equipment.
2. Determine damage and effect on Diver.
3. If required, terminate dive; commence decompression.
4. Each chamber must have a means of extinguishing a fire in the interior.

Equipment Failure

1. Evaluate effect on Diver.
2. Inform Diver of problem and action planned.
3. Alert Standby Diver.
4. Alert deck crew.
5. Diver informs topside of his readiness.
6. Activate plan, terminate dive.

Adverse Weather Conditions

The Diving Supervisor shall evaluate changing weather conditions and determined if termination is necessary. Conditions for topside personnel shall be considered as well as Divers. Lightning is cause for termination of the dive.

1. Evaluate effect on Diver and dive team.
2. Inform Diver of problem and action planned.
3. Alert Standby Diver.
4. Alert deck crew.
5. Diver informs topside of his readiness.
6. Activate plan, terminate dive.

Trapped or Fouled Diver/Umbilical

1. Avoid panic and ensure Diver does not ditch equipment.
2. Diver informs topside.
3. Alert Standby Diver.
4. Diver determines extent of entrapment.
5. Diver attempts to free himself.
6. If required, send Standby Diver to Diver’s assistance.

7. When Diver is free, if unable or unwilling to continue the dive, or if Standby Diver was required to go to his assistance, terminate dive.

Loss of Vital Support Equipment

1. Evaluate effect on Diver.
2. Inform Diver of problem and action planned.
3. Alert Standby Diver.
4. Alert deck crew.
5. Diver informs topside of his readiness.
6. Activate plan, terminate dive.

Loss of Gas Supply (Para 6-10.8.1)

1. Re-establish breathing media supply by:
   - Activating topside Secondary air supply, or
   - Diver goes on bailout bottle, or
   - Put constant purge on Diver's pneumo hose then have Diver insert the hose into helmet/mask.
2. Alert Standby Diver.
3. Diver goes to descent line or stage.
4. If required, deploy Standby Diver for assistance.
5. Terminate dive.

Loss of Communication (Para 6-10.8.2)

1. Attempt to establish line-pull signals.
2. Put air to Diver's pneumo.
3. Alert Standby Diver.
4. Diver proceeds to descent line or stage.

2. Bring Diver to first stop or surface once line-pull signals are established.
3. If required (unable to establish any form of communications with Diver), send Standby Diver to Diver's assistance prior to bringing Diver to his first stop.
4. Terminate dive.

Injured Diver

1. Diver informs topside and dive is aborted.
2. Alert Standby Diver.

3. Diver determines nature and extent of injury.
2. If required, send Standby Diver down to assist Diver, administer first aid, and evaluate injury. Standby Diver should remain with Diver.
3. Standby Diver assists injured Diver to surface, following proper decompression procedures, except when severity of injury indicates a greater risk than omitting decompression.
4. Request required medical assistance and emergency evacuation (if required).
5. Monitor breathing. If breathing stops, overpressure Diver's regulator, if possible.
6. A Diver surfacing with an injury shall be recovered as rapidly as possible and assessed for treatment.
7. Administer First Aid/CPR as required, and ascertain depth and bottom time profile to determine if decompression was missed. Once all Divers have been recovered, conduct neurological exam if warranted.

Diver Blow Up/Exceeded Ascent Rate to Surface

If a Diver blows up and makes an uncontrolled ascent to the surface, but the dive itself is within no-decompression limits, the Diver should be observed on the surface for one hour to ensure that symptoms of decompression sickness or arterial gas embolism do not develop. Recompression is not necessary unless symptoms develop.

1. If a Diver appears on the surface unexpectedly, quickly determine if the Diver is okay.
2. Recover the Diver, and deploy Standby Diver if required.
3. Determine amount of decompression missed and treat accordingly.
4. Terminate the dive and recover all Divers. Monitor all Divers thorough clean time and one hour.

Diver Loss of Consciousness (on Surface)

As a basic rule, any Diver who has obtained a breath of compressed gas from any source at depth, whether from diving apparatus or from a diving bell, and who surfaces unconscious, loses consciousness, or has any obvious neurological symptoms within 10 minutes of reaching the surface, must be assumed to be suffering from arterial gas embolism.

1. Alert dive team and deploy Standby Diver if necessary.
2. Recover Diver to dive station and check for vital signs; administer CPR if required.

3. Notify emergency services and transport to recompression chamber.
4. Recompression treatment shall be started immediately. A Diver who surfaces unconscious and recovers when exposed to fresh air shall receive a neurological evaluation to rule out arterial gas embolism.

Victims of near drowning who have no neurological symptoms should be carefully evaluated by a DMO for pulmonary aspiration.

Injury/Illness of Topside Personnel with Diver in Water

1. Administer first aid as required, and notify medical assistance as necessary. Evaluate effect on Diver.
2. Inform Diver of problem and action planned.
3. Alert deck crew.
4. Terminate dive if required.

16. EQUIPMENT CERTIFICATIONS AND INSPECTION CHECKLISTS – SURFACE SUPPLIED AIR

All equipment will be maintained in accordance with manufacturer's recommendations.

All equipment will be inspected in accordance with Appendix E, contained herein.

Equipment modifications, repairs, tests, calibrations, or maintenance shall be recorded by means of a tagging or logging system, and include the date and nature of work performed and the name of the individual performing the work.

Air Compressor(s)

VRH or leased air compressors will have air sampling certification documents meeting the requirements contained within Reference D.

Air Storage Flasks

Leased air storage flasks will have air sampling certification documents meeting the requirements contained within Reference D.

Oxygen Storage Flasks

Leased oxygen storage flasks will have oxygen sampling certification documents meeting the requirements contained within Reference D.

Umbilicals

Umbilicals shall be marked, beginning at the Divers end, in 10 ft increments to 100 ft and in 50 ft increments thereafter.

Table 16-1: Umbilical Markings

Distance (from Diver's end)	Marking
10 ft [3 m]	one white band
20 ft [6.1 m]	two white bands
30 ft [9.2 m]	three white bands
40 ft [12.2 m]	four white bands
50 ft [15.2 m]	one yellow band
60 ft [18.3 m]	1 yellow/1 white
70 ft [21.3 m]	1 yellow/2 white
80 ft [24.4 m]	1 yellow/3 white
90 ft [27.4 m]	1 yellow/4 white
100 ft [30.5 m]	1 red band
150 ft [45.7 m]	1 red/1 yellow
200 ft [61 m]	2 red bands
250 ft [76.2 m]	2 red/1 yellow
300 ft [91.5 m]	3 red bands

For each 50 ft thereafter the sequence continues by increasing the number of red bands at each even increment of 100 ft (30.5 m). In cases where the umbilical color matches an above band color, a reasonable substitute may be used (contrasting outline on same-color tape, contrasting diagonal pattern, replacement with color not used above). Umbilical's shall have a nominal breaking strength of 1000 lb and shall be made of kink resistant materials.

Hoses shall have a maximum allowable working pressure equal to or greater than the maximum depth of dive relative to supply source plus 150 psi, and have a rated bursting pressure at least four times the working pressure.

Hoses must be tested prior to being placed into initial service and after any repair, modification, or alteration and at least every 12 months to 1.5 times the working pressure. Umbilical assemblies shall be tensile tested at the same time intervals by subjecting each hose-to-fitting connection to a 200-pound axial load.

When hoses are not in use, their open ends must be closed by taping or other means.

Diving helmets and harnesses will be certified by the manufacturer upon purchasing and maintained by the Diver in accordance with Reference E.

17. SAFETY INSPECTION CHECKLIST

VRHabilis shall conduct Safety Inspections in accordance with the following schedule & checklist.

Daily

Dive Program Manager or Project Manager conduct periodic spot checks and ensure as a minimum the following has been completed.

- Verify Equipment Checklist has been completed.
- Visually inspect Dive site and water entry/egress location.
- Determine Diver's physical/mental condition and fit to dive status.
- Ensure Code Alpha/Civilian dive flags displayed and illuminated if at night.
- Test communications with all support agencies and notify diving operations are commencing.
- Ensure dive briefing is conducted to include days dive plan, EAC, AHA
- Ensure First Aid Kits available and ensure Emergency Oxygen breathing supply is adequate.
- Verify dive systems have been secured after last dive.
- Verify Code Alpha/Civilian dive flags removed after last dive.
- Notify all support agencies and inform when diving operations are complete.
- Complete daily project description/progress report, maintain with daily dive log.
- Inspect all equipment/vehicles used in emergency injury transport

Weekly

- Inventory First Aid Kits and inspect Emergency Oxygen breathing supply.
- Perform Pre-mission non-return valve check when helmet has been in storage, and weekly when diving.

Monthly

- Inspect Fire Extinguishers
- Test/operate diving compressors.
- Review Daily dive log and progress reports.

Quarterly

- Review Divers Personal Dive Log books. Pre-mission when diving.

Semi Annually

- Inspect Air compressor and obtain air sampling analysis
- Calibrate all gauges used in diving.

Annually

- Visually inspect Volume tank internally and externally for damage or corrosion.
- Visually inspect air storage tanks internally and externally for damage or corrosion.
- Visually inspect all Divers umbilical's and pressure test.
- Conduct Hydrostatic tests on all air/oxygen cylinder/storage tanks every 5th year.

18. DIVER FITNESS FOR DUTY REQUIREMENTS

Persons engaged as Divers, or otherwise subjected to hyperbaric conditions, will adhere to the requirements contained in Reference E.

The following recommendations are to be used with the **Medical History/Physical Examination Forms**. These forms will be maintained by VRH as required in Reference A.

These standards are the minimum requirements. The use of these standards is intended to be tempered with the good judgment of the examining physician. Where there is doubt about the medical fitness of the subject, the examining physician should seek the further opinion and recommendations of an appropriate specialist in that field.

Particular attention must be paid to past medical and diving history. In general, a high standard of physical and mental health is required for diving.

Consequently in addition to excluding major disqualifying medical conditions, examining physicians should identify and **give careful consideration** to minor, chronic, recurring or temporary mental or physical illnesses which may distract the Diver and cause him to ignore factors concerned with his own or others safety.

These standards, in general, apply to all Divers. Some consideration must be given to the subject's medical history, work history, age, etc.

There is no minimum or maximum age limit providing all the medical standards can be met. Reference E does, however, restrict issue of Commercial Diver Certification Cards to persons 18 years of age or older.

Serious consideration must be given to the need for all Divers to have adequate reserves of pulmonary and cardiovascular fitness for use in an emergency. The lack of these reserves may possibly lead to the termination of a professional diving career.

The examining physician should exercise the appropriate professional judgment to determine whether, in particular circumstances, additional testing may be warranted. Disqualification for an inability to meet any of these standards must be determined on a case-by-case basis related only to the specific job functions of the position being applied for, and assuming reasonable accommodations cannot be made.

1. Examinations will be conducted annually, in conjunction with Hazmat examinations.
2. A re-examination after a diving-related injury or illness will be conducted as needed to determine fitness to return to diving duty.

Physical Examination

For persons engaged as Divers or otherwise subjected to hyperbaric conditions, the initial exam and periodic medical re-examination include the following:

- Work history.
- The tests required in **Table 1** as appropriate.
- Any tests deemed necessary to establish the presence of any of the disqualifying conditions.
- Any additional tests the physician deems necessary to prepare the written report.

Re-Examination After Injury or Illness

Any person engaged as a Diver, or otherwise exposed to hyperbaric conditions, will have a medical examination following a known diving-related injury or illness, which requires hospitalization of 72 hours or more (unless national or local laws dictate otherwise).

Physician's Written Report

A written report outlining a person's medical condition and fitness to engage in commercial diving or other hyperbaric activities should be provided by the examining physician at any time a physical examination is required herein. The written **Physical Examination Form** should be accompanied with a completed copy of the standard **Medical History Form** or its equivalent.

The examining physician should be qualified by experience or training for the conduct of commercial Diver physical examinations and if not, should consult with another medical practitioner so qualified.

Disqualifying Conditions

A person having any of the following conditions, as determined by a physician's examination shall be disqualified from engaging in diving or other hyperbaric activities.

- History of seizure disorder other than early childhood febrile conditions

- Cystic or cavitary disease of the lungs, significant obstructive or restrictive lung disease, or recurrent pneumothorax
- Chronic inability to equalize sinus and middle ear pressure
- Significant central or peripheral nervous system disease or impairment
- Chronic alcoholism, drug abuse, or history of psychosis
- Significant hemoglobinpathies
- Significant malignancies
- Grossly impaired hearing
- Significant osteonecrosis
- Chronic conditions requiring continuous control by medication
- Pregnancy

Withdrawal from Hyperbaric Conditions

It shall be determined on the basis of the physician's examination, whether a person's health will be materially impaired by continued exposure to hyperbaric conditions. The physician should indicate any limitations or restrictions that would apply to the person's work activities in his written report.

Medical Record Keeping

An accurate medical record for each person subject to the medical specifications of this section should be established and maintained. The record should include those physical examinations specified herein including the **Medical History/Physical Examination Forms** and the physician's written report.

The medical record shall be maintained for a minimum of five years from the date of the last hyperbaric exposure unless otherwise prescribed by law.

19. ADMINISTRATIVE AND RECORDKEEPING PROCEDURES

All administrative and recordkeeping procedures will be maintained in accordance with Reference A.

The **record maintained for each diving operation must include:**

- the full names of the dive-team members, including the designated person-in-charge;
- the date, time, and location of the dive;
- the diving mode(s) used;
- a general description of the work performed;
- the approximate underwater and surface conditions;
- the maximum depth and bottom time for each Diver;
- surface intervals with group designators, breathing medium, depth, and duration of decompression stops; and
- date and time of last dive if within 48 hours.

This information will be recorded on the **VRH Daily Dive Log and maintained in the VRH Smooth Log.**

The following additional information is required for dives outside the no-decompression limits, deeper than 100 fsw, or using mixed-gas: depth-time and breathing-gas profiles; decompression tables (including any modifications); and, for repetitive diving, the elapsed time since the last pressure exposure (if less than 24 hours) or the repetitive dive designation for each Diver.

When two or more Divers are working simultaneously, the information required may be kept for the Divers on one record. However, if the Divers have different dive exposures or use different decompression tables, then separate entries must be made for each Diver.

Accident reporting will be conducted in accordance with references A, E and G, (OSHA, ADCI and USCG).

For each dive in which decompression sickness is suspected or symptoms are evident, the following additional information must be recorded and maintained:

- a description of decompression sickness symptoms (including depth and time of onset); and
- a description of treatment results.

The information required also shall be recorded on the OSHA 300 Log ("Log of Work-Related Injuries and Illnesses").

VRH shall maintain a log of recordable work-related injuries and illnesses. The purpose of this requirement is to document recordable illnesses, including incidents of decompression sickness, even when the initial symptoms include such manifestations as skin itch, slight joint cramps, and slight numbness of the extremities. Although seemingly innocuous, these symptoms are recognized and suspected as mild forms of decompression sickness. Symptoms and treatments must be recorded similarly to any other injury or illness.

VRH will maintain a current physical examination for every Diver every year as well as the initial exam as a baseline reference.

Diver's Personal Log Books

All Divers shall maintain a personal dive logbook (ADCI Commercial Diver Log Book) or equivalent to detail hyperbaric exposures. The Log Book must be identified to the Diver using it by photograph, signature, and home address. As a minimum, the following information shall be entered in the Log Book:

- Diving contractor's name and address
- Date of the dive
- The name or other designation and location of the diving site or vessel from which the diving operation was carried out
- Maximum depth reached on the dive
- The time left surface, bottom time, and the time reached surface for each hyperbaric exposure
- Surface interval, if dive includes time for decompression
- Type of breathing apparatus and breathing mixture used
- Task performed
- Type of designation of the decompression table and schedule used

Maintenance Records

- Suitable equipment logs shall be established and maintained in a correct and current condition.
- All equipment shall have a unique identity traceable to the equipment log.
- Entries made in the equipment log shall describe the nature of the work performed, including the dates of modification, repair or test, the name of the individual performing the work or test, and the particular piece of equipment involved.
- Individual persons performing maintenance, repair, calibration, test, or modification of any diving equipment shall both print and sign their name in the equipment log.
- Each diving helmet or mask used in the conduct of commercial diving operations shall be inspected and maintained in accordance with the manufacturer's suggested procedure. Required inspections and/or tests shall be logged and verified in the logbook of the owner of the device.

20. REFERENCES

A. Occupational Safety and Health Administration (OSHA) Instruction # 29 CFR 1910 Sub Part T

B. Army Corps of Engineers (USACE) Publication # 385-1-1

C. USACE Publication # 385-1-86

D. United States Navy Dive Manual (USNDM) (Rev. 6)

E. Association of Diving Contractors International (ADCI) Consensus Standards

F. ANSI/ACDE -01

G. USCG 46 CFR Chapter I Part 197 Subpart B, Commercial Diving Operations

APPENDIX A
DIVING SAFETY AND PLANNING CHECKLIST

SUPERVISOR___________________DATE_______________

STEPS IN PLANNING OF DIVING OPERATIONS

Detailed, advanced planning is the foundation of diving safety.

A. ANALYZE THE MISSION FOR SAFETY.

__ Ensure mission objective is defined.
__ Determine that non-diving means of mission accomplishment have been considered and eliminated as inappropriate.
__ Coordinate emergency assistance.
__ Review relevant Naval Warfare Publications (NWP) and OPNAV instructions.

B. IDENTIFY AND ANALYZE POTENTIAL HAZARDS.

__ **Natural Hazards:**

1. Atmospheric:
   __ Exposure of personnel to extreme conditions
   __ Adverse exposure of equipment and supplies to elements
   __ Delays or disruption caused by weather
2. Surface:
   __ Sea sickness
   __ Water entry and exit
   __ Handling of heavy equipment in rough seas
   __ Maintaining location in tides and currents
   __ Ice, flotsam, kelp, and petroleum in the water
   __ Delays or disruption caused by sea state
3. Underwater and Bottom:
   __ Depth which exceeds diving limits or limits of available equipment
   __ Exposure to cold temperatures
   __ Dangerous marine life
   __ Tides and currents
   __ Limited visibility
   __ Bottom obstructions
   __ Ice (underwater pressure ridges, loss of entry hole, loss of orientation, etc.)

__ Dangerous bottom conditions (mud, drop-offs, etc.)

__ **On-Site Hazards:**

__ Local marine traffic or other conflicting naval operations

__ Other conflicting commercial operations

__ High-powered, active sonar

__ Radiation contamination and other pollution (chemical, sewer outfalls, etc.)

__ **Mission Hazards:**

__ Decompression sickness

__ Communications problems

__ Drowning

__ Other trauma (injuries)

__ Hostile action

__ **Object Hazards:**

__ Entrapment and entanglement

__ Shifting or working of object

__ Explosives or other ordnance

C. SELECT EQUIPMENT, PERSONNEL, AND EMERGENCY PROCEDURES.

__ **Diving Personnel:**

__ 1. Assign a complete and properly qualified Diving Team.

__ 2. Assign the right man to the right task.

__ 3. Verify that each member of the Diving Team is properly trained and qualified for the equipment and depths involved.

__ 4. Determine that each man is physically fit to dive, paying attention to:

__ general condition and any evidence of fatigue

__ record of last medical exam

__ ears and sinuses

__ severe cold or flu

__ use of stimulants or intoxicants

__ 5. Observe Divers for emotional readiness to dive:

__ motivation and professional attitude

__ stability (no noticeably unusual or erratic behavior)

__ **Diving Equipment:**

__ 1. Verify that diving gear chosen and diving techniques are adequate and authorized for mission and particular task.

__ 2. Verify that equipment and diving technique are proper for depth involved.

__ 3. Verify that life support equipment has been tested & approved for U.S. Navy use.

__ 4. Determine that all necessary support equipment and tools are readily available and are best for accomplishing job efficiently and safely.

__ 5. Determine that all related support equipment such as winches, boats, cranes, floats, etc. are operable, safe and under control of trained personnel.

__ 6. Check that all diving equipment has been properly maintained (with appropriate records) and is in full operating condition.

__ Provide for Emergency Equipment:

__ 1 .Obtain suitable communications equipment with sufficient capability to reach outside help; check all communications for proper operation.

__ 2. Verify that a recompression chamber is ready for use, or notify the nearest command with one that its use may be required within a given timeframe.

__ 3. Verify that a completely stocked first aid kit is at hand.

__ 4. If oxygen will be used as standby first aid, verify that the tank is full and properly pressurized, and that masks, valves, and other accessories are fully operable.

__ 5. If a resuscitator will be used, check apparatus for function.

__ 6. Check that fire-fighting equipment is readily available and in full operating condition.

__ 7. Verify that emergency transportation is either standing by or on immediate call.

__ Establish Emergency Procedures:

__ 1. Know how to obtain medical assistance immediately.

__ 2. For each potential emergency situation, assign specific tasks to the diving team and support personnel.

__ 3. Complete and post Emergency Assistance Checklist; ensure that all personnel are familiar with it.

__ 4. Verify that an up-to-date copy of U.S. Navy Decompression Tables is available.

__ 5. Ensure that all Divers, boat crews and other support personnel understand all Diver hand signals.

__ 6. Predetermine distress signals and call-signs.

__ 7. Ensure that all Divers have removed anything from their mouths on which they might choke during a dive (gum, dentures, tobacco).

__ 8. Thoroughly drill all personnel in Emergency Procedures, with particular attention to cross-training; drills should include:

__ Emergency recompression

__ Rapid undressing

__ Fire

__ First aid
__ Rapid dressing
__ Embolism
__ Restoration of breathing
__ Near-drowning
__ Electric shock
__ Blowup
__ Entrapment
__ Lost Diver

D. ESTABLISH SAFE DIVING OPERATIONAL PROCEDURES

__ **Complete Planning, Organization, and Coordination Activities:**

__ 1. Ensure that other means of accomplishing mission have been considered before deciding to use Divers.

__ 2. Ensure that contingency planning has been conducted.

__ 3. Carefully state goals and tasks of each mission and develop a flexible plan of operations (Dive Plan).

__ 4. Completely brief the diving team and support personnel (paragraph 6-7).

__ 5. Designate a Master Diver or properly qualified Diving Supervisor to be in charge of the mission.

__ 6. Designate a recorder/timekeeper and verify that he understands his duties and responsibilities.

__ 7. Determine the exact depth at the job-site through the use of a lead line, pneumofathometer, or commercial depth sounder.

__ 8. Verify existence of an adequate supply of compressed air available for all planned diving operations **plus an adequate reserve for emergencies.**

__ 9. Ensure that no operations or actions on part of diving team, support personnel, technicians, boat crew, winch operators, etc., take place without the knowledge of and by the direct command of the Diving Supervisor.

__ 10. All efforts must be made through planning, briefing, training, organization, and other preparations to minimize bottom time. Water depth and the condition of the Diver (especially fatigue), rather than the amount of work to be done, shall govern Diver’s bottom time.

__ 11. Current decompression tables shall be on hand and shall be used in all planning and scheduling of diving operations.

__ 12. Instruct all Divers and support personnel not to cut any lines until approved by the Diving Supervisor.

__ 13. Ensure that ship, boat, or diving craft is securely moored and in position to permit safest and most efficient operations (exceptions are emergency and critical ship repairs).

__ 14. Verify that, when using surface-supplied techniques, the ship, boat, or diving craft has at least a two-point moor.

__ 15. Ensure that, when conducting SCUBA operations in hazardous conditions, a boat can be quickly cast off and moved to a Diver in distress.

__ **Perform Diving Safety Procedures, Establish Safety Measures:**

__ 1. Ensure that each Diver checks his own equipment in addition to checks made by Tenders, technicians or other support personnel.

__ 2. Designate a Standby Diver for all diving operations; Standby Diver shall be dressed to the necessary level and ready to enter the water if needed.

__ 3. Assign buddy Divers, when required, for all SCUBA operations.

__ 4. Take precautions to prevent Divers from being fouled on bottom. If work is conducted inside a wreck or other structure, assign a team of Divers to accomplish task. One Diver enters wreck, the other tends his lines from point of entry.

__ 5. When using explosives, take measures to ensure that no charge shall be fired while Divers are in water.

__ 6. Use safety procedures as outlined in relevant Naval publications for all U/W cutting and welding operations.

__ 7. Brief all Divers and deck personnel on the planned decompression schedules for each particular dive. Check provisions for decompressing the Diver.

__ 8. Verify that ship, boat, or diving craft is displaying proper signals, flags, day shapes, or lights to indicate diving operations are in progress. (Consult publications governing International or Inland Rules, International/Inland local signals, and Navy communications instructions.)

__ 9. Ensure that protection against harmful marine life has been provided. (See Appendix 5C.)

__ 10. Check that the quality of Diver's air supply is periodically and thoroughly tested to ensure purity.

__ 11. Thoroughly brief boat crew.

__ 12. Verify that proper safety and operational equipment is aboard small diving boats or craft.

__ **Notify Proper Parties that Dive Operations Are Ready to Commence:**

- __ 1. Diving Officer
- __ 2. Commanding Officer
- __ 3. Area Commander
- __ 4. Officer of the Deck/Day
- __ 5. Command Duty Officer or Commanding Officer of ships alongside Bridge, to ensure that ship's personnel shall not:
  - __ turn the propeller or thrusters.
  - __ get underway.
  - __ activate active sonar or other electronics.
  - __ drop heavy items overboard.
  - __ shift the moor.
- __ 7. Ship Duty Officer, to ensure that ship's personnel shall not:
  - __ activate sea discharges or suctions.
  - __ operate bow or stern-planes or rudder.
  - __ operate vents or torpedo shutters.
  - __ turn propellers.
- __ 8.Other Interested Parties and Commands:
  - __ Harbor Master/Port Services Officer
  - __ Command Duty Officers
  - __ Officers in tactical command
  - __ Cognizant Navy organizations
  - __ U.S. Coast Guard (if broadcast warning to civilians is required)
- __ 9.Notify facilities having recompression chambers and sources of emergency transportation that diving operations are underway and their assistance may be needed.

APPENDIX B
EMERGENCY ASSISTANCE CHECKLIST

SUPERVISOR____________________ DATE_________________

VRHABILIS LLC **EMERGENCY ASSISTANCE CHECKLIST**

EMERGENCY MEDICAL SERVICE (EMS) Location: Phone Number: Remarks:	RECOMPRESSION CHAMBER Location: Phone Number: Remarks:
DIVING MEDICAL OFFICER Location: Name: Phone Number: Response Time:	LAW ENFORCEMENT: Location: Phone Number: Remarks:
FIRE DEPARTMENT Location: Phone Number: Remarks:	EMERGENCY CONSULTATION Navy Experimental Dive Unit (NEDU) Phone Numbers 24 Hours a Day (850) 234-4351 (850) 230-3100

DIVERS ALERT NETWORK (DAN)	TRANSPORTATION
Location: Phone Number: (919) 684-8111 Collect Remarks: USCG Rescue Coordination Center Location: Phone Number Remarks	Location: Phone Number: Remarks: **IN THE EVENT OF AN ACCIDENT, AFTER TAKING APPROPRIATE EMERGENCY ACTION, CONTACT VR HABILIS LLC** **PM (865) 806-6689 OFFICE (508) 410-1306**

APPENDIX C
VRH EQUIPMENT INSPECTION CHECKLIST – SCUBA

SUPERVISOR___________________ DATE_______________

SCUBA EQUIPMENT INSPECTION CHECKLIST

SCUBA PREDIVE PROCEDURES
Predive procedures for SCUBA operations include equipment preparation, Diver preparation, and conducting a predive inspection before the Divers enter the water.

A. Equipment Preparation. Prior to any dive, all Divers must carefully inspect their own equipment for signs of deterioration, damage, or corrosion. The equipment must be tested for proper operation. Predive preparation procedures must be standardized, not altered for convenience, and must be the personal concern of each Diver.

Air Cylinders.
__ 1. Inspect air cylinder exteriors and valves for rust, cracks, dents and any evidence of weakness.
__ 2. Inspect O-ring.
__ 3. Verify that the reserve mechanism is closed (lever in up position) signifying a filled cylinder ready for use.
__ 4. Gauge the cylinders.

Harness Straps and Backpack.
__ 1. Check the hoses for cracks and punctures.
__ 2. Adjust straps for individual use and test quick-release mechanisms.
__ 3. Check backpack for cracks and other unsafe conditions.

Breathing Hoses.
__ 1. Attach regulator to the cylinder manifold, ensuring that the O-ring is properly seated.
__ 2. Test the connections of each hose at the regulator and mouthpiece assembly by tugging on the hose.
__ 3. Check the clamps for corrosion and damage; replace as necessary.

Regulator.

__ 1. Attach regulator to the cylinder manifold, ensuring that the O-ring is properly seated.

__ 2. Crack the cylinder valve open and wait until the hoses and gauges have equalized.

__ 3. Next open the cylinder valve completely and then close (back off) one-quarter turn.

__ 4. Check for any leaks in the regulator by listening for the sound of escaping air. If a leak is suspected, determine the exact location by submerging the valve assembly and the regulator in a tank of water and watch for escaping bubbles. Frequently the problem can be traced to an improperly seated regulator and is corrected by closing the valve, bleeding the regulator, detaching and reseating. If the leak is at the O-ring and reseating does not solve the problem, replace the O-ring and check again for leaks.

Life Preserver/Buoyancy Compensator (BC)

__ 1. Orally inflate preserver to check for leaks and then squeeze out all air. The remaining gas should be removed after entry into the water by rolling onto the back and depressing the oral inflation tube just above the surface. Never suck the air out, as it may contain excessive carbon dioxide.

__ 2. Inspect the carbon dioxide cartridges to ensure they have not been used (seals intact) and are the proper size for the vest being used and for the depth of dive.

__ 3. The firing pin should not show wear and should move freely.

__ 4. The firing lanyards and life preserve straps must be free of any signs of deterioration.

__ 5. When the life preserver inspection is completed, place it where it will not be damaged. Life preservers should never be used as a buffer, cradle, or cushion for other gear.

Face Mask.

__ 1. Check the seal of the mask and the condition of the head strap.

__ 2. Check for crack in the skirt and faceplate.

Swim Fins.

__ 1. Check straps for signs of cracking.

__ 2. Inspect blades for signs of cracking.

Dive Knife.

__ 1. Test the edge of the knife for sharpness.

__ 2. Ensure the knife is fastened securely in the scabbard.

__ 3. Verify that the knife can be removed from the scabbard without difficulty, but will not fall out.

Snorkel.
__ 1. Inspect the snorkel for obstructions.
__ 2. Check the condition of the mouthpiece.

Weight Belt.
__ 1. Check the condition of the weight belt.
__ 2. Make sure that the proper number of weights are secure and in place.
__ 3. Verify that the quick-release buckle is functioning properly.

Submersible Wrist Watch.
__ 1. Ensure wristwatch is wound and set to the correct time.
__ 2. Inspect the pins and strap of the watch for wear.

Depth Gauge and Compass.
__1. Inspect pins and straps.
__ 2. If possible, check compass with another compass.
__ 3. Make comparative checks on depth gauges to ensure depth gauges read zero fsw on the surface.

Miscellaneous Equipment.
__ 1. Inspect any other equipment that will be used on the dive as well as any spare equipment that may be needed during the dive including spare regulators, cylinders, and gauges.
__ 2. Check all protective clothing, lines, tools, flares, and other optional gear.

B. Diver Preparation and Brief. When the Divers have completed inspecting and testing their equipment, they shall report to the Diving Supervisor. The Divers shall be given a Predive briefing of the dive plan. This briefing is critical to the success and safety of any diving operation and shall be concerned with only the dive about to begin. All personnel directly involved in the dive should be included in the briefing. Minimum items to be covered are:

__ 1. Dive objectives
__ 2. Time and depth limits for the dive
__ 3. Task assignments
__ 4. Buddy assignments
__ 5. Work techniques and tools
__ 6. Phases of the dive

__ 7. Route to the work site
__ 8. Special signals
__ 9. Anticipated conditions
__10. Anticipated hazards
__11. Emergency procedures (e.g., unconscious Diver, trapped Diver, loss of air, aborted dive, injured Diver, lost Diver, etc.)

APPENDIX D
VRH SCUBA PREDIVE CHECKLIST

SUPERVISOR____________________ DATE_________________

SCUBA PREDIVE CHECKLIST

The Divers must report to the Diving Supervisor for a final inspection. During this final predive inspection, the Diving Supervisor must:

___1. Ensure that the Divers are physically and mentally ready to enter the water.

___2. Verify that all Divers have all minimum required equipment (SCUBA, facemask, life preserver or buoyancy compensator, weight belt, dive knife, scabbard, swim fins, watch and depth gauge). When diving SCUBA and a buddy line is used, only one depth gauge and one watch per dive team are required.

___3. Verify that the cylinders have been gauged and that the available volume of air is sufficient for the planned duration of the dive.

___4. Ensure that all quick-release buckles and fastenings can be reached by either hand and are properly rigged for quick release.

___5. Verify that the weight belt is outside of all other belts, straps, and equipment and will not become pinched under the bottom edge of the cylinders.

___6. Verify that the life preserver or buoyancy compensator is not constrained and is free to expand, and that all air has been evacuated.

___7. Check position of the knife to ensure that it will remain with the Diver no matter what equipment is left behind.

___8. Ensure that the cylinder valve is open fully and backed off one-quarter to one-half turn.

___9. Ensure that the hose supplying air passes over the Diver’s right shoulder and the exhaust hose on the double-hose unit passes over the left shoulder. Double-hose regulators are attached so that the exhaust ports face up when the tank is standing upright.

___10. With mouthpiece or full-face mask in place, breathe in and out for several breaths, ensuring that the demand regulator and check valves are working correctly.

___11. Depress and release the purge button at the mouthpiece and listen for any sound of leaking air. Breathe in and out several times ensuring valves are working correctly.

___12. Give the breathing hose and mouthpiece a final check; ensure that none of the connections have pulled open during the dressing process.

___13. Check that the air reserve mechanism lever is up (closed position).

___14. Conduct a brief final review of the dive plan.

___15. Verify that the dive signals are displayed and personnel and equipment are ready to signal other vessels in the event of an emergency.

APPENDIX E
VRH PRE-MISSION EQUIPMENT INSPECTION CHECKLIST – SURFACE SUPPLIED

VRHABILIS LLC PRE-MISSION
SURFACE-SUPPLIED EQUIPMENT CHECKLIST

CAUTION

This checklist is an overview intended for use with the appropriate equipment O&M technical manual.

A. Basic Preparation:

__1. Verify that a recompression chamber is on the diving station for dives of more than 100 fsw or outside the No-Decompression limits.
__2. Ensure that all personnel concerned, or in the vicinity, are informed of diving operations.
__3. Determine that all valves, switches, controls, and equipment components affecting diving operation are tagged-out to prevent accidental shutdown or activation.

B. General Equipment:

__1. Verify that all diving system components have been properly assembled on station and arranged to facilitate smooth operations.
__2. Verify that proper signals indicating underwater operations being conducted are displayed correctly.
__3. Compressors:

> __a. Ensure that compressor is secure in diving craft and shall not be subject to operating angles, caused by roll or pitch that will exceed 15 degrees from the horizontal.
> __b. Check that the Divers air compressor oil supply is adequate and does not overflow the fill mark; contamination of air supply could result from fumes or oil mist.
> __c. Check the fuel and oil level in the Divers air compressor engine for proper level.
> __d. Check the compressor exhaust is vented away from work areas and, specifically, does not foul the compressor intake.
> __e. Check that compressor intake is obtaining a free and pure suction without contamination. Use pipe to lead intake to a clear suction if necessary.
> __f. Check all filters, cleaners and oil separators for cleanliness.
> __g. Bleed off all condensed moisture from filters and from the bottom of volume tanks. Check all manifold drain plugs, and that all petcocks are closed.

__h. Check that all belt-guards are properly in place on drive units.

__i. Check the fuel and oil in the electric generator.

__j. Check the fuel and oil in all support equipment.

__k. Verify that all supply hoses running to and from the compressor have proper leads, do not pass near high-heat areas, are free of kinks and bends, and are not exposed on deck in such a way that they could be rolled over, damaged, or severed by machinery or other means.

__l. Verify that all pressure supply hoses have safety lines and strain reliefs properly attached.

__m. Make connections between primary and secondary air supply and Diver's volume tank and console.

C. Activate the Air Supply:

__1. Compressors:

__a. Ensure that all warm-up procedures are completely followed.

__b. Check all petcocks, filler caps, overflow points, bleed valves, and drain plugs for leakage or malfunction of any kind.

__c. Verify that there is a properly functioning pressure gauge on the volume tank and that the compressor is meeting its delivery requirements.

__2. Cylinders:

__a. Gauge all H/P cylinders for adequate pressure.

__b. Gauge all EGS cylinders.

__c. Check all manifolds and Divers console valves for operation.

__d. Activate and check delivery.

__3. For all supply systems, double check "Do Not Touch" tags.

D. Equipment Protection:

__1. Assemble and lay out all dive equipment, both primary equipment and standby spares for Diver (or Standby Diver), including all accessory equipment and tools.

__2. Check all equipment for superficial wear, tears, dents, distortion, or other discrepancies.

__3. Check all masks, helmets, neck damns, faceplates, seals, and visors for damage.

__4. Check all exhaust and non-return valves.

__5. Check all harnesses, laces, strain reliefs, and lanyards for wear; renew as needed.

__6. Check all masks, helmets for communications, cameras, and lights.

E Diving Hoses:

__1. Ensure all Diver's umbilical are laid out and have a clear fairlead.

__2. Bleed air through Diver's umbilical to check that hoses are free of moisture.

F. Test Equipment with Activated Air Supply.

__1. Hook up all air hoses to helmets, masks

__2. Verify flow to helmets and masks.

__3. Hook up and test all communications, cameras, and lights as required.

G. Recompression Chamber Checkout (If required):

__1. Check that chamber is completely free and clear of all combustible materials.

__2. Hook up all air and oxygen hoses to chamber.

__3. Check primary and back-up air supply to chamber and all pressure gauges.

__4. Check that chamber is free of all odors or other "contaminants".

__5. Hook up and test all communications.

__6. Check airflow from both primary and back-up supplies to chamber.

H. Final Preparations:

__1. Verify that all necessary records, logs, and timesheets are on the diving station.

__2. Check that appropriate decompression tables are readily at hand.

__3. Place the dressing bench in position, reasonably close to the diving ladder or stage, to minimize Diver travel.

APPENDIX F
VRH SURFACE SUPPLIED PREDIVE CHECKLIST

VRHABILIS LLC
SURFACE SUPPLIED PREDIVE CHECKLIST

When the Divers have completed inspecting and testing their equipment, they shall report to the Diving Supervisor. The Divers shall be given a predive briefing of the dive plan. This briefing is critical to the success and safety of any diving operation and shall be concerned with only the dive about to begin. All personnel directly involved in the dive should be included in the briefing. Minimum items to be covered are:

- Clear, brief statement of the mission/dive objectives.
- Time and depth limits for the dive
- Dive station assignments and responsibilities.
- Review of all tasks required to complete the mission.
- Review of diving phases from water entry to post dive.
- Anticipated conditions expected throughout the dive both underwater and topside.
- Review of Job Safety Analysis/AHA.
- Any changes to operating procedures due to specific underwater operations.
- Specific signals to be used.
- Question the health of each Diver instruct them to report any physical conditions, problems or adverse physiological effects that may render the Diver unfit to dive.
- Conditions that will cause the termination of the dive
- Review the Emergency Assistance Checklist and all Emergency Procedures

The Tenders report to the Diving Supervisor for a final inspection. During this final predive inspection, the Diving Supervisor must.

- Ensure that the Divers are physically and mentally ready to enter the water.
- Verify that all Divers have all required equipment and tools.
- Verify that the Diver's minimum manifold pressure is sufficient for the depth of the dive.

- Verify the EGS pressure, ensure the cylinder valve is shut and helmet supply valve is open, inform the Diver.
- Verify the weights are sufficient for the diving apparatus in use.
- Check the position of the knife to ensure it will not be lost.
- Ensure the Diver's umbilical is properly rigged to the harness and will not come undone.
- Verify airflow to helmets and don helmets.
- Witness Divers perform surface checks and ensure proper operation.
- Perform communications checks between topside and all Divers.
- Deploy Divers, conduct in-water checks, and check for leaks.
- When satisfied and Diver reports ready to leave surface, start time keeping and recording devices as required.

APPENDIX G
DIVE LOG SHEET AND REPETITIVE DIVE WORKSHEET

VRH DAILY DIVE LOG & REPETITIVE DIVE WORKSHEET

Job Name ________________________________ Location ______________________________________

Job No. _______________ Date _______________ Start Time _______________ Secure Time____________

Diving task & job description: Breathing medium and apparatus used

Date & Time of last previous Dive

CREW AND POSITION

DIVING CONDITIONS

Weather ___________________ Air Temp _______________ Water Temp ________________

Current _____________ Visibility _____________ Tide Schedule: MWH ________ MLW _______

Primary Air Pressure______________________

Emergency Air Pressure ____________________________________ Initials ______________

		1	2	3	4	5
Diver #1	Leave Surface					
	Leave Bottom					
	Reach Surface					
Bail-Out PSI	Bottom Time					
	Depth/Penetration					
	Schedule					
	Repet Group					
	Surface Interval					

	NewGroup/RNT					
Diver #2		1	2	3	4	5
	Leave Surface					
	Leave Bottom					
	Reach Surface					
Bail-Out PSI	Bottom Time					
	Depth/Penetration					
	Schedule					
	Repet Group					
	Surface Interval					
	New Group/RNT					

Table & Schedule used____________Depth and Duration of any stops.______________________.
RNT Rule Y/N

Signature _____________________________________ Date _______________________________

		1	2		
Diver #1	Leave Surface Leave Bottom Reach Surface			Diver #2	Leave Surface Leave Bottom Reach Surface
Bail-out PSI	Bottom Time Depth Penetr. Schedule Repet Group Surface Interval New Group/RNT			Bail-out PSI	Bottom Time Depth Penetr. Schedule Repet Group Surface Interval New Group/RNT

Diver #3	Leave Surface Leave Bottom Reach Surface	1	2	Diver #4	Leave Surface Leave Bottom Reach Surface	1
Bail-out PSI	Bottom Time Depth Penetr. Schedule Repet Group Surface Interval New Group/RNT			Bail-out PSI	Bottom Time Depth Penetr. Schedule Repet Group Surface Interval New Group/RNT	

APPENDIX H
USN NO-DECOMPRESSION LIMITS AND REPETITIVE GROUP DESIGNATION TABLE FOR NO-DECOMPRESSION AIR DIVES

USNDM Page 9-62

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APPENDIX I
USN RESIDUAL NITROGEN TIMETABLES FOR REPETITIVE AIR DIVES

USNDM Page 9-63

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APPENDIX J
USN STANDARD AIR DECOMPRESSION TABLES

USNDM Pages 9-64 thru 9-82

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APPENDIX K
VRH POLICY STATEMENT

VRHabilis LLC
Policy Statement of Compliance

VRHabilis LLC will administer and conduct all diving operations in accordance with OSHA 29 CFR 1910 Subpart T and USACE Publication 385-1-1.

All Standard and Emergency Operating Procedures will be conducted in accordance with the USNDM current revision.

All personnel engaged in Diving Operations acknowledge these requirements and submit by their signature below that they have read, understand, and will comply with these standards

Dated______________________

Signed ________________________________Printed ________________________

VRH Project Manager_____________________Printed________________________

APPENDIX L
DESIGNATED DIVING SUPERVISOR CERTIFICATION LETTER(S)

VRHabilis Designated Diving Supervisor Certification Letter

_____________________________is hereby designated VRH Diving Supervisor.

VRH having reviewed your qualification and training authorize you to supervise all diving operations on Air.

You are directed to conduct all diving operations in accordance with OSHA 29 CFR 1910 Subpart T, and US Army Corps of Engineers Publication 385-1-1, current revisions.

You are directed to maintain your knowledge of all diving, standard and emergency operating procedures as well as recompression procedures.

The VRH Safe Practices Manual will be on site for every diving evolution.

VRH Diving Program Manager________________________ Date______________

VRH Project Manager ________________________ Date______________

APPENDIX M
OSHA 29 CFR 1910, SUBPART T

OSHA 29 CFR 1910 SUBPART T

Pages 1-62

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APPENDIX N
USACE PUBLICATION 385-1-1

SECTION 30
DIVING OPERATIONS
30.A GENERAL

30.A.01 All USACE diving operations, both government and contractor shall be performed in accordance with this manual. Failure to meet these requirements will be cause for rejection or cessation of operations. Unless otherwise delegated in this section, requests for waivers or variance to the requirements of this section must be made in accordance with Appendix N of this manual through the local Designated Dive Coordinator (DDC) or the Alternate Dive Coordinator (ADC) acting on their behalf.

30.A.02 The USACE Command, at their discretion, may elect to implement and enforce more conservative diving requirements than stated herein, but under no circumstances will the operational requirements be less than specified in this Section.

30.A.03 Diving shall not be used as a work method if the work objective can be more safely and efficiently accomplished by another means (e.g., using remote controlled television systems in lieu of Divers).

30.A.04 Surface-Supplied Air (SSA) shall be used whenever possible in accordance with the practical constraints of diving operations.

30.A.05 Live boating will not be used without prior specific acceptance by the DDC.

30.A.06 Training documentation shall be in compliance with the OSHA Diving Standards 29 CFR 1910.410 and shall show that the dive team members have successfully completed training to the appropriate level (e.g., SSA Diver's certificate, surface supplied mixed-gas Diver certificate). Such training shall be provided by:

a. A commercial diving school, military school, Federal school (e.g., USACE), or an Association of Commercial Diving Educators (ACDE) accredited school;
b. An in-house training program that meets the requirements contained in ANSI/ACDE-01, or in the Association of Diving Contractors International (ADCI) Consensus Standards;

c. Training for Scientific Divers using compressed air (SCUBA or SSA), shall be in compliance with 29 CFR 1910.410 and shall meet the above requirements or the training guidelines in the Standards for Scientific Diving published by the American Academy of Underwater Scientists (AAUS).

30.A.07 In substitution for a training certificate, an ADCI member company may show proof of a dive team member's qualification or experience by submitting a valid "ADCI Card" for the appropriate training level issued by the current employer.

30.A.08 Contractors shall provide evidence that each dive team member has training and experience consistent with the performance requirements of the scope of work. As a minimum, each team member shall have at least 1 year of commercial experience in the applicable position; Divers shall have completed at least four (4) working dives with similar decompression techniques as in the contract, using the particular diving techniques and equipment to be used under the contract. Divers shall demonstrate that at least one (1) of the four (4) qualification dives was performed in the last 6 months prior to the contract award date. The DDC will ensure USACE Divers meet the training and qualification requirements of ER 385-1-86.

30.A.09 Each dive team member shall have current certification in CPR, first aid, the use of emergency oxygen systems, and, if provided on the dive site, the use of Automated External Defibrillators (AEDs). Evidence of this will be a photocopy of the certificates.

30.A.10 Divers will receive an annual diving physical. A statement that each Diver has been medically examined within the previous 12 months and has been determined fit and approved to dive shall be signed by a licensed physician. The DDC will maintain a file of physician clearance certifications for all USACE Divers. Contractors shall submit physician's certification to the DDC in accordance with 30.A.14. After any serious diving injury or illness, Divers shall be re-examined by a physician and approved for diving.

30.A.11 Divers will wait at least 12 hours before flying after any dive: this interval should be extended to 24 hours following multiple days of repetitive dives.

30.A.12 When diving at altitudes of 1000 ft (304.8 m) or more of elevation above sea level, Dive Supervisors shall use appropriate high altitude decompression tables that compensate for the increased elevation.

30.A.13 Contract diving operations will be monitored and/or inspected by personnel qualified as USACE Dive Inspectors. Individual USACE Dive teams shall be inspected during operations at least once annually by the DDC, ADC and/ or Dive Safety Representative (DSR).
a. Qualified Dive Inspectors shall hold current USACE training certification as Dive Inspector, Diver/ Dive Supervisor, Dive Safety Administrator, or Dive Coordinator; however, use of trained monitors/inspectors with other credentials will be considered on a case-by-case basis and may be approved in writing by the DDC. All USACE personnel used as dive inspectors must be approved by the DDC prior to performing inspector duties.
b. Inspectors shall conduct on-site monitoring/ inspections of contractor dive sites during pre-dive conference, equipment inspection, and initial dives. Monitoring may be continuous for the duration of the contract dive activity or intermittent, as determined by the DDC based on an evaluation of the job complexity and degree of hazards.

30.A.14 The following documents are required for all USACE and Contractor diving operations. All documents will be reviewed and found acceptable by two of the following: DDC/ ADC/ DSR, prior to start of diving operations. Contractors shall submit the documents through the Contracting Officer. Additional documentation may be required depending on the scope of the diving operation:
a. Safe Practices Manual. *> See 30.A.16.*
b. Dive Operations Plan(s). *> See 30.A.17*.
c. AHA to cover all aspects of the job. *> See 30.A.18.*
d. Emergency Management Plan. *> See 30.A.19.*
e. Dive Personnel Qualifications. *> See 30.A.06 – 10.*
> Note: The above review requirement is that two qualified USACE personnel independently evaluate the documents prior to acceptance. The ADC may substitute for either the DDC or DSR in the review and/or acceptance process if these personnel are not available at the time of review.

30.A.15 A Dive Operations Plan, AHA, emergency management plan, and personnel list with qualifications will be developed for each separate diving operation. These documents will be submitted to the DDC for review and found acceptable prior to commencement of diving operations and will be at the diving location at all times. Each of these documents will become a part of the project file. Potential high-hazard conditions, such as penetration diving, contaminated environment diving, dives outside the no decompression limits, and in areas where differential pressure entrapment hazards exist, will be specifically addressed in each document when they are anticipated as part of the diving operation.

30.A.16 Safe Practices Manual. Contractors and USACE Districts/ Labs with in-house dive teams shall develop and maintain a safe practices manual that encompasses their entire diving program. The safe practices manual shall be available at all times to the Government representative and all dive team members at each diving location. The safe practices manual shall include, as a minimum, the following:

a. Dive safety procedures and checklists;

b. Assignments and responsibilities of dive team members;

c. Equipment certifications, procedures, and inspection checklists;

d. Emergency procedures for fire, equipment failure, adverse weather conditions, and medical illness or injury and specific procedures for:

(1) Entrapped or fouled Diver including fouled umbilical (suction and entanglement/debris);

(2) Actions upon loss of vital support equipment;

(3) Actions upon loss of gas supply;

(4) Action upon loss of communication;

(5) Lost Diver plan;

(6) Injured Diver plan;

(7) Actions upon discovery of fire;

(8) Diver blow up/over rapid ascent to surface;

(9) Diver loss of consciousness; and

(10) Injury/illness of member of surface crew with Diver in the water.

e. Procedures for internal safety inspections (frequency, checklists, etc.);

f. A complete copy of OSHA, 29 CFR 1910, Subpart T, and a statement of the employer's policy for ensuring compliance with the standard;

g. The appropriate U.S. Navy Table(s), including as a minimum;

(1) U.S. Navy Table of No-Decompression Limits and Repetitive Group Designation for No-Decompression Air Dives;

(2) U.S. Navy Residual Nitrogen Timetables for Repetitive Air Dives;

(3) U.S. Navy Standard Air Decompression Table.

h. A sample of the diving log sheets to be used;

i. A sample of the repetitive dive worksheets or equivalent (dive profile method) to be used;

j. An outline of the fitness for duty (including medical) requirements for dive team members, and

k. An outline of administrative and recordkeeping procedures.

30.A.17 Dive Operations Plan. This plan is a general overview of all tasks to be performed, dive modes and equipment, site access, etc. Complex projects involving more than one work task, location, and/or dive team require task-specific dive plans as part of the overall Dive Operations Plan. As a minimum the Dive Operations Plan will contain the following:

a. Date of dive plan submission;
b. Name and contact information for Diving Supervisor preparing the dive plan;
c. Names and duties of on-site dive team members, including Diving Supervisor;
d. List of diving equipment to be used;
e. Type of diving platform to be used;
f. Detailed description of the mission; Identify how/ if work will be divided into separate tasks or phases of work;
g. Date(s), time(s), duration, and location of operation;
h. Diving mode used (SCUBA, SSA, and snorkeling) including a description of the backup air supply, as required;
i. Nature of work to be performed by the Divers, including tools used and materials to be handled or installed;
j. Anticipated surface and underwater conditions, to include visibility, temperature, currents, etc. Thermal protection will be considered as appropriate;
k. Maximum single dive bottom time for the planned depth of dive for each Diver. Altitude adjustments to dive tables will be calculated for dives made at altitudes of 1000 ft (304.8 m) or more above sea level;
l. Identification of topside assistance/support to the dive team (i.e., crane operator, lock operator, etc.);
m. Means of direct communication between the dive site and the project office, the lockmaster/USACE project manager, and the contracting officer (if applicable);
n. Plans submitted for Contractor operations shall also include the name of Contractor (and diving subcontractor if applicable), Contract number, and names and contact information for key personnel.

< NOTE: The dive plan will include the following statement: "If for any reason the dive plan is altered in mission, depth, personnel, or equipment, the DDC will be contacted in order to review and accept the alteration prior to actual operation."

30.A.18 Activity Hazard Analysis. An AHA represents the dive team's best effort to anticipate and mitigate or prevent the adverse effects of equipment failure, extreme weather/environmental conditions, or other hazardous/unexpected situations.

a. AHA's shall address risk to personnel, property and to impacts to the overall USACE mission. When required, a new AHA shall be conducted to reflect changes in site conditions, operational changes, etc.
b. Each AHA will be job specific and address each phase of work, to include the hazards associated with flying after diving.
c. For USACE dive teams, a Risk Assessment Code should be applied to high hazard jobs, with residual risk being approved by the appropriate level of command.
d. Control of Hazardous Energy (Lockout/ Tagout) procedures in accordance with Section 12 of this manual and procedures for dealing with differential pressures will be included if appropriate. If Hazardous Energy Control procedures are required for the diving operation, the Diving Supervisor will visually check all lockout/tagout and other control procedures/devices to assure they are in place and redundant where possible prior to the commencement of the diving operation. A copy of any clearances/permits to be issued to deal with identified hazards will be attached to the AHA.
e. Some dives may be sufficiently complex to warrant several separate analyses.
f. The AHA will be covered in detail at the pre-dive conference.

30.A.19 Emergency management plan. An emergency management plan will be prepared for each dive operation. The minimum content of the plan will be as follows:
a. Location and phone number of nearest operational recompression chamber if not located at the dive site and the Divers Alert Network (DAN) phone number (919-684-8111);
b. Location, directions to and phone number(s) of nearest hospital(s) or available physicians capable of treating dive injuries;
c. Location and phone number of nearest USCG Rescue Coordination Center, where appropriate;
d. Description of an emergency victim transport plan including phone numbers of appropriate emergency transport services;
e. Procedures and phone numbers or other means of communications to activate emergency services at the facility where the work is being performed;
f. Diver rescue procedures conducted by the dive team, including responsibilities of team members, best location(s) where injured Divers may be removed from the water, and best location(s) for performing first aid/ stabilization prior to emergency medical assistance arrival.

30.A.20 Prior to the initial work on each dive operation, a Pre-Dive Conference shall be held with key personnel designated by the DDC to discuss the Dive Operations plan, AHA, and Emergency Plan and any modifications needed. For contractor operations, the pre-dive conference will also be attended by the USACE dive inspector or DDC and a representative of the Contractor with sufficient authority to implement any changes required by the USACE diving inspector or coordinator.

30.A.21 Prior to each dive, the entire dive team will be briefed in detail on the following (as a minimum):
a. Description of mission and location, including drawings and/or photographs
pertinent to the mission and equipment and materials that are to be installed as part of the mission;
b. Description of diving apparatus/equipment and craft to be used;
c. Maximum working depth with estimated bottom times and water temperatures;
d. Names and duties of personnel on the team (when possible, incorporate at least one person on the dive that has previously performed the same or similar mission);
e. Discussion of AHA; and
f. Emergency procedures.

30.A.22 Upon completion of each diving operation or at the conclusion of each day, a dive team debriefing shall be conducted by the dive supervisor. At the debriefing Divers are advised of the location of the nearest recompression chamber (if not located on site), the phone number for DAN or local dive medical facility, and cautioned on the limitations of their post dive activities including repetitive dives and flying.

30.A.23 If for any reason the dive mission is altered, minor to moderate revisions to the accepted dive plan will be reviewed and accepted by the DDC or ADC prior to continuing the operation. These revisions may include differences in time, date, dive team members, work methods/ tools used, and other changes that do not affect overall risk. This review may be conducted electronically or verbally and confirmed in writing after completion of the dive operation. Major changes or those which modify high-risk activities, such as modifying pressure differential and hazardous energy controls, adding penetration diving, changing dive equipment modes (i.e. from SCUBA to SSA), discovery of unexpected contaminated diving conditions, etc. require a two-person review as outlined in 30.A.14. For contract operations, the project superintendent or the dive supervisor shall submit/ request the revised plan through the GDA for DDC acceptance.

30.A.24 All diving activities shall be conducted with full knowledge and close coordination with the GDA and on-site authorities such as the lockmaster/project manager, etc.

30.A.25 For each Diver and dive, the following dive log information, as a minimum, shall be recorded and maintained at the dive location:

a. Full name;
b. Date, time and location of dive;
c. Maximum depth and bottom time;
d. Surface interval between dives;
e. Breathing medium and type of equipment used;
f. Group classification at the beginning and end of each interval and repetitive dive worksheet;
g. Underwater and surface conditions;
h. Depth(s) and duration(s) of any decompression stops;
i. Date and time of last previous dive if it occurred in the last 48 hours;
j. Name of Dive Supervisor(s) during dive;
k. General description of work performed; AND
l. For dives outside the no-decompression limits, deeper than 100 (30.5m) feet salt water (fsw), or using mixed-gas, include depth-time and breathing-gas profiles and decompression tables (including any modifications).

30.A.26 For each dive in which decompression sickness and/or pulmonary barotraumas is suspected or symptoms are evident, the following information shall be recorded and maintained:

a. Descriptions of signs and symptoms (including depth and time of onset);
b. Description and results of treatment; and
c. Name, address, and phone number of attending physician.

30.A.27 Prior to the dive, the Dive Supervisor shall assure, as a minimum, the following pre-dive checks are performed:

a. Breathing air tanks contain sufficient air supply to perform the required work (i.e., standby air tanks are on site and full to the capacity);
b. All diving equipment shall be checked for proper function prior to Diver entry;
c. All necessary safety equipment specified herein is on site and functioning properly;
d. Lockout/tagout procedures are followed;
e. When applicable, crane signals are reviewed and radio communication with the crane operator is functioning properly;
f. When applicable, welding or cutting procedures are clearly reviewed, the proper welder polarity is set, and precautions have been taken to ensure that electrocution will not occur;

g. When applicable, blasting procedures are clearly reviewed and precautions have been taken to ensure unplanned/ unscheduled blasts will not occur;
h. A pre-dive briefing shall be given that includes, but is not limited to, the accident management plan, AHA, equipment checklist, diving logs, diving conditions, and diving procedures;
i. When applicable, manbaskets used for Diver access shall be inspected and load tested prior to use.

30.A.28 Copies of the dive logs shall be submitted to the DDC after completion of the dive operation. For USACE dive teams, these records shall be maintained on file for two years.

30.B DIVING OPERATIONS

30.B.01 Staging areas, where the fully suited and equipped Diver enters the water, shall be selected and configured based on a hazard analysis that includes an examination of:
a. ease of Diver access to the water;
b. hazards to Diver (currents, equipment, etc.) in route from surface to work area;
c. ability of Standby Diver to access the water immediately and to reach the Diver quickly;
d. if used as the topside dive team station, the ability to protect topside members and the Standby Diver from weather, operational, and other hazards;
e. whether topside equipment can be stowed safely and function properly;
f. if Diver entry to water is remote from the staging area, the Standby Diver shall be placed at the water entry or immediately accessible to it.

30.B.02 All Dive teams shall be manned in accordance with the criteria established in Appendix O.

30.B.03 A Standby Diver will be provided whenever a Diver(s) is in the water to serve as immediate emergency assistance to the primary Diver(s). Untethered SCUBA Divers, working in “buddy” pairs, shall have one standby at the surface for each pair. A standby will deploy only after the dive supervisor assesses the situation and instructs him/ her to do so.
a. The Standby Diver shall be fully equipped to dive and readily available the entire time the Diver is in the water. The Standby Diver shall don all specific gear (suits, harnesses, and equipment) they will wear/use and test all for proper operation before the primary Diver leaves the surface. All gear shall be maintained operational and ready for immediate use for the

duration of the dive. If any of the tested gear is exchanged or replaced during the dive, it shall be donned and tested by the Standby.
b. The Standby Diver shall be dressed appropriately for the water and air temperature and remain fully suited up with helmet/ mask ready for immediate donning from the time the primary Diver leaves the surface until reaching the work area/ working depth. At that point, the Standby may remove the portions of his or her gear needed to prevent heat/cold stress and prevent fatigue. If the AHA identifies a need for the Standby to remain fully dressed to deploy, it will address measures that will be taken to control these hazards (i.e., Standby in water at surface). Any gear that has been removed must be maintained ready for immediate donning and use, accessible to the Standby at the entry to the water.
c. If configuration of the surface staging area prevents safe, immediate entry of the Standby into the water, the Standby Diver will be placed in the water fully dressed prior to the primary Diver leaving the surface, and remain at the surface ready for deployment if needed.

30.B.04 Dive operations that require surface decompression as an integral part of the dive operation shall have a trained competent person, whose sole purpose is to attend to the chamber operation. In dive operations where the chamber is required for emergency, first aid, or used for other unexpected recompression events, a team member with other team duties (Tender, console operations, etc.) not diving during the current dive may serve as the chamber operator so long as he is specifically trained and competent in hyperbaric chamber operations. If used for the latter purpose, all diving shall be suspended during the chamber operations. Whenever a chamber is on site, the competent chamber operator shall be capable of communicating with a diving physician. Divers completing a recompression dive will remain within 30 minutes drive time from a fully operable and staffed recompression chamber for a minimum of 2 hours after completing the recompression dive.

30.B.05 Dive operations will be conducted in full coordination with external operations and processes that may impact the safety of the dive.
a. When the operation of machinery or release of hazardous energy will affect the Diver or dive team safety, the dive supervisor will develop a Hazardous Energy Control Plan (see Section 12). When diving at a facility with an existing Hazardous Energy Control Plan, the dive supervisor will review the facility’s plan and establish positive control procedures with the facility leader.
b. When water traffic, land-based traffic, industrial operations, heavy equipment operation, or other operations exist that present a hazard to the Diver or dive team, the dive supervisor shall coordinate with the controlling authorities to minimize the hazards.

30.B.06 Crane operations conducted to support diving operations shall follow the requirements of Section 16 of this manual. All working dives requiring communications between the Divers and topside to direct crane load movements, etc., shall be performed in Surface Supplied Air mode. The crane operator will take direction from the Tender or supervisor directly in communication with the Diver. Crane operations where the load is placed or removed underwater shall be considered Critical Lifts and the Diver/ load director will participate in the Critical Lift Plan development as outlined in Section 16.H.

30.B.07 When dives will take place in an area or facility where potential or actual pressure differentials exist (locks, dams, spillways, powerhouses, etc.), the dive supervisor will develop specific plans and procedures, in coordination with the facility operator, to prevent Diver exposure to pressure differentials. The plans and procedures shall be site-specific and include the following:
a. Identification of all potential exposure points (gate sills, valve openings, holes, etc.);
b. Means for identifying whether control structures/ mechanisms are fully in place (measurements of stop gates and openings, valve indicators, etc.);
c. Methods for checking pressure differential openings (observing current/ water flow, remote testing of opening area with objects (rope, sandbags, cinders, etc.);
d. Route Diver will take from staging area to work area with specific designs to prevent Diver and umbilical from uncontrolled pressure differential openings;
e. Procedures for immediate emergency pressure equalization or reduction, if possible, AND
f. Procedures for emergency Diver extraction or rescue due to pressure differential exposure, including Standby Diver deployment precautions.

30.C SCUBA OPERATIONS

30.C.01 SCUBA diving operations shall not be conducted:
a. At depths greater than 100 ft (30.5 m);
b. On dives outside the no-decompression limits unless a dual lock, multi-place, recompression chamber (capable of recompressing Diver at the surface to a depth equivalent to 165 ft (50.3 m) of sea water) is available at the dive location and is immediately available for use, a trained competent operator is on site, and the chamber is of sufficient size to accommodate the Diver as well as an inside Tender;
c. Against currents exceeding one knot;
d. In enclosed or physically confining spaces;
e. Using closed circuit or semi-closed circuit SCUBA;

f. In visibility less than 3 ft (0.9 m) unless line tended with Diver/surface two-way voice communications;
g. In areas where pressure differentials exist and it cannot be positively verified that all potential leaks have been eliminated;
h. When the Diver does not have direct access to the surface.

30.C.02 Specific operational requirements for SCUBA operations are as follows:
a. Each SCUBA Diver shall be equipped with a bailout bottle with a minimum of 30 ft3 (0.85 m3) of air and separate regulator. An octopus is not considered to be an alternate air source.
b. Each Diver shall be equipped with a buoyancy compensation device (BCD) and/or an inflatable flotation device capable of maintaining the Diver at the surface in a face-up position, having a manually activated inflation source independent of the breathing supply, an oral inflation device, and an exhaust valve.
c. Each SCUBA Diver shall be equipped with a submersible cylinder pressure gauge capable of being monitored by the Diver during the dive.
d. Each SCUBA Diver shall be equipped with a weight belt or assembly capable of quick release.
e. Each SCUBA Diver shall be equipped with a depth gauge and knife.
f. SCUBA air cylinders shall comply with the following requirements:
(1) Air cylinders of seamless steel or aluminum that meet DOT 3AA and DOT 3AL specifications are approved for used on USACE projects;
(2) Each cylinder used on USACE projects must have identification symbols stamped into the shoulder of the tank; and
(3) SCUBA tanks used on USACE projects must be visually inspected internally at least annually and hydrostatically tested at least once every 5 years in accordance with DOT and the CGA regulations; test dates will be stamped into the shoulder of each tank.
g. A timekeeping device shall be used for recording diving times for all SCUBA diving operations. When two-way voice communications are not used, each dive supervisor and Diver shall have a timekeeping device. When two-way voice communications are used, the dive supervisor, at a minimum shall have a timekeeping device.
h. Each tethered SCUBA Diver shall wear a safety harness with a positive buckling device, attachment point for the safety line, and a lifting point to distribute the pull force of the line over the Diver's body while maintaining the body in a heads-up vertical position when unconscious or inert.

30.D SURFACE SUPPLIED AIR (SSA) OPERATIONS

30.D.01 SSA operations shall not be conducted at depths greater than 190 ft (57.9 m) except that dives with bottom times of 30 minutes or less may be conducted to depth of 220 ft (67 m). Exceptional exposure dives, as defined by the US Navy Diving Manual, shall not be conducted except in emergency lifesaving situations. USACE in-house SSA operations shall not exceed a depth of 110 ft unless a waiver is requested by the DDC and approved by the HQUSACE Dive Safety Program Manager.

30.D.02 SSA equipment components shall be a type specifically designed to be used in diving support systems.

30.D.03 Dual lock, multi-place, recompression chambers shall be available and ready for used at the dive location for any dive outside the no-decompression limits or deeper than 100 ft (30.4 m). Sufficient oxygen shall be available to complete chamber operations.

30.D.04 A bell shall be used for dives with an in-water decompression time greater than 120 minutes, unless heavy gear is worn or diving is conducted in physically confining spaces.

30.D.05 Minimum specific operational requirements for SSA diving operations are as follows:
a. Each Diver shall be continuously Tendered while in the water, with one Diver per Tender, regardless of depth;
b. An underwater Tender/Diver shall be stationed at the underwater point of entry when any penetration diving is conducted or in enclosed or physically confining spaces;
c. Each diving operation shall have a primary breathing air supply sufficient to support Divers for the duration of the planned dive, including decompression;
d. Each Diver must have a reserve breathing supply available that can be turned on immediately by the Diver in the event of loss of air. The reserve breathing air supply shall be of sufficient capacity to recover the Diver and complete emergency recompression (if required) in the event of loss of primary air but no less than 30 ft3 (0.85 m3). Heavy-gear diving is exempted from these provisions because the gear carries its own reserve;
e. Each dive location shall have a reserve breathing air supply integral or in-line with the primary air source sufficient to safely terminate the dive and recover the Diver(s) in the event of loss of the primary air supply;
f. For dives deeper than 100 ft (30.5 m) or outside the no decompression limits and using heavy gear, a spare air supply hose, to replace the Diver's air hose should it become damaged, shall be available to the Standby Diver. An in-water support stage shall be provided to Divers in water when using heavy gear, regardless of depth;

g. Electronic communication systems with an external speaker shall be incorporated in all SSA diving operations so the entire dive team can monitor communications. Communications devices shall be tested prior to each dive, maintained in an operable condition, and protected from damage during use and storage in accordance with the manufacturer's recommendations. All dive operations will be terminated in a safe, orderly fashion using line-pull signals if voice communications are lost. Defective electronic communication equipment shall not prevent a Standby Diver from deploying in an emergency if the dive supervisor determines it is safe for the Diver to deploy and line-pull signals are used.

30.E MIXED-GAS DIVING OPERATIONS

30.E.01 Dual lock, multi-place, recompression chambers with a trained, competent operator shall be available and ready for use at the dive location for any mixed-gas dive. Sufficient oxygen shall be available to complete chamber operations. At extreme depth, mixed gas diving can only be done if:
a. A bell is used at depths greater than 220 ft (67 m) or when the dive involves in-water decompression time of greater than 120 minutes (except when heavy gear is worn or when diving in physically confining spaces), or
b. A closed bell is used at depths greater than 300 ft (91.4 m), except when diving is conducted in physically confining spaces.

30.E.02 Each diving operation shall have a primary breathing gas supply sufficient to support Divers for the duration of the planned dive, including decompression.

30.E.03 Each diving operation shall have a reserve breathing gas supply integral or in-line with the primary air source sufficient to safely recover the Diver(s) in the event of failure of the primary breathing gas supply.

30.E.04 When heavy gear is worn:
a. An extra breathing gas hose capable of supplying breathing gas to the Diver in the water shall be available to the Standby Diver, and
b. An in-water stage shall be provided to Divers in the water.

30.E.05 An in-water stage shall be provided for Divers without access to a bell for dives deeper than 100 ft (30.4 m) or outside the no-decompression limits.

30.E.06 When a closed bell is used, one dive team member in the bell shall be available and tend the Diver in the water.

30.E.07 Oxygen Enriched Air.
a. The use of "Oxygen Enriched Air" (OEA) such as Nitrox (EANx) breathing mixtures by USACE in-house dive teams requires the specific initial approval of the HQUSACE Dive Safety Program Manager prior to the first use of such equipment. Requests for approval will be accompanied by a written program that identifies training, certification, and procedures for OEA use. Use of OEA by Contractors requires approval by the local DDC.
b. Navy or NOAA Nitrox Dive Tables or other decompression tables designed specifically for the OEA mixture being used shall be followed without exception.
c. The use of OEA/ Nitrox is considered mixed gas diving and requires a decompression chamber on site and ready for use.

30.E.08 Contractors must provide evidence of training and experience with OEA breathing mixtures prior to actual diving operations.

30.E.09 OEA breathing mixture shall be analyzed/ tested by the Diver to assure proper mix prior to each use. No more than 40% OEA is allowed for normal diving operations. Higher OEA concentrations are allowable for in-water decompression at shallow safety stops.

30.F EQUIPMENT REQUIREMENTS

30.F.01 Equipment modifications, repairs, tests, calibrations, or maintenance shall be recorded by means of a tagging or logging system, and include the date and nature of work performed and the name of the individual performing the work.

30.F.02 Air compressor systems used on-site as a direct source to supply air to SSA Divers (Direct Source Compressors) shall be equipped with a volume tank with a check valve on the inlet side, a pressure gauge, a relief valve, and a drain valve.

30.F.03 Direct Source compressors shall be of sufficient capacity to overcome any line loss or other losses and deliver a minimum 4.5 cfm (2.1 L/s) (actual) to each Diver at the maximum diving depth.

30.F.04 All air compressor intakes shall be located away from/ upwind of areas containing exhaust or other contaminants. Compressors used in areas where there is known or suspected chemical air contamination (sandblasting operations, painting, etc.) shall be equipped with appropriate in-line air purifying absorbent beds and filters inserted into the supply line to assure breathing air quality. Oil -lubricated compressors containing a petroleum or potential CO-producing lubricant for the air pressurization pistons will not be used. Direct Source compressors shall be equipped specifically for their intended use and shall have a suitable approved means to regulate the pressure and a low air pressure alarm in the system. All monitor alarm systems shall be so designed and placed so that the dive supervisor will be made aware of the hazardous conditions. Direct Source compressors will have a Carbon Monoxide (CO) monitor with alarm in the following situations:
a. The compressor is powered by an internal combustion engine, and
b. Compressors used in close proximity to internal combustion engines that may/ will be running during dive operations (boat motors, generators, cranes, etc.). Air intake pipes shall be placed away from/ upwind of the exhaust source.

30.F.05 Air compressor systems will be tested by means of sampling at the connection to the distribution system.
a. All air compressors with a working pressure greater than 500 psi will be tested every six months by an accredited testing laboratory. Compressors with a working pressure less than 500 psi may be tested in-house with documentation every six months and must be tested by an accredited testing laboratory every two years. Lab accreditation shall be from NIST/NVLAP, American Association of Laboratory Accreditation (A2LA – for environmental or calibration) or similar recognized accreditation. Purchased air must be certified by the supplier that it has been tested and meets the standards below.
b. A copy of the certificate of analysis showing the breathing air meets the minimum acceptable criteria shall be provided to the GDA.
c. Air purity standards are as follows:
(1) Air shall not contain a level of carbon monoxide greater than 10 ppm;
(2) Air shall not contain a level of carbon dioxide greater than 1,000 ppm;
(3) Air shall not contain a level of oil mist greater than 5 milligrams per cubic meter (mg/m3);
(4) Air shall not contain a level of hydrocarbons other than methane greater than 25 ppm; and
(5) Air shall not contain a noxious or pronounced odor.

30.F.06 Breathing supply hoses.

a. Breathing air supply hoses shall be suitable for breathing gas service or shall be specifically manufactured for SSA use. Hoses shall have a maximum allowable working pressure equal to or greater than the maximum depth of dive relative to supply source plus 150 psi, and have a rated bursting pressure at least four times the working pressure.
b. Breathing air supply hoses shall have connectors made of corrosion resistant materials and have a working pressure at least equal to the working pressure of the hose to which they are attached: connectors must not be able to become accidentally disengaged.
c. Umbilicals shall be marked, beginning at the Divers end, in 10 ft (3 m) increments to 100 ft (30.5 m) and in 50 ft (15.2 m) increments thereafter. USACE in-house dive teams shall use the following umbilical marking system found in the ADCI Consensus Standard 006 in order to assure consistency and interoperability:

Table 30-1
Umbilical Markings

Distance (from Diver's end)	**Marking**
10 ft [3 m]	one white band
20 ft [6.1 m]	two white bands
30 ft [9.2 m]	three white bands
40 ft [12.2 m]	four white bands
50 ft [15.2 m]	one yellow band
60 ft [18.3 m]	1 yellow/1 white
70 ft [21.3 m]	1 yellow/2 white
80 ft [24.4 m]	1 yellow/3 white
90 ft [27.4 m]	1 yellow/4 white
100 ft [30.5 m]	1 red band
150 ft [45.7 m]	1 red/1 yellow
200 ft [61 m]	2 red bands
250 ft [76.2 m]	2 red/1 yellow
300 ft [91.5 m]	3 red bands

For each 50 ft (15.2 m) thereafter the sequence continues by increasing the number of red bands at each even increment of 100 ft (30.5 m). In cases where the umbilical color matches an above band color, a reasonable substitute may be used (contrasting outline on same-color tape, contrasting diagonal pattern, replacement with color not used above).

d. Umbilicals shall have a nominal breaking strength of 1000 lb (453.6kg) and shall be made of kink resistant materials.
e. Hoses must be tested prior to being placed into initial service and after any repair, modification, or alteration, and at least every 12 months to 1.5 times the working pressure. Umbilical assemblies shall be tensile tested at the same time intervals by subjecting each hose-to-fitting connection to a 200 pound axial load.
f. When hoses are not in use, their open ends must be closed by taping or other means.
g. The umbilical assembly used for the standby diver must be of sufficient length to reach the primary diver at the furthest distance he can proceed from the dive station or beyond.
h. Umbilicals shall be carefully tended to maintain them and the diver clear of hazards such as propellers (including those of ROV's) or intakes present in the diving zone so that the diver or umbilical cannot be drawn into them.

30.F.07 SSA and mixed-gas helmets and masks shall have a non-return valve at the attachment between the helmet or mask and hose which will close readily and also have an exhaust valve; helmets and masks shall have a minimum ventilation rate capacity of 4.5 cfm (2.1 L/s) (actual) at the depth at which they are operated. The use of Jack Brown masks is prohibited on SSA operations unless it incorporates electronic communication and a means of incorporating a diver carried bailout system.

30.F.08 SSA and mixed-gas helmets and masks must be capable of supporting a reserve breathing supply which can be immediately turned on by the diver in event of loss of air.

30.F.09 SSA and mixed-gas helmets and masks must be capable of supporting a two-way or four way diver-surface communication system.

30.F.10 Weights and harnesses. Unless heavy gear is worn, each tethered diver shall wear a safety harness with a positive buckling device, attachment point for the safety line, and a lifting point to distribute the pull force of the line over the diver's body while maintaining the body in a heads-up vertical position when unconscious or inert.

30.F.11 The following emergency and first-aid equipment shall be located at all dive sites:
a. A first-aid kit meeting the requirements of Section 3;
b. An oxygen resuscitation system capable of delivering oxygen for a minimum of 30 minutes or until emergency medical assistance can be administered; and
c. A stokes litter or backboard, with flotation capability.

30.F.12 When diving from vessels, international alpha code and recreational dive flags with a minimum dimension of 23 in (58.4 cm) will be displayed a minimum of 3 ft (0.9 m) above the working surface at the dive location during diving operations. When diving from surfaces other than vessels in areas capable of supporting marine traffic, a rigid replica of the international code flag "A" at least one meter in height shall be displayed at the dive location in a manner which allows all-round visibility, and shall be illuminated during night diving operations.

30.F.13 Hand-held power tools shall be tested and certified to be safe for underwater use; these tools shall be de-energized at the surface before being placed into or retrieved from the water and shall not be supplied with power until requested by the diver.

30.F.14 the use of one-atmosphere suits (e.g., Newt Suits) requires the specific approval of the MSC DDC and FOA DDC prior to the use of such equipment.

30.G SCIENTIFIC SNORKELING

30.G.01 Scientific snorkeling will be conducted only with prior acceptance of the DDC.

30.G.02 Scientific snorkeling will be allowed only for environmental assessments such as fish surveys, stream surveys, and the like. It will not be used for structural inspections or other work.

30.G.03 An on-site snorkeling team shall be made up of no less than two person: snorkeler, and the observer/assistant. Additional site personnel may be required by the DDC or Safety Office Diving Safety Representative based on site hazards and conditions. Snorkeling team plans and procedures shall be developed and enacted by a team supervisor who is qualified and experienced in scientific snorkeling.

30.G.04 Quality assurance for contractor snorkeling operations will be provided by USACE certified Diving Inspectors or qualified USACE scientific snorkelers.

30.G.05 Scientific snorkeling will only be done on the surface of the water. No diving of any kind is permitted. Untethered scientific snorkeling will NOT be allowed in waters, deeper than 5 ft (1.5 m), in bodies of water that a snorkeler cannot wade across, or anywhere a pressure differential may exist. Scientific snorkeling in open waters greater than 5 feet deep may be allowed by the local DDC based on an acceptable AHA and compliance with all of the following:

a. The snorkeler shall be tethered with a harness and a maximum of 40 ft (12.2 m) of floating line;
b. The tether must be constantly tended from the shore or boat;
c. The snorkeler must wear a device providing a minimum of 15.5 pounds (7 kg) of positive buoyancy (Type III PFD, fully inflated snorkeling vest, etc.), and
d. There are no potential tether entanglement hazards in the snorkeling area (overhanging branches, surface stumps, rocks, etc.).

30.G.06 All snorkelers and observers/assistants will be certified as skin divers (snorkelers) or open water divers by a nationally-recognized organization (e.g., Professional Association of Diving Instructors (PADI), National Association of Underwater Instructors (NAUI), etc.) or the U.S. Forest Service Snorkel Safety Program.

30.G.07 An observer/assistant will accompany each untethered snorkeler either along the shore or in a boat and be within 50 ft (15.2 m) of the snorkeler at all times. Two untethered snorkelers in the same body of water may act as observer/assistant for each other if they remain within 50 ft (15.2m) of each other. Non-snorkeling observer/assistants shall wear a PFD and be equipped with a throw bag and/or ring buoy with at least 70 ft (21.3) of line, and must be capable of performing a rescue on the specific snorkeler(s) in an emergency.

30.G.08 Areas of extreme water velocity and turbulence will be avoided especially those immediately upstream from debris jams or bedrock outcrops.

30.G.09 Snorkelers will be provided with appropriate thermal protection.

30.G.10 Employees will be determined medically fit by a licensed physician prior to snorkeling. This certification shall be signed by the physician and state that each snorkeler is physically and medically fit to perform snorkeling activities. The Contractor shall submit such certification to the GDA for acceptance.

30.G.11 All snorkeling team members shall be certified in CPR and first aid.

30.G.12 A first-aid kit meeting the requirements of Section 03 will be available at each location where snorkeling is being performed. A means of securely transporting an unconscious person, such as a litter or stretcher, shall be provided when snorkeling is conducted in areas inaccessible to vehicles or boats.

30.G.13 A means of communication capable of contacting emergency services must be available at locations where snorkeling is performed.

30.G.14 Each snorkeler will be equipped with a professional grade diving mask and snorkel.

30.G.15 A snorkeling protocol will be developed and included in the project file. It will contain as a minimum, the following:
a. An AHA for each specific snorkeling mission. Particular detail will be given to currents and other environmental considerations;
b. Records for snorkeling activities will be maintained. These records will include as a minimum: snorkeler's annual physician certifications, AHAs, and a snorkeling plan. The latter will be based on the requirements of 30.A16.a-e. Contractors shall submit these to the GDA for acceptance by the DDC/SOH Dive Safety officer a minimum of 10 days prior to start of work.

30.G.16 Snorkelers will wear apparel which provides appropriate environmental protection. The apparel must include fins or other appropriate foot protection.

APPENDIX O
ICE AND COLD WATER DIVING OPERATIONS

INTRODUCTION

Purpose
This appendix explains the special requirements for ice and cold water diving.

Scope
Polar Regions and other cold weather environments are uniquely hostile to Divers, topside support personnel, and equipment. Diving where ice cover is present can be extremely hazardous and requires special equipment as well as appropriate operating and support procedures. Awareness of environmental conditions, personnel and equipment selection, and adequate logistical support are vital to mission success and dive team safety.

OPERATIONS PLANNING
Normal diving procedures generally apply to diving in extremely cold environments. However, there are a number of significant equipment and procedural differences that enhance the Diver's safety.

Planning Guidelines
The following special planning considerations relate to diving under/near ice cover or in water at or below a temperature of 37°F:

NOTE: Minimum Ice thickness that will support Divers/Tenders is 4 inches.

- The task and requirement for ice diving should be reviewed to ascertain that it is operationally essential.
- Environmental conditions such as ice thickness, water depth, altitude, temperature, wind velocity, current, visibility, and light conditions should be determined. Ideally, a reconnaissance of the proposed dive site is performed by the Diving Supervisor or a person with ice-covered or cold-water diving experience.
- The type of dive equipment chosen must be suited for the operation.

- Logistical planning must include transportation, ancillary equipment, provisioning, fuel, tools, clothing and bedding, medical evacuation procedures, communications, etc.

NOTE The water temperature of 37°F was set as a limit as a result of Naval Experimental Diving Unit's regulator freeze-up testing. For planning purposes, the guidance above may also be used for diving where the water temperature is above 37°F.

Navigational Considerations
Conditions in cold and ice-covered water affect Diver underwater navigation in the following ways:

The proximity of the magnetic pole in Polar Regions makes the magnetic compass useless.
The life of batteries in homing beacons, strobes, and communication equipment is shortened when used in cold water.
Surface light is so diffused by ice cover that it is nearly impossible to determine its source.
Direct ascent to the surface is impossible when under the ice and determining return direction is often hindered.
In shallow ice-covered waters, detours are often required to circumvent keels or pressure ridges beneath the ice.
With an ice cover, there are no waves and therefore no ripple patterns on the bottom to use for general orientation.

SCUBA Considerations
SCUBA equipment has advantages and disadvantages that should be considered when planning a cold-water dive. The advantages of using SCUBA are:

- Portability.
- Quick deployment.
- Minimal surface-support requirements.

The disadvantages of using SCUBA are:

- Susceptibility of regulator to freezing.
- Depth limitations.
- Limited communications.
- Severely limited ability to employ decompression diving techniques.
- Duration limitations of CO_2 removal systems in closed-circuit UBA.

SCUBA Regulators

The single-hose regulator is susceptible to freezing. The first and/or second stage of the single-hose regulator may freeze in the free-flow position after a few minutes of exposure in cold water. The single-hose regulator should be kept in a warm place before diving. It is important that the Diver test the regulator in a warm place, and then refrain from breathing it until submerging. When returning to the surface, the regulator should remain submerged and the Diver should refrain from breathing from the regulator until resubmerging. The Diver's time on the surface should be kept to a minimum. Once under the water, chances of a freeze-up are reduced. However, if a regulator is allowed to free-flow at depth for as little as five seconds, freeze-up may occur. The Diver should therefore avoid purging the second stage of the regulator when diving in cold water. If water needs to be purged from the mouthpiece, the Diver should do so by exhaling into it.

Special Precautions

Single-hose regulators should be equipped with an antifreeze cap, which is a special first-stage cap that can be filled with liquid silicone available from the manufacturer. Correct maintenance and application of an approved lubricant to the appropriate points are also essential. Extra precautions must also be taken to make sure that SCUBA cylinders are completely dry inside, that moisture-free air is used, and that the regulator is thoroughly dried prior to use.

Octopus and Redundant Regulators

Where water temperature is at or below 37°F, a redundant SCUBA system (twin SCUBA bottles, each having a K-valve and an approved cold water regulator) or twin SCUBA bottles with one common manifold and an approved cold water regulator (with octopus) shall be used.

Life Preserver

The use of life preservers with CO_2 actuation is prohibited only when diving under ice. The accidental inflation of a life preserver will force the Diver upward and may cause a collision with the undersurface of the ice. Should the Diver be caught behind a pressure ridge or other subsurface ice structure, recovery may be difficult even with tending lines. In addition, the exhaust and inlet valves of the variable volume dry suit will be covered if a life preserver is worn. In the event of a dry suit blow-up, the inability to reach the exhaust dump valve could cause rapid ascent and collision with the surface ice.

Face Mask

The Diver's mask may show an increased tendency to fog in cold water. An anti-fog solution should be used to prevent this from occurring. Saliva will not prevent cold water fogging.

SCUBA Equipment

The minimum equipment required by every SCUBA Diver for under-ice operations consists of:

- Wet suit/variable volume dry suit.
- Approved cold-water open-circuit SCUBA or closed-circuit UBA.
- Face mask or approved Full Faced Mask.
- Weight belt and weights as required.
- Knife and scabbard.
- Swim fins.
- Wrist watch.
- Depth gauge.
- Submersible SCUBA bottle pressure gauge.
- Harness such as an Integrated Divers Vest (IDV).
- Lifelines.
- Stainless Steel Ice Screws.

A variety of special equipment, such as underwater cameras and lift bags, is available to Divers However, the effect of extreme cold on the operation of special equipment must be ascertained prior to use.

Surface-Supplied Diving System (SSDS) Considerations

Using SSDS in ice-covered or cold water requires detailed operations planning and extensive logistical support. This includes thermal protection for an elaborate dive station and recompression chamber and hot water heating equipment. In addition, dive equipment may require cold climate modification. Because of logistical considerations, SCUBA is used in most ice diving situations. However, SSDS may be required because of prolonged bottom times, depth requirements, and complex communications between topside and Diver. When diving in cold water that is not ice covered, logistic and equipment support requirements are reduced; however, very cold water poses many of the same dangers to the surface-supplied Diver as ice diving.

Advantages and Disadvantages of SSDS

The advantages of using SSDS are:

- Configuration supports bottom-oriented work.
- Hot water suit and variable volume dry suit offer Diver maximum thermal and environmental protection.
- Communications cable offers audio communications.
- Gas supply allows maximum duration to the maximum depth limits of diving.

The disadvantages of using SSDS are:

- Air console may freeze up.
- Low-pressure compressors do not efficiently remove moisture from the air, which may freeze and clog filters or fracture equipment. This is more likely when the water is very cold and the air is warm. Banks of high-pressure cylinders may have to be used.
- Buildup of air or gas under the ice cover could weaken and fracture thin ice, endangering Tenders, other topside personnel, and equipment.
- Movement of ice could foul or drag Diver's umbilical.
- Battery life of electronic gear is severely reduced.
- Carbon dioxide removal recirculator components may have to be heated.
- Decompression under extreme cold conditions may be dangerous due to water temperature, ice movement, etc.
- Umbilicals are rigid and difficult to maneuver.
- Failure of hot water heater during in-water decompression must be considered during operational planning.

Effect of Ice Conditions on SSDS

Ice conditions can prevent or severely affect surface-supplied diving. In general, the ice field must be stationary and thick enough to support the dive station and support equipment. If the dive must be accomplished through an ice floe, the floe must be firmly attached to land or a stable ice field. Severe ice conditions seriously restrict or prohibit surface-supplied diving through the ice (i.e., moving, unstable ice or pack ice and bergs, and deep or jagged pressure ridges could obstruct or trap the Diver). In cases where a Diver is deployed from a boat in a fixed mooring, the boat, Divers, and Divers' umbilicals must not be threatened by moving ice floes.

Suit Selection

Custom wet suits designed for cold-water diving, variable volume dry suits, and hot water suits have all been used effectively for diving in extremely cold water. Each has advantages and disadvantages that must be considered when planning a particular dive mission. All suits must be inspected before use to ensure they are in good condition with no seam separations or fabric cuts.

Wet Suits

Custom wet suits have the advantages of wide availability, simplicity and less danger of catastrophic failure than dry suits. Although the wet suit is not the equipment of choice, if used the following should be considered:

- The wet suit should be maintained in the best possible condition to reduce water flushing in and out of the suit.
- Wearing heavy insulating socks under the boots in a wet suit will help keep feet warm.

CAUTION—In very cold water, the wet suit is only a marginally effective thermal protective measure, and its use exposes the Diver to hypothermia and restricts available bottom time. The use of alternative thermal protective equipment should be considered in these circumstances.

Variable Volume Dry Suits

Variable volume dry suits provide superior thermal protection to the surface-supplied or SCUBA Diver in the water and on the surface. They are constructed so the entry zipper or seal and all wrist and neck seals are waterproof, keeping the interior dry. They can be inflated orally or from a low-pressure air source via an inlet valve. Air can be exhausted from the suit via a second valve, allowing excellent buoyancy control. The level of thermal protection can be varied through careful selection of the type and thickness of long underwear. However, too much underwear is bulky and can cause overheating, sweating, and subsequent chilling of the Standby Diver. Dry suit disadvantages are increased swimmer fatigue due to suit bulk, possible malfunction of inlet and exhaust valves, and the need for additional weights for neutral buoyancy. Furthermore, if the Diver is horizontal or deployed with the head below the rest of the body, air can migrate into the suit lower extremities, causing over-inflation and loss of fins and buoyancy control. A parting seam or zipper could result in a dramatic loss of buoyancy control and thermal shock. Nevertheless, because of its superior thermal protection, the dry suit is an essential component of extremely cold water diving.

CAUTION—Prior to the use of variable volume dry suits and hot water suits in cold and ice-covered waters, Divers must be trained in their use and be thoroughly familiar with the operation of these suits.

Extreme Exposure Suits/Hot Water Suits

Hot water suits provide excellent thermal protection. If their use can be supported logistically, they are an excellent choice whenever bottom times are lengthy. They are impractical for use by Standby Divers exposed on the surface.

A hot water system failure can be catastrophic for a Diver in very cold water since the hot water is a life support system under such conditions. Hot water temperature must be carefully monitored to ensure that the water is delivered at the proper temperature. When using the hot water suit, wet suit liners must be worn. The hose on the surface must be monitored to ensure it does not melt into the ice. When not in use, the heater and hoses must be thoroughly drained and dried to prevent freezing and rupture.

Clothing

Proper planning must include protecting Tenders and topside support personnel from the environment. However, bulky clothing and heavy mittens make even routine tasks difficult for topside personnel. Waterproof outer gloves and boots may also be considered. Regardless of the type of clothing selected, the clothing must be properly fitted (loosely worn), and kept clean and dry to maximize insulation. In planning operations for such conditions, reduced efficiency resulting in longer on-site time must be considered. Refer to the *Polar Operations Manual* for complete information on thermal protection of support personnel and equipment.

Ancillary Equipment

A detailed reconnaissance of the dive site will provide the planner with information that is helpful in deciding what ancillary equipment is required. Diving under ice will require special accessory equipment such as a line with lights for underwater navigation, ice-cutting tools, platforms, engine protection kits, and stainless steel ice screws.

The method of cutting the hole through the ice depends on ice thickness and availability of equipment. Normally, two or more of the following tools are used: hand ice chipper, ice handsaw, ice auger, chain saw, thermal ice cutter, or blasting equipment. In addition, equipment to lift the ice block, remove the slush, and mark the hole is required. Sandbags, burlap bags, or pallets for the Tenders to stand on are also needed. Ladders should be in place in case a Tender falls into the hole. If there is a possibility of surface support personnel falling through the ice, floatable work platforms, such as an inflated Zodiac boat, should be used. With such flotation equipment, the operation could be continued or safely concluded if the ice breaks up.

Gasoline and diesel engines must be cold weather modified to prevent engine freeze-up. Vibrations of engines running on the ice can be a problem and vibration-dampening platforms may be required.

Dive Site Shelter

Tent equipment including framing and flooring material may be required to construct a dive site shelter and a windbreak. Depending on the severity of the climate, remoteness of the site, and duration of the mission, shelters can range from small tents to steel sea-land vans and elaborate insulated huts transported to the site and erected from kits. Dive site shelters should have storage areas for dry items and a place for drying equipment. Benches should be provided for dressing Divers, flooring should be installed for insulation, and heating and lighting should be adequate. In an extremely cold and dry climate, fire and inadequate ventilation are ever-present dangers. A carbon monoxide detection kit should be available and periodic checks made of all living and working spaces. Fire extinguishers shall be available in each shelter.

PREDIVE PROCEDURES

Personnel Considerations

The Diving Supervisor must ensure that all personnel required to make the dive have been properly trained in ice-diving techniques and are physically fit. No Diver may be allowed to make the dive if, in the opinion of the Diving Supervisor, the Diver is suffering from the psychological stress of an ice dive (anxiety, claustrophobia, or recklessness).

Dive Site Selection Considerations

The selection of the dive site will depend upon the purpose of the dive and the geographical environment of the area (ice thickness, ice surface conditions, etc.). Additionally, the diving method chosen, safe access routes, shelter location, emergency holes, and exposure of Divers and required support personnel will also have a bearing on site selection.

Shelter

When ice diving is conducted, a shelter must be erected as close as possible to the diving site to reduce the probability of frostbite and equipment freeze-up. Normally, tents are not placed over the dive hole because they would restrict the movement of Tenders and light available to the Diver. However, a windbreak should be constructed. A shelter of modular tents and space heaters is ideal, although precautions must be taken to ensure that the ice beneath the shelter is not weakened. Extreme caution must be used when diving for objects, such as downed aircraft, that have fallen through the ice; the area around the original hole may be dangerously weakened.

Entry Hole

Proper equipment should be used to cut a suitable hole or holes through the ice in order to leave a clean edge around the hole. Using a sledgehammer to break through the ice is not recommended, as it will weaken the surrounding ice. The hole should be a rectangle 6 feet by 3 feet, or a triangle with six-foot sides. The triangular hole is easier to cut and is large enough to allow simultaneous exit by two Divers. Slush and ice must be removed from the hole, not pushed under the ice surface, as it could slip back and block the hole. To assist exiting Divers and improve footing for other team members on the ice surface, sand, wooden pallets, or burlap bags should be placed on the ice around the hole. Upon completing the dive, the hole must be clearly marked to prevent anyone from falling in accidentally. When possible, the pieces cut from the ice should be replaced to speed up the refreezing process.

Escape Holes

Escape holes provide alternative exit points and aid in searching for a lost Diver. Downstream escape holes or emergency exit holes must be cut in the ice when diving in a river or bay where there is a current or tidal stream.

Navigation Lines

A weighted line should be hung through the hole to aid the Diver in retaining his bearing and sense of direction. Suspending a light at the end of the line may be helpful, as well as attaching a series of strobe lights to indicate depth. After locating the work site, a distance line should be laid from the weighted line to the work site. Another method of aiding the Diver in keeping his bearings in clear water is to shovel the snow cover on the ice around the dive site in the form of a spoked wheel. When the ice and snow cover is less than 2 feet thick, the Diver should be able to see the spokes leading to the dive hole located at the center of the wheel. The wheel should have a minimum diameter of 60 feet.

Lifelines

Diver tending lines are mandatory when diving under ice to help the Diver relocate the entrance hole. A polypropylene braided or twisted line has proven to be the best lifeline. It has the advantage of floating up and away from the Diver and is available in yellow, white, and orange for high visibility. A bowline or a D-ring and snap hook spliced into the lifeline is the easiest method of attaching the lifeline to the Diver. The attachment of the lifeline on both ends must be absolutely secure. Do not tie the line to a vehicle, shovel, first aid box, or other portable equipment. The preferred method to secure the bitter end of the lifeline is with a stainless steel ice screw threaded into the ice. Alternatively, a 4-inch by 4-inch by 2-foot board placed under the ice several yards away from the dive hole can be used to secure the bitter end of the lifeline. The D-ring and snap hook allow the quickest transfer of the lifeline from Diver to Diver on the surface, provided the snap hooks are not frozen shut. The snap hooks should be checked for corrosion at frequent intervals. A wet lifeline must be kept off the bare ice to prevent it from freezing to the surface.

Equipment Preparation

The Diver must wear a distress light that should be turned on upon entering the water. Divers should not be encumbered with unnecessary equipment during cold-water dives. Snorkels should be removed and knives worn on the inside of the leg to help prevent the lifeline from snagging on the Diver's equipment. Personnel, Divers, and Tenders must handle rubber accessories such as masks and fins carefully; extreme cold causes them to become brittle.

UNDERWATER PROCEDURES

Buddy Diving

Diving under the ice or in extremely cold waters requires the use of paired dive partners. When diving through the ice, the pair shall always be surface tended. The life-threatening consequences of suit failure, regulator freeze-up or other equipment problems make a solitary tended SCUBA Diver particularly vulnerable. Divers must practice buddy breathing prior to the operation because of the increased possibility that buddy breathing will be required. Proficiency in the process will minimize loss of valuable time during an emergency. Using approved cold-water SCUBA equipment will minimize or eliminate freeze-up problems.

Tending the Diver

The lifeline is to be held by the Tender at all times. As an additional safety measure during ice diving, the end of the lifeline must be secured to a stationary object to prevent it from falling into the entry hole should it be dropped by the Tender. It is recommended that the lifeline be marked at 10-foot intervals to allow the Tender and Diving Supervisor to estimate the Diver's position. However, the Diver's radial position can only be roughly estimated. The dive team must be thoroughly familiar with the procedures for umbilical tending.

Tending line sensitivity and awareness of the Diver's position by Tenders may be difficult with the added factors of lifeline drag on subsurface ice formations, line drag over the lip of the under-ice hole, tending through heavy mittens, and the lack of surface bubbles.

Standby Diver

The Standby Diver and Tender must be immediately available. The Standby Diver should be kept warm until the Diving Supervisor determines that the Standby Diver is needed. If possible, a shelter or windbreak at the hole should be used. The lifeline of the Standby Diver should be twice the length of the Diver's lifeline in order to perform a thorough circular search. The Standby Diver must be dressed with the exception of fins, mask, and tanks. These will be ready to don immediately.

OPERATING PRECAUTIONS

Normal procedures generally apply to diving in extremely cold environments. However, the increased likelihood of regulator freeze-up calls for total familiarity with the buddy breathing procedures. This section outlines some of the precautions for operating in cold and ice-covered water.

General Precautions

General precautions for ice and cold water diving operations include:

- Divers should be well rested, have a meal high in carbohydrates and protein, and should not consume any alcohol. Alcohol dilates the blood vessels in the skin, thus increasing body heat loss.
- Bathing is an important health measure to prevent infectious diseases prevalent in cold environments. If necessary, the body can be sponge-bathed under clothing.
- After bathing, a soothing ointment or lotion should be applied to the skin to keep it soft and protect it against evaporation caused by the dry air.

- Shaving and washing the face should be done in the evening because shaving removes protective oils from the skin. Shaving too close can also remove some of the protective layer of the skin, promoting frostbite.

Ice Conditions

The inconsistency and dynamics of ice conditions in any particular area can make diving operations extremely hazardous. The movement of ice floes can be very significant over a relatively short period, requiring frequent relocation of dive sites and the opening of new access holes in order to work a fixed site on the sea floor. Diving from drifting ice or in the midst of broken free ice is dangerous and should be conducted only if absolutely necessary.

Differential movement of surface and subsurface pressure ridges or icebergs could close an access hole, sever a diving umbilical, and isolate or crush a Diver. The opening of a rift in the ice near a dive site could result in loss of support facilities on the ice, as well as Diver casualties.

Dressing Precautions

With a properly fitting suit and all seals in place, the Diver can usually be kept warm and dry for short periods in even the coldest water. When dressing for an ice or cold-water dive:

- Thermal protection suits should be checked carefully for fabric cuts and separations. Thermal protection suits should expose only a minimum of facial area.
- Mittens, boots, and seals should prevent water entry, while causing no restriction of circulation. Wearing a knitted watchcap under the hood of a dry suit is effective in conserving body heat.

With the cap pushed back far enough to permit the suit’s face seal to seat properly, the head will be relatively dry and comfortable.

On-Surface Precautions

While on the surface:

- Suited Divers should be protected from overheating and associated perspiring before entering the water. Overheating easily occurs when operating from a heated hut, especially if Diver exertion is required to get to the dive site. The Divers’ comfort can be improved and sweating delayed before entering the water by cooling the Divers face with a damp cloth and fanning every few minutes. Perspiration will dampen undergarments, greatly reducing their thermal insulating capabilities.

- While waiting to enter the water, Divers should avoid sitting on or resting their feet on the ice or cold floor of a hut. Even in an insulated hut, the temperature at the floor may be near freezing.
- Time on the surface with the Diver suited, but relatively inactive, should be minimized to prevent chilling of the Diver. Surface time can also cool metal components of the diving gear, such as suit valves and SCUBA regulators, below the freezing point and cause the parts to ice up when the Diver enters the water. Dressing rehearsals prior to diving will help minimize surface delays.
- When operating from an open boat, heavy parkas or windbreakers should be worn over the exposure suits.
- When operating at the surface in newly formed ice, care should be taken to avoid cutting exposed facial skin. Such wounds occur easily and, although painless because of the numbness of the skin, usually bleed profusely.
- Diving from a beach and without a support vessel should be limited to a distance that allows the Divers to return to the beach if the suit floods.
- Extreme caution must be exercised when diving near ice keels in Polar Regions, as they will often move with tidal action, wind, or current. In doing so, they can foul umbilical's and jeopardize the Divers' safety.

In-Water Precautions

- Because severe chilling can result in impaired judgment, the tasks to be performed under water must be clearly identified, practiced, and kept simple.
- A dive should be terminated upon the onset of involuntary shivering or severe impairment of manual dexterity.
- If the exposure suit tears or floods, the Diver should surface immediately, regardless of the degree of flooding. The extreme chilling effect of frigid water can cause thermal shock within minutes, depending on the extent of flooding.
- Divers and Diving Supervisors must be aware of the cumulative thermal effect of repetitive diving. A thermal debt can accumulate over successive

diving days, resulting in increased fatigue and reduced performance. The progressive hypothermia associated with long, slow cooling of the body appears to cause significant core temperature drop before shivering and heat production begins.

Postdive Precautions

Upon exiting cold water, a Diver will probably be fatigued and greatly susceptible to additional chilling:

- If a wet suit was worn, immediate flushing with warm water upon surfacing will have a comforting, heat-replacing effect.
- Facilities must be provided to allow the Diver to dry off in a comfortable, dry, and relatively warm environment to regain lost body heat.
- The Diver should remove any wet dress, dry off, and don warm protective clothing as soon as possible. Personnel should have warm, dry clothing, blankets, and hot non-alcoholic beverages available to them.

EMERGENCYPROCEDURES

Lost Diver

A Diver who becomes detached from the lifeline and cannot locate the entrance hole should:

1. Ascend to the underside of the ice.
2. Remove weight belt and allow it to drop.
3. Thread an ice screw onto underside of the ice to maintain position.
4. Remain in a vertical position, to maximize vertical profile and thereby snag the searching Standby Diver's lifeline.
5. Watch for lifeline and the lifeline of the Standby Diver and wait for the Standby Diver to arrive. The lost Diver MUST NOT attempt to relocate the hole. The Diver must remain calm and watch for the Standby Diver.

Searching for a Lost Diver

As soon as the Tender fails to get a response from the Diver, the Tender must notify the Diving Supervisor immediately. These procedures are to be implemented at once:

1. The Diving Supervisor shall immediately recall all other Divers.
2. The Diving Supervisor must estimate the probable location of the lost Diver by assessing the Diver's speed and direction of travel.

3. As directed by the Diving Supervisor, the Standby Diver enters the water and swims in the indicated direction, a distance equal to twice that believed to be covered by the lost Diver. The distance may be the full extent of the Standby Diver's lifeline since it is twice as long as the lost Diver's lifeline.
4. The Tender must keep the Standby Diver's lifeline taut.
6. The Standby Diver conducts a circular sweep.
7. When the lifeline snags on the lost Diver, the Standby Diver swims toward the Diver signaling the Tender to take up slack.
8. Upon locating the lost Diver, the Standby Diver assists the Diver back to the hole.
9. If the first sweep fails, it should be repeated only once before moving the search to the most likely emergency hole.

Hypothermia

When diving in cold water, hypothermia may predispose the Diver to decompression sickness. Hypothermia is easily diagnosed. The hypothermic Diver loses muscle strength, the ability to concentrate and may become irrational or confused. The victim may shiver violently, or, with severe hypothermia, shivering may be replaced by muscle rigidity. Profound hypothermia may so depress the heartbeat and respiration that the victim appears dead. However, a Diver should not be considered dead until the Diver has been rewarmed and all resuscitation attempts have been proven to be unsuccessful.

Hypothermia demands immediate treatment and prompt evacuation to a medical facility. A hypothermic Diver must not be allowed to walk; the Diver should be transported in a horizontal position. Improper handling of the Diver can cause dangerous rhythms of the heart and a drop in the body core temperature, known as after drop.

ADDITIONAL REFERENCES

For information on extreme cold weather conditions and the polar environment, refer to:

- *A Guide to Extreme Cold Weather Operations* (Naval Safety Center, July 1986)
- *Polar Operations Manual* S0300-A5-MAN-010 (Naval Coastal Systems Center) (NCSC)
- *Guide to Polar Diving* (Office of Naval Research, June 1976)

- *UCT Arctic Operation Manual* NAVFAC P-992(To obtain a copy of this manual contact NAVFAC Ocean Facilities Programs.)

ACTIVITY HAZARDS ANALYSIS

Date Prepared (mm-dd-yyyy): 11/08/2012

Project: Wallops Flight Facility Job: Air Lift Operations

Prepared By: Reviewed By: Risk Assessment Code (RAC): H

Recommended Protective Clothing & Equipment:
• Diver's Air Control Box with Two Diver Radios • Diver's Helmet • 5-Part Umbilicals

E = Extremely High Risk
H = High Risk
M = Moderate Risk
L = Low Risk

Severity \ Probability	Frequent	Likely	Occasional	Seldom	Unlikely
Catastrophic	**E**	**E**	**H**	**H**	**M**
Critical	**E**	**H**	**H**	**M**	**L**
Marginal	**H**	**M**	**M**	**L**	**L**
Negligible	**M**	**L**	**L**	**L**	**L**

JOB STEPS	HAZARDS	ACTIONS TO ELIMINATE OR MINIMIZE HAZARDS	EM 385-1-1 (PARA REF)
1. Connect air lift to tool air compressor	Step 1: 1. Personnel injury due to hose rupture, coupling failure and/or improper connection	All steps 1. Ensure all personnel are trained and qualified IAW EM385-1-1. 2. Conduct all operations IAW VRH Safe Practices Manual and Emergency Management Plan. Step 1: 1. Inspect all tool hoses for damage prior to use. 2. Tag all unsuitable hoses "Out of Service" and remove from the work area immediately. 3. Ensure all hose connections are secured with cotter pins and whip-checks.	30.A.18 30.A.06 (b) 30.A.16 30.A.27 (b)
2. Deliver air lift to diver location	Step 2: 2. Diver injury/equipment damage due to collision with small boat or propeller strike 3. Umbilical failure due to propeller strike	Step 2: 1. Wait until the diver is on the surface before approach. 2. Do not operate outboard motor within 10 feet of the diver or umbilical. 3. Approach the diver from down current and down wind. 4. Stop engine when closer than 5 feet to Diver.	30.B.05 (a) (b) 30.A.05

ACTIVITY HAZARDS ANALYSIS

Date Prepared (mm-dd-yyyy): 11/08/2012

Project: Wallops Flight Facility Job: Air Lift Operations

JOB STEPS	HAZARDS	ACTIONS TO ELIMINATE OR MINIMIZE HAZARDS	EM 385-1-1 (PARA REF)
		5. Diver swim to boat to retrieve air lift	
3. Turn on air at compressor	Step 3: 1. Loss of buoyancy control due to improper valve position on air lift 2. Loss of air lift control due to unexpected activation	Step 3: 1. Do not attach the air lift to the Diver. 2. Diver return to bottom with air lift and positions himself for operation ensuring that all equipment is clear of the airlift suction and discharge. 3. Diver verifies air lift air control valve is in the OFF position. 4. When the diver requests air for the air lift, start tool compressor and slowly open air valve. 5. Report to Diver, "air line is charged". 6. Diver test air lift and reports to topside positive function test. 7. Topside personnel remain prepared to secure air lift air at the compressor in the event of an emergency.	30.F.01 30.A.06 (b)
3. Use air lift to perform underwater excavations	Step 4: 1. Diver loss of depth control due to clogging of air lift	Step 4: 1. Diver keeps his hand on the air control valve at all times when in operation. 2. Diver secure air supply valve if he notes excessive thrust from the air lift. 3. Top side secure the air lift air supply at the compressor if the Diver reports he has lost control. 4. Report all ordnance finds while excavating with the air lift.	30.A.06 30.A.06 (b)

ACTIVITY HAZARDS ANALYSIS

Date Prepared (mm-dd-yyyy): 11/08/2012

Project: Wallops Flight Facility   Job: Air Lift Operations

EQUIPMENT TO BE USED	INSPECTION REQUIREMENTS	TRAINING REQUIREMENTS
Divers Air Control Box with Two Diver Radio	Daily safety inspections Divers Air control Box with Two Diver Radio Pneumofathometer Video System Function Test	HAZCOM 40Hr. HAZWOPER Site-specific Indoctrination Training Diver Training Dive Supervisor Training
Divers Helmet	Daily safety inspections Divers Helmet Predive/Postdive Video System function test	HAZCOM 40Hr. HAZWOPER Site-specific Indoctrination Training Diver Training Dive Supervisor Training
5 part Umbilicals	Daily safety inspections Divers Helmet Divers Air control Box with Two Diver Radio Pneumofathometer	HAZCOM 40Hr. HAZWOPER Site-specific Indoctrination Training Diver Training Dive Supervisor Training

Involved Personnel:

ACTIVITY HAZARDS ANALYSIS

Date Prepared (mm-dd-yyyy): 11/08/2012

Project: Wallops Flight Facility Job: Diver's Breathing Air Compressor Operations

Prepared By: Reviewed By: Risk Assessment Code (RAC): M

Recommended Protective Clothing & Equipment:

- Divers Air Compressor
- Air Receiver
- Divers Air Control Box with Two Diver Radio Divers
- Helmet
- 5-part Umbilicals

E = Extremely High Risk
H = High Risk
M = Moderate Risk
L = Low Risk

		Probability				
		Frequent	Likely	Occasional	Seldom	Unlikely
Severity	Catastrophic	E	E	H	H	M
	Critical	E	H	H	M	L
	Marginal	H	M	M	L	L
	Negligible	M	L	L	L	L

JOB STEPS	HAZARDS	ACTIONS TO ELIMINATE OR MINIMIZE HAZARDS	EM 385-1-1 (PARA REF)
1. Check Engine Fuel Level	Step 1: 1. Compressor stoppage due to low fuel 2. Diver injury due to insufficient air supply	All steps: 1. Ensure all personnel are trained and qualified IAW EM385-1-1 2. Conduct all operations IAW VRH Safe Practices Manual and Emergency Management Plan 3. Operate engine and compressor IAW manufacturers guidelines Step 1: 4. Fill engine fuel tank while stopped 5. Ensure engine fuel tank is filled at beginning of dive day and shift change	16.A.01 1.B.02
2. Check engine and compressor lubricating oil level	Step 2: 1. Engine and/or compressor damage 2. Compressor stoppage due to bearing failure	Step 2: 1. Check engine and compressor oil at each refueling 2. Inspect dipstick for oil color change or excessive wear products (i.e. metal particles) 3. Add oil as necessary	16.A.01 1.B.02
3. Connect air intake to compressor	Step 3: 1. Diver injury due to CO or other toxic fume poisoning	Step 3: 1. Connect intake mast ensuring it is upwind of all engine exhaust	30.F.04
4. Connect Air Compressor to Air Receiver	Step 4: 1. Diver injury due to insufficient air supply	Step 4: 1. Do not utilize breathing air compressor	30.F.02 30.A.27 (a)

ACTIVITY HAZARDS ANALYSIS

Date Prepared (mm-dd-yyyy): 11/08/2012

Project: Wallops Flight Facility Job: Diver's Breathing Air Compressor Operations

JOB STEPS	HAZARDS	ACTIONS TO ELIMINATE OR MINIMIZE HAZARDS	EM 385-1-1 (PARA REF)
	as a result of improper valve alignment	without volume tank 2. Tighten all air fittings with a wrench 3. Diving supervisor verify valve alignment	
5. Connect Air Receiver to Air Control Box	Step 5: 1. Diver injury due to insufficient air supply as a result of improper valve alignment	Step 5: 1. Do not utilize breathing air compressor without volume tank 2. Tighten all air fittings with a wrench 3. Diving supervisor verify valve alignment	30.F.02 30.A.27 (a)
6. Connect Divers Umbilical to Air Control Box	Step 6: 1. Diver injury due to insufficient air supply as a result of improper valve alignment	Step6: 1. Do not utilize breathing air compressor without volume tank 2. Tighten all air fittings with a wrench 3. Diving supervisor verify valve alignment	30.F.02 30.A.27 (a)
7. Connect helmet to umbilical	Step 7: 1. Diver injury due to insufficient air supply as a result of improper valve alignment	Step 7: 1. Do not utilize breathing air compressor without volume tank 2. Tighten all air fittings with a wrench 3. Diving supervisor verify valve alignment	30.F.02 30.A.27 (a)
8. Start compressor	Step 8: 1. Personnel/Equipment damage due to malfunction of air system safeties	Step 8: 1. Observe compressor for proper functioning 2. Function test relief valves 3. Drain air receiver and filters	30.A.27 (b)
9. Check operating pressures	Step 10: 1. Diver injury due to insufficient air supply as a result of improper valve alignment 2. Diver Injury due to CO or other toxic fume poisoning	Step 9: 1. Verify breathing system in diver's hat is performing within manufacturers recommended limits 2. Breathe air on surface for a minimum of 5 minutes prior to commencing dive 3. Diver report any unusual odor or feelings	30.A.27 (b)
10. Test diver air supply	Step 10: 1. Diver injury due to insufficient air supply as a result of improper valve alignment 2. Diver Injury due to CO or other toxic fume poisoning	Step10: 1. Verify breathing system in diver's hat is performing within manufacturers recommended limits 2. Breathe air on surface for a minimum of 5 minutes prior to commencing dive 3. Diver report any unusual odor or feelings	30.A.27 (b)

ACTIVITY HAZARDS ANALYSIS

Date Prepared (mm-dd-yyyy): 11/08/2012

Project: Wallops Flight Facility Job: Diver's Breathing Air Compressor Operations

EQUIPMENT TO BE USED	INSPECTION REQUIREMENTS	TRAINING REQUIREMENTS
Divers Air Compressor	Daily safety inspections Divers Helmet Diver's Air control Box with Two Diver Radio Air Filters Air System Drains Air System Relief Valves	HAZCOM 40Hr. HAZWOPER Site-specific Indoctrination Training Diver Training Dive Supervisor Training
Air Receiver	Daily safety inspections Divers Helmet Divers Air control Box with Two Diver Radio Air Filters Air System Drains Air System Relief Valves	HAZCOM 40Hr. HAZWOPER Site-specific Indoctrination Training Diver Training Dive Supervisor Training
Divers Air Control Box with Two Diver Radio	Daily safety inspections Divers Helmet Divers Air control Box with Two Diver Radio Pneumofathomneters	HAZCOM 40Hr. HAZWOPER Site-specific Indoctrination Training Diver Training Dive Supervisor Training
Divers Helmet	Daily safety inspections Divers Helmet Predive/Postdive	HAZCOM 40Hr. HAZWOPER Site-specific Indoctrination Training Diver Training Dive Supervisor Training
5 part Umbilicals	Daily safety inspections Divers Air control Box with Two Diver Radio Pneumofathometers	HAZCOM 40Hr. HAZWOPER Site-specific Indoctrination Training Diver Training Dive Supervisor Training

Involved Personnel:

ACTIVITY HAZARDS ANALYSIS

Date Prepared (mm-dd-yyyy): 11/08/2012

Project: Wallops Flight Facility   Job: Diving Operations – Ordnance Recovery

Prepared By: Reviewed By: Risk Assessment Code (RAC): H

Recommended Protective Clothing & Equipment:
• Divers Air Control Box with Two Diver Radio • Diver's Helmet • 5-Part Umbilical

E = Extremely High Risk
H = High Risk
M = Moderate Risk
L = Low Risk

Severity \ Probability	Frequent	Likely	Occasional	Seldom	Unlikely
Catastrophic	E	E	H	H	M
Critical	E	H	H	M	L
Marginal	H	M	M	L	L
Negligible	M	L	L	L	L

JOB STEPS	HAZARDS	ACTIONS TO ELIMINATE OR MINIMIZE HAZARDS	EM 385-1-1 (PARA REF)
1. Observe weather conditions.	All Steps: 1. Wind and wave action endangers all on-site personnel due to possible knock down, slips, trips and/or falls 2. Diver injury due to unstable footing 3. Tender injury due to unstable footing 4. Diver injury due to loss of depth control 5. Ineffective bottom search due to loss of diver bottom position 6. Inability to adequately control the dive due to weather conditions interfering with the safe operation of equipment 7. Danger to personnel and equipment due to other work being conducted in area Step 1: 1. Injury to personnel due to inadequate site control 2. Injury to personnel due to improper equipment operation.	All steps: 1. Ensure all personnel are trained and qualified IAW EM385-1-1. 2. Conduct all operations IAW VRH Safe Practices Manual and Emergency Management Plan. 3. Ensure all divers are graduates of an approved Diving Curriculum and are fully qualified UXO Technicians Step 1: 1. Dive Supervisor carefully assess weather conditions to include wind speed, wave height, current, etc. ABORT dive operations if weather conditions interfere with diving safely. 2. Ensure that the dive station is established in a location free from traffic other than may be used as part of the diving operation. 3. Ensure that the dive station is established in a location where no	30.A.01 30.A.06 (a) (b) 30.A.16 30.A.19 30.A.17 (j) 30.A.18 TP 18 30.B.01 30.B.03 25.A.01 (b)

ACTIVITY HAZARDS ANALYSIS

Date Prepared (mm-dd-yyyy): 11/08/2012

Project: Wallops Flight Facility Job: Diving Operations – Ordnance Recovery

JOB STEPS	HAZARDS	ACTIONS TO ELIMINATE OR MINIMIZE HAZARDS	EM 385-1-1 (PARA REF)
		other operation will interfere with the safe conduct of dive station control or actions in the water. 4. Inspect umbilical lay down area for any items which may damage umbilicals (i.e., sharp rocks, debris, etc.). 5. Ensure visual barriers are in place to protect umbilicals and air whips. 6. Ensure standby diver is fully dressed, connected to his umbilical and prepared to respond at the direction of the Diving Supervisor. 7. Notify all on-site personnel dive operations are commencing.	
2. Inspect dive station.	Step 2: 1. Injury to personnel due to inadequate site control 2. Injury to personnel due to improper equipment operation	Step 2: 1. Dive Supervisor carefully assess weather conditions to include wind speed, wave height, current, etc. ABORT dive operations if weather conditions interfere with diving safely. 2. Ensure that the dive station is established in a location free from traffic other than may be used as part of the diving operation. 3. Ensure that the dive station is established in a location where no other operation will interfere with the safe conduct of dive station control or actions in the water. 4. Inspect umbilical lay down area for any items which may damage umbilicals (i.e., sharp rocks, debris, etc.). 5. Ensure visual barriers are in place to protect umbilicals and air whips. 6. Ensure standby diver is fully dressed, connected to his umbilical and prepared to respond at the direction of the Diving Supervisor. 7. Notify all on-site personnel dive operations are commencing.	30.A.01 30.A.06 (a) (b) 30.A.16 30.A.19 30.A.17 (j) 30.A.18 TP 18 30.B.01 30.B.03 (a) (b) 30.A.18 30.A.19 30.A.27 (a-g)
3. Begin dive.	Step 3: 1. Diver injury due to inability to	Step 3: 1. ABORT dive operations if weather	30.A.01 30.B.03

ACTIVITY HAZARDS ANALYSIS

Date Prepared (mm-dd-yyyy): 11/08/2012

Project: Wallops Flight Facility Job: Diving Operations – Ordnance Recovery

JOB STEPS	HAZARDS	ACTIONS TO ELIMINATE OR MINIMIZE HAZARDS	EM 385-1-1 (PARA REF)
	maintain depth control 2. Diver injury due to unstable footing 3. Tender injury due to unstable footing	conditions interfere with diving safely. 2. Tender escort the diver into the water while keeping a firm grasp on his harness to prevent the diver from falling due to unstable footing or visibility limited by the dive helmet. 3. Ensure diver slowly enters the water being tightly tended in the event of falling. 4. Dive supervisor assess if the standby needs to be positioned closer to the water's edge in the event of an emergency. 5. If the diver entry point is distant from the divers control station, position the standby diver next to the water entry 6. Ensure the standby diver umbilical is staged for use	30.F.06 (g) (h)
4. Conduct instrument assisted Jackstay search to locate submerged ferrous metal objects.	Step 4: 1. Diver injury due to inability to maintain depth control 2. Inadequate search due to diver deviation from Jackstay line.	Step 4: 1. ABORT dive operations if weather conditions interfere with diving safely. 2. Diver search visually and with magnetometer 5ft wide corridor centered on the Jackstay line. 3. Diver maintain contact either visually or physically to ensure 100% coverage of the search corridor.	30.A.01 30.A.06 (a) (b) 30.A.16 30.A.19 30.A.17 (j) 30.A.18 30.B.01 30.B.03 (a) (b) 30.A.18 30.A.19 30.A.27 (a-g)
5. Report any item suspected to be ordnance related and identify with assistance from topside personnel.	Step 5: 1. Diver injury due to inadvertent disturbance of an ordnance item not acceptable to move. 2. Diver injury due to improper identification of ordnance condition (Acceptable to move/not acceptable to move)	Step 5: 1. STOP search and request identification assistance from topside when an item suspected of being ordnance related is encountered. 2. DO NOT disturb any item until it has been positively identified. 3. Dive Supervisor and at least one UXO Technician III and/or contractor and government OE Safety Specialist view video feed and direct diver to collect data needed for positive identification	30.A.16 25.A.01 (b)

ACTIVITY HAZARDS ANALYSIS

Date Prepared (mm-dd-yyyy): 11/08/2012

Project: Wallops Flight Facility Job: Diving Operations – Ordnance Recovery

JOB STEPS	HAZARDS	ACTIONS TO ELIMINATE OR MINIMIZE HAZARDS	EM 385-1-1 (PARA REF)
		and status of condition (acceptable to move/not acceptable to move). 4. DO NOT move items unless all parties agree it is acceptable to move. 5. Mark item with float if not acceptable to move. 6. Recover item if acceptable to move. 7. Any item located which is not acceptable to move may be removed at the discretion of the diver and/or Diving Supervisor.	
6. Investigate instrument responses indicating possible buried ordnance.	Step 6: 1. Diver injury due to improper air lift operation 2. Diver injury due to inadvertent disturbance of an ordnance item not acceptable to move 3. Diver injury due to improper identification of ordnance condition (Acceptable to move/not acceptable to move)	Step 6: 1. In the event of an instrument response with no visual indication of an item being present on the bottom air lift will be used to remove the overburden and expose the item. 2. Use the air lift to partially expose the item and then secure the air lift and continue exposing the item by hand digging Remove the material adjacent to the item while not disturbing the item. 3. DO NOT disturb any item until it has been positively identified. 4. Dive Supervisor and at least one UXO Technician III and/or contractor and government OE Safety Specialist view video feed (real time) and direct diver to collect data needed for positive identification and status of condition (acceptable to move/not acceptable to move). 5. DO NOT move items unless all parties agree it is acceptable to move 6. Mark item with float if not acceptable to move. 7. Recover item if acceptable to move.	25.A.01 (b) TP 18
7. Recover items located.	Step 7: 1. Diver injury/Equipment damage due to collision with small boat or propeller strike 2. Umbilical failure due to propeller strike	Step 7: Notes: 1. Small items may be brought to the surface.	

ACTIVITY HAZARDS ANALYSIS

Date Prepared (mm-dd-yyyy): 11/08/2012

Project: Wallops Flight Facility Job: Diving Operations – Ordnance Recovery

JOB STEPS	HAZARDS	ACTIONS TO ELIMINATE OR MINIMIZE HAZARDS	EM 385-1-1 (PARA REF)
		2. Items too large for diver carry will be recovered by topside support personnel 3. Diver may swim the item to the surface for recovery by boat or walk the item to shallow water and pass to support personnel. 4. The Diver will attach a pull line for all items too large to be handled by the Diver. Recommended Controls: 1. Wait until the diver is on the surface before approach. 2. Do no operate outboard motor with 10 feet of the Diver or umbilical. 3. Approach the Diver from down current and down wind. 4. Stop engine when closer than 5 feet to Diver. 5. Diver pass item to personnel in small boat. 6. Do not attempt to pull items until Diver is clear. 7. Ensure umbilical is clear of pull line and direction of pull prior to pulling.	

ACTIVITY HAZARDS ANALYSIS

Date Prepared (mm-dd-yyyy): 11/08/2012

Project: Wallops Flight Facility   Job: Diving Operations – Ordnance Recovery

EQUIPMENT TO BE USED	INSPECTION REQUIREMENTS	TRAINING REQUIREMENTS
Divers Air Control Box with Two Diver Radio	Daily safety inspections Divers Air control Box with Two Diver Radio Magnetometer Function test Video system function test Pneumofathometer	HAZCOM 40Hr. HAZWOPER Site-specific Indoctrination Training Diver Training Dive Supervisor Training Explosive Ordnance Disposal Air Lift Operations AHA
Divers Helmet	Daily safety inspections Divers Helmet Predive/Postdive Video system function test	HAZCOM 40Hr. HAZWOPER Site-specific Indoctrination Training Diver Training Dive Supervisor Training Explosive Ordnance Disposal Air Lift Operations AHA
5 part Umbilicals	Daily safety inspections Divers Helmet Divers Air control Box with Two Diver Radio Magnetometer Function test Video system function test Pneumofathometer	HAZCOM 40Hr. HAZWOPER Site-specific Indoctrination Training Diver Training Dive Supervisor Training Explosive Ordnance Disposal Air Lift Operations AHA

Involved Personnel:

ACTIVITY HAZARDS ANALYSIS

Date Prepared (mm-dd-yyyy): 11/08/2012

Project: Wallops Flight Facility   Job: Diving Operations

Prepared By: Reviewed By: Risk Assessment Code (RAC): M

Recommended Protective Clothing & Equipment:

- Diver's Air Control box with Two Diver Radios
- Diver's Helmet
- 5-Part Umbilical

E = Extremely High Risk
H = High Risk
M = Moderate Risk
L = Low Risk

Severity	Probability: Frequent	Likely	Occasional	Seldom	Unlikely
Catastrophic	E	E	H	H	M
Critical	E	H	H	M	L
Marginal	H	M	M	L	L
Negligible	M	L	L	L	L

JOB STEPS	HAZARDS	ACTIONS TO ELIMINATE OR MINIMIZE HAZARDS	EM 385-1-1 (PARA REF)
1. Select Site for Dive Station.	Step 1: 1. Danger to personnel and equipment due to other work being conducted in area	All steps: 1. Ensure all personnel are trained and qualified IAW EM385-1-1 2. Conduct all operations IAW VRH Safe Practices Manual and Emergency Management Plan.	30.B.01 (a-f) 30.A.18 30.A.16 30.A.19
2. Select Location for Entering and Leaving Water	Steps 1 & 2: 1. Restricted access for support personnel 2. Inability to recover diver 3. Slow standby diver deployment	Steps 1 & 2: 1. Ensure that the dive site is established in a location free from traffic or material handling equipment other than may be used as part of the diving operation 2. Place umbilicals in non-traffic areas and inspect laydown area to prevent umbilical damage	30.B.01 (a-f)
3. Ensure water is free of potential snags or obstructions	Step 3: 1. Diver impalement 2. Inability to communicate with diver 3. Damage to umbilical resulting in failure of air supply and/or communications	Step 3: 1. Ensure diver slowly enters the water by (i.e. climbing down the ladder instead of jumping) and verifies the entry point is free of hazard	30.B.01 (a-f)
4. Ensure Standby Diver has free access to the water in the event he is deployed	Step 4: 1. Slow emergency response and rescue	Step 4: 1. If the diver entry point is distant from the divers control station, position the standby diver next to the water entry 2. Ensure the standby diver umbilical is	30.B.03 (a-c)

ACTIVITY HAZARDS ANALYSIS

Date Prepared (mm-dd-yyyy): 11/08/2012

Project: Wallops Flight Facility Job: Diving Operations

JOB STEPS	HAZARDS	ACTIONS TO ELIMINATE OR MINIMIZE HAZARDS	EM 385-1-1 (PARA REF)
		staged for use	
5. Connect air supply	Step 5: 1. Insufficient life support air for diver and standby	Step 5: 1. Verify adequate primary and secondary air sources are connected and ready for use 2. Ensure air intake (if used) is free from contamination from outside sources	30.F.04 30.F.03 30.D.05 (d)

ACTIVITY HAZARDS ANALYSIS

Date Prepared (mm-dd-yyyy): 11/08/2012

Project: Wallops Flight Facility   Job: Diving Operations

EQUIPMENT TO BE USED	INSPECTION REQUIREMENTS	TRAINING REQUIREMENTS
Divers Air Control Box with Two Diver Radio	Daily safety inspections Divers Air control Box with Two Diver Radio, test operate	HAZCOM 40Hr. HAZWOPER Site-specific Indoctrination Training Diver Training Dive Supervisor Training
Divers Helmet	Divers Helmet Predive/Postdive	HAZCOM 40Hr. HAZWOPER Site-specific Indoctrination Training Diver Training Dive Supervisor Training
5 part Umbilicals	Umbilical visual inspection	HAZCOM 40Hr. HAZWOPER Site-specific Indoctrination Training Diver Training Dive Supervisor Training

Involved Personnel:

ACTIVITY HAZARDS ANALYSIS

Date Prepared (mm-dd-yyyy): 11/08/2012

Project: Wallops Flight Facility　　Job: Diving Station Set Up - Beach

Prepared By:　　Reviewed By:　　Risk Assessment Code (RAC): M

Recommended Protective Clothing & Equipment:

- Diver's LP Air Compressor
- Diver's Generator GFCI
- Diver's Air Control Box with Two Diver Radios
- Diver's Helmet
- 5-Part Umbilicals
- Diver's Hot Water Heater

E = Extremely High Risk
H = High Risk
M = Moderate Risk
L = Low Risk

Severity	Probability: Frequent	Likely	Occasional	Seldom	Unlikely
Catastrophic	E	E	H	H	M
Critical	E	H	H	M	L
Marginal	H	M	M	L	L
Negligible	M	L	L	L	L

JOB STEPS	HAZARDS	ACTIONS TO ELIMINATE OR MINIMIZE HAZARDS	EM 385-1-1 (PARA REF)
1. Observe weather conditions	Step 1: 1. Wind and wave action endangers all on-site personnel due to possible knock down, slips, trips and/or falls. 2. Diver injury due to unstable footing 3. Tender injury due to unstable footing 4. Diver injury due to loss of depth control 5. Ineffective bottom search due to loss of diver bottom position 6. Inability to adequately control the dive due to weather conditions interfering with the safe operation of equipment.	All steps: 1. Ensure all personnel are trained and qualified in accordance with EM385-1-1. 2. Conduct all operations in accordance with the VRHabilis, LLC Safe Practices Manual and Emergency Management Plan. Step 1: 1. Dive supervisor carefully assess weather conditions to include wind speed, wave height, current, etc. ABORT dive station setup if weather conditions will interfere with diving safely.	30.A.18 30.A.19 30.A.16 30.A.06 30.B.01 (a-f)
2. Select location for diver water entry/recovery	Step 2: 1. Personnel injury due to slips, trips and/or falls 2. Diver injury due to unstable footing 3. Tender injury due to unstable footing	Step 2: 1. Do not test bottom if high surf is present. ABORT dive station setup if weather conditions will interfere with diving safely or station setup. 2. Ensure support personnel testing bottom are properly dressed for operations in the surf (i.e., PFD, waders with safety belt or dry suit, walking stick to assist if footing	30.B.01 (a-f)

ACTIVITY HAZARDS ANALYSIS

Date Prepared (mm-dd-yyyy): 11/08/2012

Project: Wallops Flight Facility Job: Diving Station Set Up - Beach

JOB STEPS	HAZARDS	ACTIONS TO ELIMINATE OR MINIMIZE HAZARDS	EM 385-1-1 (PARA REF)
		proves to be unstable). 3. Do not allow personnel to test bottom conditions alone. A designated rescue person must be standing by at all times while the bottom is tested as an adequate walking surface. 4. Rescue person does not enter the surf without being tended by another individual outside the surf danger.	
3. Select location for dive station	Step 3: 1. Personnel/Equipment damage due to excessive surf and/or tidal action	Step 3: 1. Dive supervisor carefully assess weather conditions to include wind speed, wave height, current, etc. ABORT dive station setup if weather conditions will interfere with diving safely. 2. Ensure Dive Station is established in a location far enough inland so as not to be affected by rising tides and/or increasing surf.	30.B.01 (a-f)
4. Deploy Diver's support equipment a. Compressor (if used) b. Umbilicals c. Generator (if used) d. Hot Water Heater (if used) e. High Pressure Air Source f. Diver's Air Control Box	Step 4: 1. Personnel injury due to improper lifting technique. 2. Personnel Injury due to lifting heavy equipment with unstable footing (sand) 3. Personnel injury/equipment damage due to improperly secured equipment. 4. Equipment damage due to vehicles	Step 4: 1. Ensure all personnel are using safe lifting techniques 2. Use two or more personnel to lift any equipment >50lbs 3. Utilize lifting equipment if necessary to move large pieces of dive support equipment (compressor, generator, air cylinders, etc.) 4. Place planking/sheeting on ground to stabilize walking surfaces if footing proves to be unmanageable 5. Utilize planking/sheeting if necessary to move heavy support equipment with installed wheels 6. Place visual barriers to protect umbilicals and hose whips from personnel and vehicle traffic 7. Mount compressor air intake mast upwind from any source of engine	30.D.05 (a-g) 30.F.1-13

ACTIVITY HAZARDS ANALYSIS

Date Prepared (mm-dd-yyyy): 11/08/2012

Project: Wallops Flight Facility Job: Diving Station Set Up - Beach

JOB STEPS	HAZARDS	ACTIONS TO ELIMINATE OR MINIMIZE HAZARDS	EM 385-1-1 (PARA REF)
		exhaust 8. Ensure generator is grounded and GFCI is functioning	
5. Place Divers Air Control Box In Service	Step 5: 1. Diver injury due to insufficient air supply 2. Loss of diver communications 3. Improper depth measurement	Step 5: 1. Check all air fittings are tightened with an appropriately sized wrench 2. Verify emergency air supply cylinders contain a minimum of 1500 psig 3. Ensure air intake mast (if used) is free from contamination and mounted upwind from vehicle/compressor/generator exhaust 4. Verify primary and secondary air sources are connected to the Diver's Air Control Box 5. Connect Diver's Helmets to umbilicals 6. Charge umbilicals 7. Leak check all fittings 8. Function Test Diver's Helmets 9. Function Test Pneumofathometers Shift to emergency air supply and repeat 8 & 9	30.F.1-13

ACTIVITY HAZARDS ANALYSIS

Date Prepared (mm-dd-yyyy): 11/08/2012

Project: Wallops Flight Facility Job: Diving Station Set Up - Beach

EQUIPMENT TO BE USED	INSPECTION REQUIREMENTS	TRAINING REQUIREMENTS
Diver's LP Air Compressor	Daily safety inspections Compressor oil levels Engine oil level	HAZCOM 40Hr. HAZWOPER Site-specific Indoctrination Training Safe lifting techniques Diver Training Dive Supervisor Training
Diver's Generator GFCI	Daily safety inspections Engine oil levels Generator GFCI	HAZCOM 40Hr. HAZWOPER Site-specific Indoctrination Training Safe lifting techniques Diver Training Dive Supervisor Training
Diver's Air Control Box with Two Diver Radio	Daily safety inspections Emergency air supply cylinder pressure Divers Air control Box with Two Diver Radio Pneumofathometers	HAZCOM 40Hr. HAZWOPER Site-specific Indoctrination Training Safe lifting techniques Diver Training Dive Supervisor Training
Diver's Helmet	Daily safety inspections Divers Helmet Predive/Postdive	HAZCOM 40Hr. HAZWOPER Site-specific Indoctrination Training Safe lifting techniques Diver Training Dive Supervisor Training
5 Part Umbilicals	Daily safety inspections Divers Air control Box with Two Diver Radio Pneumofathometers	HAZCOM 40Hr. HAZWOPER Site-specific Indoctrination Training Safe lifting techniques Diver Training Dive Supervisor Training
Diver's Hot Water Heater	Daily safety inspections Fuel oil levels Generator GFCI Divers Hot water heater hose Divers hot water suit	HAZCOM 40Hr. HAZWOPER Site-specific Indoctrination Training Safe lifting techniques Diver Training Dive Supervisor Training

Involved Personnel:

ACTIVITY HAZARDS ANALYSIS

Date Prepared (mm-dd-yyyy): 11/08/2012

Project: Wallops Flight Facility Job: Diving Station Set Up - Boat

Prepared By: Reviewed By: Risk Assessment Code (RAC): M

Recommended Protective Clothing & Equipment:
• Diver's Air Control Box with Two Diver Radio • Diver's Helmet • 5-Part Umbilicals • Diver's HP Air Cylinders • Generator or 12 VDC Power Supply • Diver's Hot Water Heater

E = Extremely High Risk
H = High Risk
M = Moderate Risk
L = Low Risk

Severity \ Probability	Frequent	Likely	Occasional	Seldom	Unlikely
Catastrophic	**E**	**E**	**H**	**H**	**M**
Critical	**E**	**H**	**H**	**M**	**L**
Marginal	**H**	**M**	**M**	**L**	**L**
Negligible	**M**	**L**	**L**	**L**	**L**

JOB STEPS	HAZARDS	ACTIONS TO ELIMINATE OR MINIMIZE HAZARDS	EM 385-1-1 (PARA REF)
1. Observe weather conditions	Step 1: 1. Wind and wave action endangers all on-site personnel due to possible knock down, slips, trips and/or falls 2. Diver injury due to unstable footing 3. Tender injury due to unstable footing 4. Diver injury due to loss of depth control 5. Ineffective bottom search due to loss of Diver bottom position 6. Inability to adequately control the dive due to weather conditions interfering with the safe operation of equipment..	All steps: 1. Ensure all personnel are trained and qualified IAW EM385-1-1. 2. Conduct all operations IAW VRH Safe Practices Manual and Emergency Management Plan Step 1: 1. Dive supervisor carefully assess weather conditions to include wind speed, wave height, current, etc. ABORT dive station setup if weather conditions will interfere with diving safely.	30.A.18 30.A.19 30.A.16 30.A.06 (a-c) 30.B.01 (a-f)
2. Load Diver's Support Equipment a. Compressor (if used) b. Umbilicals c. Generator (if used) d. Hot Water Heater (if used) e. High Pressure Air Source f. Diver's Air Control Box	Step 2: 1. Personnel injury due to improper lifting technique 2. Personnel Injury due to lifting heavy equipment with unstable footing (wave action) 3. Personnel injury/equipment damage due to improperly secured equipment	Step 2: 1. All diving equipment will be loaded while pierside. 2. Ensure all personnel utilize safe lifting techniques. 3. Use two or more people when lifting weights>50lbs. 4. Use lifting equipment where possible. 5. Secure all equipment with	14.A.01 30.F.04 20.B.02 (a-b)

ACTIVITY HAZARDS ANALYSIS

Date Prepared (mm-dd-yyyy): 11/08/2012

Project: Wallops Flight Facility Job: Diving Station Set Up - Boat

JOB STEPS	HAZARDS	ACTIONS TO ELIMINATE OR MINIMIZE HAZARDS	EM 385-1-1 (PARA REF)
		ratcheting tie down straps or equivalent. 6. Mount compressor air intake mast (if diving compressor is used) above pilot house and upwind from compressor/generator or boat exhaust. 7. Ensure Diver's air control box is securely mounted. 8. Ensure emergency/primary air cylinders are secured.	
3. Transit to dive location	Step 3: 1. Loss of personnel overboard 2. Drowning due to falling overboard	Step 3: 1. Ensure all lifelines and rails which may have been removed during equipment load-out are replaced and secure 2. Ensure all personnel are wearing USCG approved Personal Flotation Devices prior to departure and at all times while embarked 3. All personnel maintain constant vigilance and be aware of footing and handholds 4. Ensure an accurate personnel manifest is maintained	5.A.01 (a) 19.A.03 (a) 19.A.04 (a-h)
4. Mount Diver water entry/ recovery ladder	Step 4: 1. Diver injury due to improperly mounted ladder 2. Difficulty in recovering diver in an emergency	Step 4: 1. Secure ladder using braces/ratcheting tie downs (or equivalent) 2. Diver Test ladder security prior to first dive 3. Ensure diver is fully dressed with all dive equipment in service.	30.B.01 (a-f)
3. Place Diver's air control box in service	Step 5: 1. Diver injury due to insufficient air supply 2. Loss of diver communications 3. Improper depth measurement	Step 5: 1. Check all air fittings are tightened with an appropriately sized wrench 2. Verify emergency air supply cylinders contain a minimum of 1500 psig 3. Ensure air intake mast (if used) is free from contamination and mounted upwind from vehicle/compressor/generator exhaust. 4. Verify primary and secondary air sources are connected to the diver's Air Control Box	30.F.1-13

ACTIVITY HAZARDS ANALYSIS

Date Prepared (mm-dd-yyyy): 11/08/2012

Project: Wallops Flight Facility Job: Diving Station Set Up - Boat

JOB STEPS	HAZARDS	ACTIONS TO ELIMINATE OR MINIMIZE HAZARDS	EM 385-1-1 (PARA REF)
		5. Connect Diver's Helmets to umbilicals 6. Charge umbilicals 7. Leak check all fittings 8. Function Test Diver's Helmets 9. Function Test Pneumofathometers 10. Shift to emergency air supply and repeat 8 & 9	

ACTIVITY HAZARDS ANALYSIS

Date Prepared (mm-dd-yyyy): 11/08/2012

Project: Wallops Flight Facility Job: Diving Station Set Up - Boat

EQUIPMENT TO BE USED	INSPECTION REQUIREMENTS	TRAINING REQUIREMENTS
Divers Air Control Box with Two Diver Radio	Daily safety inspections Emergency air supply cylinder pressure Divers Air control Box with Two Diver Radio Pneumofathometers	HAZCOM 40Hr. HAZWOPER Site-specific Indoctrination Training Safe lifting techniques Diver Training Dive Supervisor Training
Divers Helmet	Daily safety inspections Divers Helmet Predive/Postdive	HAZCOM 40Hr. HAZWOPER Site-specific Indoctrination Training Safe lifting techniques Diver Training Dive Supervisor Training
5 part Umbilicals	Daily safety inspections Diver's Air control Box with Two Diver Radio Pneumofathometers	HAZCOM 40Hr. HAZWOPER Site-specific Indoctrination Training Safe lifting techniques Diver Training Dive Supervisor Training
Divers HP Air Cylinders	Daily safety inspections Emergency air supply cylinder pressure Diver's Air control Box with Two Diver Radio Pneumofathometers	HAZCOM 40Hr. HAZWOPER Site-specific Indoctrination Training Safe lifting techniques Diver Training Dive Supervisor Training
Generator or 12 VDC power supply	Daily safety inspections Generator GFCI Divers Helmet Divers Air control Box with Two Diver Radio	HAZCOM 40Hr. HAZWOPER Site-specific Indoctrination Training Safe lifting techniques Diver Training Dive Supervisor Training
Divers hot water heater	Daily safety inspections Fuel oil levels Diver's Hot water hose Diver's Hot water suit	HAZCOM 40Hr. HAZWOPER Site-specific Indoctrination Training Safe lifting techniques Diver Training Dive Supervisor Training

Involved Personnel:

ACTIVITY HAZARDS ANALYSIS

Date Prepared (mm-dd-yyyy): 11/08/2012

Project: Wallops Flight Facility Job: Liveboating

Prepared By: Reviewed By: Risk Assessment Code (RAC): H

Recommended Protective Clothing & Equipment:
• Diver's Air Control Box with Two Diver Radio • Diver's Helmet • 5-Part Umbilicals • Dive Boat

E = Extremely High Risk
H = High Risk
M = Moderate Risk
L = Low Risk

Severity \ Probability	Frequent	Likely	Occasional	Seldom	Unlikely
Catastrophic	E	E	H	H	M
Critical	E	H	H	M	L
Marginal	H	M	M	L	L
Negligible	M	L	L	L	L

JOB STEPS	HAZARDS	ACTIONS TO ELIMINATE OR MINIMIZE HAZARDS	EM 385-1-1 (PARA REF)
Observe weather conditions	Step 1: Wind and wave action endangers all on-site personnel due to possible knock downs, slips, trips and/or falls Diver injury due to unstable footing Tender injury due to unstable footing Diver injury due to loss of depth control Ineffective bottom search due to loss of diver position on the bottom Inability to adequately control the dive due t weather conditions interfering with the safe operation of equipment	All Steps: Ensure all personnel are trained and qualified IAW EM385-1-1 Conduct all operations IAW VRH Safe Practices Manual and Emergency Management Plan Step 1: Dive supervisor carefully assess weather conditions to include wind speed, wave height, current, etc. ABORT dive station setup if weather conditions will interfere with diving safely	30.A.06 (a-c) 30.A.16 30.A.18 30.A.19 30.B.01 (a-f) 30.A.05
Load Diver's support equipment a. Compressor (if used) b. Umbilicals c. Generator (if used) d. Hot Water Heater (if used) e. HP Air Source f. Divers Air control console g. Divers Communication Box	Step 2: Personnel injury due t improper lifting technique Personnel injury due to lifting equipment with unstable footing (wave action) Personnel injury/equipment damage due to improperly secured equipment	Step 2: All diving equipment will be loaded while pierside Ensure all personnel utilize safe lifting techniques Use two or more people when lifting weight > 50 lbs Use lifting equipment where possible Secure all equipment with ratcheting tie-down straps or equivalent. Mount compressor air intake mast (if used) above pilot house and upwind from	14.A.01 30.F.04 20.B.02 (a-b)

ACTIVITY HAZARDS ANALYSIS

Date Prepared (mm-dd-yyyy): 11/08/2012

Project: Wallops Flight Facility Job: Liveboating

JOB STEPS	HAZARDS	ACTIONS TO ELIMINATE OR MINIMIZE HAZARDS	EM 385-1-1 (PARA REF)
		compressor/generator and boat exhaust Ensure all Divers life support equipment is securely mounted	
Transit to dive site	Step 3: Loss of personnel overboard Drowning due to falling overboard	Step 3: Ensure all lifelines and rails which may have been removed during equipment load-out are replaced and secure Ensure all personnel are wearing USCG approved Personal Floatation Devices prior to departure and at all times while embarked All personnel maintain constant vigilance and be aware of footing and handholds Ensure an accurate personnel manifest is maintained.	5.A.01 (a) 19.A.03 (a) 19.A.04 (a-h)
Mount Diver's ladder	Step 4: Diver injury due to improperly mounted ladder Difficulty recovering diver in an emergency	Step 4: Secure ladder using braces/ratcheting tie-downs or equivalent Diver test ladder security prior to first dive	30.B.01 (a-f)
Place Diver's air console and comm box in service	Step 5: Insufficient life support air for diver and standby Loss of divers communications Improper Depth measurement	Step 5: Check all air fittings are tightened with an appropriately sized wrench Verify emergency air cylinders contain a minimum of 1500 psig. Verify adequate primary and secondary air sources are connected and ready for use Ensure air intake (if used) is free from contamination from outside sources Connect Divers helmets to umbilical's Pressurize umbilical's and leak check all fittings Function test Diver's helmets Function test Pneumofathometers Shift to secondary gas supply and repeat 7 & 8	30.F.1-13
Launching/Recovering the Diver	Step 6: 1. Diver injury due to collision with boat. 2. Diver/equipment injury due to entanglement with ladder/boat	Step 6: Ensure diver slowly enters the water by (i.e., climbing down the ladder instead of jumping) and verifies the entry point is free of hazard Dive Supervisor verify coxswain has boat in neutral while launching and	30.F.1-13 30.A.16

ACTIVITY HAZARDS ANALYSIS

Date Prepared (mm-dd-yyyy): 11/08/2012

Project: Wallops Flight Facility Job: Liveboating

JOB STEPS	HAZARDS	ACTIONS TO ELIMINATE OR MINIMIZE HAZARDS	EM 385-1-1 (PARA REF)
		recovering Diver Ensure tender maintains constant awareness of Diver and umbilical location at all times	
Motoring with Diver in water	Step 7: 1. Diver injury due to dragging on/off the bottom 2. Damaged/fouled Diver's umbilical 3. Loss of Diver's communications 4. Diver injury due to loss of depth control 5. Ineffective bottom searches due to Diver loss of Diver's position on the bottom	Step 7: 1. .Coxswain maintain constant awareness of Diver's location and tend of Diver's umbilical at all times 2. Coxswain maintain constant visual contact with dive tender and respond to directions 3. Dive Supervisor ensure tend remains forward of bow and speed is as per Diver's request	30.A.05

ACTIVITY HAZARDS ANALYSIS

Date Prepared (mm-dd-yyyy): 11/08/2012

Project: Wallops Flight Facility Job: Liveboating

EQUIPMENT TO BE USED	INSPECTION REQUIREMENTS	TRAINING REQUIREMENTS
Diver's Air Control Box with Two Diver Radio	Daily Safety inspections Divers Helmet Divers Air control Box with Two Diver Radio Video System Function Test Pneumofathometer	HAZCOM 40Hr. HAZWOPER Site-specific Indoctrination Training Diver Training Dive Supervisor Training
Diver's Helmet	Daily Safety inspections Divers Helmet Predive/Postdive Diver's Air Control Box with Two Diver Radio	HAZCOM 40Hr. HAZWOPER Site-specific Indoctrination Training Diver Training Dive Supervisor Training
5 Part Umbilicals	Daily Safety inspections Divers Helmet Video System Function Test	HAZCOM 40Hr. HAZWOPER Site-specific Indoctrination Training Diver Training Dive Supervisor Training
Dive Boat	Daily Safety inspections	HAZCOM 40Hr. HAZWOPER Site-specific Indoctrination Training Diver Training Dive Supervisor Training

Involved Personnel:

APPENDIX H

UNIFORM FEDERAL POLICY-QUALITY ASSURANCE PROJECT PLAN

FINAL
UNIFORM FEDERAL POLICY
QUALITY ASSURANCE PROJECT PLAN
MILITARY MUNITIONS RESPONSE PROGRAM
PROJECT 7
BOAT BASIN, VISITORS INFORMATION CENTER

REMEDIAL INVESTIGATION
WALLOPS FLIGHT FACILITY FORMERLY USED DEFENSE SITE

WALLOPS ISLAND, VIRGINIA

Prepared by:

U.S Army Corps of Engineers
Baltimore District
10 South Howard Street
Baltimore, Maryland 21201

June 2014

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TABLE OF CONTENTS

Title **Page**

TABLE OF CONTENTS (CONTINUED)

Title **Page**

LIST OF TABLES

Title **Page**

LIST OF ATTACHMENTS

LIST OF ACRONYMS

AES	atomic emission spectroscopy
APP/SSHP	Accident Prevention Plan/Site Safety and Health Plan
BTAG	Biological Technical Assistance Group
CA	Corrective Action
CAS	Chemical Abstracts Service
CCC	calibration check compound
CCV	continuing calibration verification
CENAB	United States Army Corps of Engineers – Baltimore District
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CIH	Certified Industrial Hygienist
CLP	Contract Laboratory Program
CNAAS	Chincoteague Naval Auxiliary Air Station
COC	chain-of-custody
COD	coefficient of determination
COR	Contracting Officer's Representative
CRI	color rendering index
CVAA	Cold Vapor Atomic Absorption
DAD	diode array detector
DERP-FUDS	Defense Environmental Restoration Program for Formerly Used Defense Sites
DI	deionized water
DO	delivery order
DoD	Department of Defense
DPT	direct push technology
DQI	data quality indicator
EcoSSL	ecological soil screening level
EDD	electronic data deliverable
ELAP	Environmental Laboratory Accreditation Program
EOD	explosive ordnance disposal
EPA	United States Environmental Protection Agency
FIMS	Flow Injection Mercury Systems
FIP	Field Investigation Plan
GC/MS	gas chromatograph/mass spectrometer
HDPE	high density polyethylene
HFA	Human Factors Applications, Inc.
HPLC	High Performance Liquid Chromatography

LIST OF ACRONYMS (CONTINUED)

HRGC/HRMS	high resolution gas chromatography/high resolution mass spectrometry
ICAL	initial calibration
IC-MS	Ion Chromatography-Mass Spectrometry
ICP	inductively coupled plasma
ICV	initial calibration verification
IDW	investigation derived waste
IPA	isopropyl alcohol
IRCS	internal recovery and calibration standard
IS	internal standard
ISO	International Organization for Standards
kg	kilogram
L	liter
LC/MS	Liquid Chromatography/Mass Spectrometry
LCS	laboratory control sample
LCSD	laboratory control sample duplicate
LEED® AP	Leadership in Energy and Environmental Design Accredited Professional
LIMS	Laboratory Information Management System
LOD	limit of detection
LODV	limit of detection verification
LOQ	limit of quantitation
MC	munitions constituent
MCAWW	Methods for the Chemical Analysis of Water and Wastes
MCGI	Meridian Consultant Group, Inc.
MCL	maximum contaminant level
MD	munitions debris
MDL	method detection limit
MEC	munitions and explosives of concern
MS	matrix spike
MSD	matrix spike duplicate
MPC	measurement performance criteria
NFG	National Functional Guidelines
µg/L	microgram per liter
mg	milligram
mg/kg	milligram per kilogram

LIST OF ACRONYMS (CONTINUED)

mg/L	milligram per liter
MMRP	Military Munitions Response Program
MPPEH	Material Potentially Presenting an Explosive Hazard
MRS	Munitions Response Site
MS	matrix spike
MSD	matrix spike duplicate
NFG	National Functional Guidelines
N/A	not applicable
NAOTS	Naval Aviation Ordnance Test Station
NASA	National Aeronautics and Space Administration
NELAC	National Environmental Laboratory Accreditation Conference
ORNL	Oak Ridge National Laboratory
PAL	project action limit
PE	Professional Engineer
PG	Professional Geologist
PMP	Program Management Professional
POC	point of contact
PQO	project quality objective
psi	pounds per square inch
QA	quality assurance
QAM	Quality Assurance Manual
QAPP	Quality Assurance Project Plan
QC	quality control
QL	quantitation limit
QSM	Quality System Manual
RF	response factor
RI	remedial investigation
RPD	relative percent difference
RPM	Remedial Project manager
RRT	relative retention time
RSD	relative standard deviation
RSL	regional screening levels
SAP	Sampling and Analysis Plan
SB	small business

LIST OF ACRONYMS (CONTINUED)

SEDD	Staged Electronic Data Deliverable
SI	site inspection
S/N	signal to noise
SOP	standard operating procedure
SPCC	system performance check compound
SSC	systems, structures, and components
SVOC	semivolatile organic compound
TAL	target analyte list
TBD	to be determined
TCL	target compound list
TerranearPMC	TerranearPMC, LLC/Human Factors Applications, Inc.
THQ	target hazard quotient
TR	target risk
UFP-QAPP	Uniform Federal Policy-Quality Assurance Project Plan
U.S.	United States
USACE	U.S. Army Corps of Engineers
UXO	unexploded ordnance
VDEQ	Virginia Department of Environmental Quality
VOA	volatile organic analysis
VOC	volatile organic compound
WESTON®	Weston Solutions, Inc.
WFF	Wallops Flight Facility
WP	Work Plan

Introduction

This Quality Assurance Project Plan (QAPP) has been developed to support the Military Munitions Response Program (MMRP) Project 7 Remedial Investigation (RI) of the Boat Basin, Visitors Information Center site located at the Wallops Flight Facility (WFF) Formerly Used Defense Site (FUDS).The Boat Basin, Visitors Information Center RI is being investigated through the Defense Environmental Restoration Program for Formerly Used Defense Sites (DERP-FUDS) Contract Number W912DR-09-D-0015, Delivery Order 0035. The QAPP provides information on five areas: (1) Project Management and Objectives, (2) Measurement and Data Acquisition, (3) Field Sampling Rationale, (4) Assessment and Oversight, and (5) Data Review. This document meets the requirements and elements set forth in the Department of Defense (DoD) Quality System Manual Version 4.2 (QSM), and the Uniform Federal Policy-Quality Assurance Project Plan Manual (United States Environmental Protection Agency, EPA505-B-04-900A, Version 1, 2005 [UFP-QAPP]). This QAPP provides a process for obtaining data of sufficient quality and quantity to satisfy project needs. It describes policy, organization, functional activities, and the data quality objectives and measures necessary to obtain adequate data for a given purpose. Additionally, it clearly identifies the rationale for selection of the proposed sampling locations, analysis, and specific procedures for collecting data during the RI.

The United States Army Corps of Engineers, Baltimore District (CENAB) has contracted with Weston Solutions, Inc. (WESTON®) to complete an RI of the Boat Basin, Visitors Information Center, which encompasses approximately 1.53 acres of land that includes the Pyrotechnics Burn Area, Gun Butt Nos. 1 and 2, and South Bank Boat Basin.

Historical investigations have included an unexploded ordnance (UXO) clearance conducted in January 2006 and most recently, a Site Inspection (SI) conducted in December 2011. The SI was conducted at the Boat Basin, Visitors Information Center by Human Factors Applications, Inc. (HFA), a wholly owned subsidiary of TerranearPMC, LLC (TerranearPMC). Based on historical evidence and the results from the SI, it was concluded that evidence of munitions and explosives of concern (MEC) and munitions constituents (MC) is present at the Boat Basin, Visitors Information Center; therefore, an RI was recommended to address the presence of MEC and MC at the Boat Basin, Visitors Information Center.

Environmental sampling in accordance with this UFP-QAPP includes discrete sampling of surface and subsurface soil, sediment, surface water, and groundwater to support the characterization of the Boat Basin, Visitors Information Center. Discrete samples will be collected for MC where MEC or significant munitions debris (MD) is detected and where MC is suspected to be present based on the identification of a potential release (e.g., broken munitions, soil staining). Additional soil and groundwater samples will be collected at select areas across the site to delineate source areas and the vertical extent of soil, sediment, and groundwater contamination within the site. Environmental samples (including 15% quality control [QC] samples) will be collected from surface soil, subsurface soil, sediment, surface water, and groundwater to characterize the nature and extent of environmental contamination resulting from historical munitions activities at the Boat Basin, Visitors Information Center. The field work and data evaluation will be completed in accordance with this QAPP. As any new procedure is required, addendums to this document will be issued.

All staff participating in project/field efforts are required to read this plan and become familiar with the analytical procedures and the implementation of these procedures to ensure that analytical/sample goals are met consistently. In addition, key personnel are responsible to mentor assigned staff in aspects of this QAPP that would have a potential impact on the work assigned to them.

Boat Basin, Visitors Information Center Overview

WFF is located in Accomack County, Virginia, near the Atlantic Coast on the Delmarva Peninsula approximately 5 miles south of the Maryland-Virginia border and about 5 miles west of Chincoteague Island. The WFF FUDS property consists of the Main Base and Wallops Island. The Boat Basin, Visitors Information Center is located on the Main Base portion of the FUDS property.

The Boat Basin, Visitors Information Center was used by the Naval Aviation Ordnance Test Station (NAOTS) between 1946 and 1959. In June 1959, the U.S. Navy ceased training and flight operations and the WFF, including the Boat Basin, Visitors Information Center, was declared excess and transferred to the newly formed National Aeronautics and Space Administration (NASA) in 1961.

Boat Basin, Visitors Information Center Description, History, and Background

The U.S. Government acquired the property in Accomack County in fee in 1942 for use as a naval auxiliary air station. The airfield was commissioned 5 March 1943 and was originally known as Chincoteague Naval Auxiliary Air Station (CNAAS). The airfield was used primarily as a training facility for naval aviation units; however, it was also used for anti-submarine operations. On 26 January 1946, the Bureau of Ordnance established the NAOTS at CNAAS. CNAAS was on the Main Base and NAOTS test facilities were on Wallops Island. The NAOTS provided a test range and training for personnel to test, modify, and develop guided missiles, aircraft weapons, and aviation fire control equipment. Naval use commenced in 1946 when NAOTS established a range and constructed support facilities for research and development and to test and evaluate aviation ordnance and related systems and equipment. Based on historical documentation obtained, no known chemical warfare material activities were conducted on the WFF property. In June 1959, the U.S. Navy ceased training and flight operations. CNAAS and NAOTS were declared excess and leased to the newly formed NASA. The Main Base was formally transferred to NASA on 1 December 1961. In 1981, the facility became part of the Goddard Space Flight Center.

The Pyrotechnics Burn Area is an approximately 20-foot by 25-foot fenced in area used by the Navy to dispose of parachute flares and practice bomb signals using either gasoline or trinitrotoluene. The fencing remains and the Pyrotechnics Burn Area is overgrown with vegetation. Gun Butt No. 1 was constructed in 1952 and used to test and perfect the use of medium caliber (20 millimeter [mm] to 37mm) aviation guns and ammunition. Gun Butt No. 2 was constructed in 1952 and, similar to Gun Butt No. 1, was used to test and perfect the use of medium caliber (20mm to 37mm) aviation guns and ammunition. The South Bank Boat Basin consists of a boat basin and the surrounding bank. Dredging of the boat basin and channel was completed on 26 April 1949 by the Navy in order to establish a boat dock and basin to transport rocket testing materials from the Wallops Main Base to the Wallops Island test facilities. The South Bank Boat Basin had no known munitions use; however, numerous munitions items have been observed in this area. The boat basin is still in use occasionally by NASA and the Marine Science Consortium.

Historical investigations at the Boat Basin, Visitors Information Center include a partial UXO clearance (top 12 inches of soil) conducted in January 2006 and an SI conducted in December 2011 by HFA. The UXO clearance was considered partial because it only addressed the top 12 inches of soil in select areas around the former gun butts. No confirmed MEC was observed during the SI field event. However, three munitions debris items and seven items that could not be discounted as containing energetic material were observed. Additionally, surface and subsurface soil, sediment, surface water, and groundwater samples were collected at the Boat Basin, Visitor's Center. Iron was detected in groundwater collected at Gun Butt Nos. 1 and 2 above the background concentrations. Antimony, copper, lead, and zinc were detected in surface soil and may present potentially unacceptable risks to ecological receptors. During field activities, samples were not collected within the Pyrotechnics Burn Area because of the high concentration of subsurface anomalies (i.e., an anomaly-free sample location could not be identified). Therefore, samples could not be collected from the location most likely to contain the highest MC concentrations.

Worksheet 1 — Title and Approval Page

Document Title: UFP-QAPP, MMRP Project 7 Remedial Investigation, Boat Basin, Visitors Information Center, WFF FUDS

Lead Organization: U.S. Army Corps of Engineers (USACE), Baltimore (CENAB) District

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Preparation Date (Day/Month/Year): 18 June 2014

Investigative Organization's Senior Chemist: Gretchen M. Fodor
Gretchen Fodor/Weston Solutions, Inc.

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Tony Pace/Weston Solutions, Inc.

Investigative Organization's QA Manager: Stacie A. Popp
Stacie Popp-Young/Weston Solutions, Inc.

Approval Signatures:

Lead Organization's Project Manager: ____________________
Sher Zaman/USACE Baltimore District

Lead Organization: ____________________
Alan Warminski/USACE Baltimore District

Worksheet 2 — QAPP Identifying Information

Site Name/Project Name:	Boat Basin, Visitors Information Center MMRP RI
Site Location:	Wallops Flight Facility, VA
Site Number/Code:	Not Applicable (N/A)
Operable Unit:	N/A
Contractor Name:	Weston Solutions, Inc.
Contract Number:	W912DR-09-D-0015
Contract Title:	Military Munitions Response Program, Project 7 Boat Basin, Visitors Information Center, Remedial Investigation, Wallops Island, VA
Work Assignment Number:	N/A

1. Identify guidance used to prepare QAPP:
   Uniform Federal Policy for Quality Assurance Project Plans: Part I (UFP QAPP) Manual (March 2005)

2. Identify regulatory program:
   Military Munitions Response Program

3. Identify approval entities:
   CENAB

4. Indicate whether the QAPP is a:
   Project-Specific.

5. List dates of scoping sessions that were held:
   Army/Contractor Scoping Session – 01 November 2012

6. List dates and titles of QAPP documents written for previous WFF FUDS work, if applicable:

Title	Received Date
Final Site-Wide UFP- QAPP for CERCLA and MMRP Investigations Performed by Contractors at the Wallops Flight Facility, Accomack County, Virginia	November 2011

7. List organizational partners (stakeholders) and connection with lead organization:
   CENAB, NASA, U.S. Environmental Protection Agency (EPA) Region III and Virginia Department of Environmental Quality (VDEQ)

8. List data users:
   CENAB, NASA, EPA Region III, VDEQ, and WESTON

9. If any required QAPP elements and required information are not applicable to the project, then circle the omitted QAPP elements and required information on the attached table. Provide an explanation for their exclusion below:
   All QAPP worksheets are applicable.

Worksheet 2 — QAPP Identifying Information (Continued)

Required QAPP Element(s) and Corresponding QAPP Worksheet(s)	Crosswalk to Required Documents	Optional Worksheet in QAPP Workbook	Required Information
Project Management and Objectives			
2.1 Title and Approval Page	RI WP[1] Signature Page	1	- Title and Approval Page
2.2 Document Format and Table of Contents 2.2.1 Document Control Format 2.2.2 Document Control Numbering System 2.2.3 Table of Contents 2.2.4 QAPP Identifying Information	RI WP Table of Contents	2	- Table of Contents - QAPP Identifying Information
2.3 Distribution List and Project Personnel Sign-Off Sheet 2.3.1 Distribution List 2.3.2 Project Personnel Sign-Off Sheet	RI WP Cover Letter APP/SSHP[2] Signature page	3 4	- Distribution List - Project Personnel Sign-Off Sheet
2.4 Project Organization 2.4.1 Project Organizational Chart 2.4.2 Communication Pathways 2.4.3 Personnel Responsibilities and Qualifications 2.4.4 Special Training Requirements and Certification	RI WP Section 2.2 APP/SSHP Section 5	5 6 7 8	- Project Organizational Chart - Communication Pathways - Personnel Responsibilities and Qualifications Table - Special Personnel Training Requirements Table
2.5 Project Planning/Problem Definition 2.5.1 Project Planning (Scoping) 2.5.2 Problem Definition, Site History, and Background	RI WP Sections 1, 2	9 10	- Project Planning Session Documentation (including Data Needs tables) - Project Scoping Session Participants Sheet - Problem Definition, Site History, and Background - Site Maps (historical and present)
2.6 Project Quality Objectives and Measurement Performance Criteria 2.6.1 Development of Project Quality Objectives Using the Systematic Planning Process 2.6.2 Measurement Performance Criteria	RI WP Section 3	11 12	- Site-Specific Project Quality Objectives (PQOs) - Measurement Performance Criteria Table
2.7 Secondary Data Evaluation		13	- Sources of Secondary Data and Information - Secondary Data Criteria and Limitations Table
2.8 Project Overview and Schedule 2.8.1 Project Overview 2.8.2 Project Schedule	RI WP Sections 2.5, 3, Appendix F	14 15 16	- Summary of Project Tasks - Reference Limits and Evaluation Table - Project Schedule/Timeline Table

Worksheet 2 — QAPP Identifying Information (Continued)

Required QAPP Element(s) and Corresponding QAPP Worksheet(s)	Crosswalk to Required Documents	Optional Worksheet in QAPP Workbook	Required Information
Measurement/Data Acquisition			
3.1 Sampling Tasks 3.1.1 Sampling Process Design and Rationale 3.1.2 Sampling Procedures and Requirements 3.1.2.1 Sampling Collection Procedures 3.1.2.2 Sample Containers, Volume, and Preservation 3.1.2.3 Equipment/Sample Containers Cleaning and Decontamination Procedures 3.1.2.4 Field Equipment Calibration, Maintenance, Testing, and Inspection Procedures 3.1.2.5 Supply Inspection and Acceptance Procedures 3.1.2.6 Field Documentation Procedures	RI WP Section 3.9	17 18 19 20 21 22	- Sampling Design and Rationale - Sample Location Map - Sampling Locations and Methods/Standard Operating Procedure (SOP) Requirements Table - Analytical Methods/SOP Requirements Table - Field Quality Control Sample Summary Table - Sampling SOPs - Project Sampling SOP Reference Table - Field Equipment Calibration, Maintenance, Testing, and Inspection Table
3.2 Analytical Tasks 3.2.1 Analytical SOPs 3.2.2 Analytical Instrument Calibration Procedures 3.2.3 Analytical Instrument and Equipment Maintenance, Testing, and Inspection Procedures 3.2.4 Analytical Supply Inspection and Acceptance Procedures	QAPP Attachment A	23 24 25	- Analytical SOPs - Analytical SOP References Table - Analytical Instrument Calibration Table - Analytical Instrument and Equipment Maintenance, Testing, and Inspection Table
3.3 Sample Collection Documentation, Handling, Tracking, and Custody Procedures 3.3.1 Sample Collection Documentation 3.3.2 Sample Handling and Tracking System 3.3.3 Sample Custody	RI WP Section 3.9	26 27	- Sample Handling System - Sample Collection, Documentation Handling, Tracking, and Custody SOPs - Sample Custody Requirements Table - Sample Container Identification - Sample Handling Flow Diagram - Example Chain-of-Custody (COC) Form and Seal

Worksheet 2 — QAPP Identifying Information (Continued)

Required QAPP Element(s) and Corresponding QAPP Worksheet(s)	Crosswalk to Required Documents	Optional Worksheet in QAPP Workbook	Required Information
3.4 Quality Control Samples 3.4.1 Sampling Quality Control Samples 3.4.2 Analytical Quality Control Samples	RI WP Section 3.9.8	28	- Quality Control (QC) Samples Table - Screening/Confirmatory Analysis Decision Tree
3.5 Data Management Tasks 3.5.1 Project Documentation and Records 3.5.2 Data Package Deliverables 3.5.3 Data Reporting Formats 3.5.4 Data Handling and Management 3.5.5 Data Tracking and Control	RI WP Section 4	29 30	- Project Documents and Records Table - Analytical Services Table - Data Management SOPs
Assessment/Oversight			
4.1 Assessments and Response Actions 4.1.1 Planned Assessments 4.1.2 Assessment Findings and Corrective Action Responses	RI WP Section 5	31 32	- Planned Project Assessments Table - Assessments and Response Actions - Audit Checklists - Assessment Findings and Corrective Action Responses Table
4.2 Quality Assurance (QA) Management Reports	RI WP Section 5	33	- QA Management Reports Table
4.3 Final Project Report			- All information obtained during RI Field work
Data Review			
5.1 Overview			
5.2 Data Review Steps 5.2.1 Step I: Verification 5.2.2 Step II: Validation 5.2.2.1 Step IIa Validation Activities 5.2.2.2 Step IIb Validation Activities 5.2.3 Step III: Usability Assessment 5.2.3.1 Data Limitations and Actions from Usability Assessment 5.2.3.2 Activities	RI WP Section 3.9.11	34 35 36 37	- Sampling and Analysis Verification (Step I) Process Table - Sampling and Analysis Validation (Steps IIa and IIb) Process Table - Sampling and Analysis Validation (Steps IIa and IIb) Summary Table - Data Usability Assessment
5.3 Streamlining Data Review 5.3.1 Data Review Steps To Be Streamlined 5.3.2 Criteria for Streamlining Data Review 5.3.3 Amounts and Types of Data Appropriate for Streamlining			

[1] *Remedial Investigation (RI) Work Plan (WP)* [2]*Accident Prevention Plan/Site Safety and Health Plan (APP/SSHP)*

Worksheet 3 — Distribution List

QAPP Recipients	Title	Organization	Number of Copies	Telephone Number	E-Mail Address
Sher Zaman	Project Manager	USACE Baltimore	1	410-962-3134	Sher.Zaman@usace.army.mil
T.J. Meyer	Restoration Program Manager	NASA WFF	1	757-824-2319	Theodore.j.meyer@nasa.gov
Alan Warminski	Chemist	USACE Baltimore	1	410-962-7677	alan.s.warminski@usace.army.mil
Tony Pace	Contractor Project Manager	WESTON	1	757-362-2461	anothony.pace@westonsolutions.com
Gretchen Fodor	Project Chemist	WESTON	1	703-724-0544	gretchen.fodor@westonsolutions.com
D. Rick Davis	Project Manager	Empirical Laboratories	1	877-345-1113	rdavis@empirlabs.com
Sherif Mina	Data Validator	Meridian Consultant Group, Inc. (MCGI)	1	301-803-9207	S.Mina@meridiancgi.com

A hard copy of the Work Plan will also be made available to the field team during RI activities.

Worksheet 4 — Project Personnel Sign-Off Sheet

Organization: USACE Baltimore District

Project Personnel	Title	Signature	Date QAPP Read E-Mail Receipt
Sher Zaman	Project Manager		Sher.Zaman@usace.army.mil
Alan Warminski	Chemist		alan.s.warminski@usace.army.mil

Organization: Regulatory Agencies/Other Stakeholders

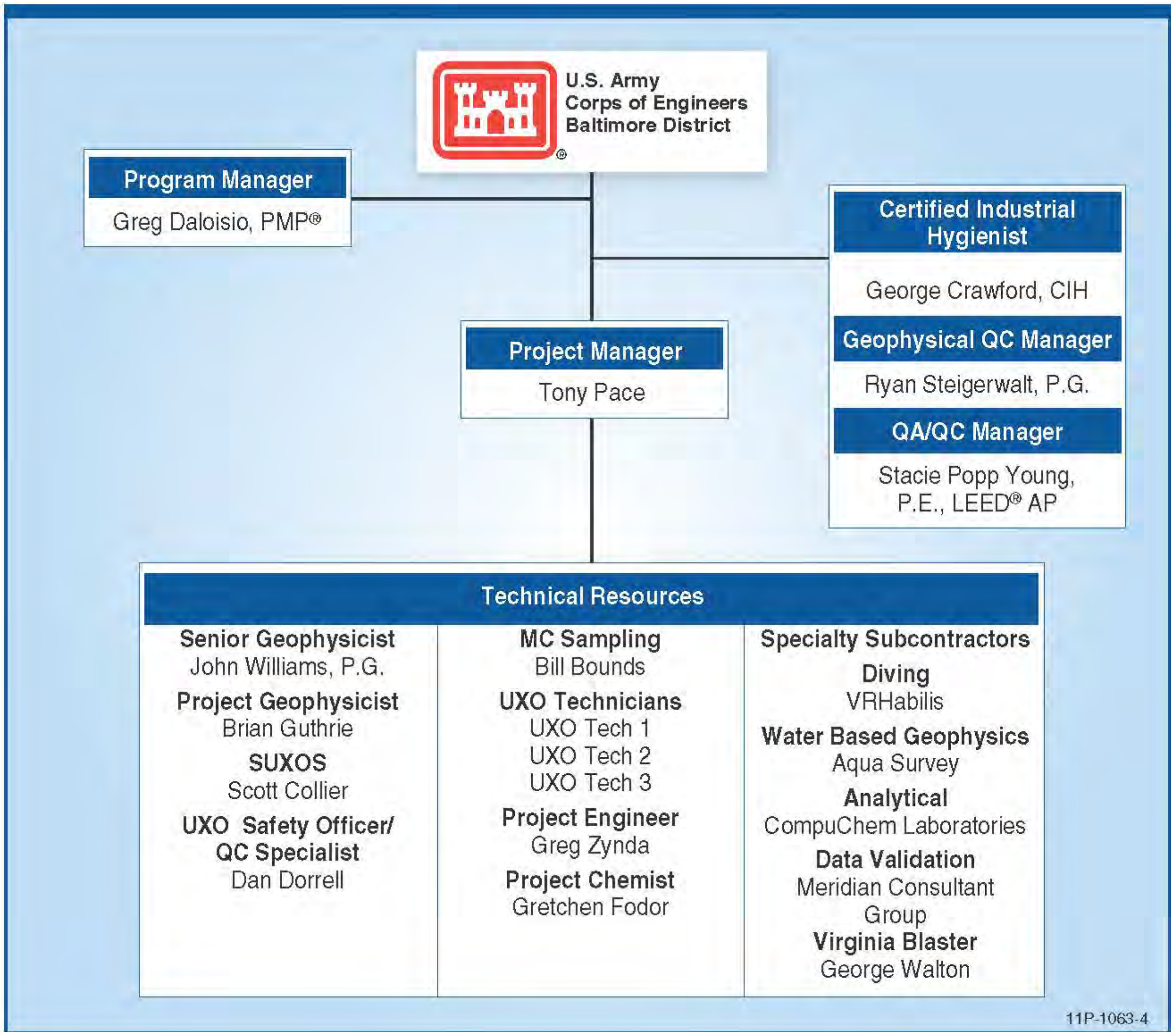
Project Personnel	Title	Signature	Date QAPP Read E-Mail Receipt
Steve Hirsch	EPA Region III/Remedial Project Manager		hirsch.steven@epamail.epa.gov
T.J. Meyer	NASA Restoration Program Manager		Theodore.j.meyer@nasa.gov
Paul Herman	VDEQ/Remediation Project Manager		peherman@deq.virginia.gov

Organization: Contractor

Project Personnel	Title	Signature	Date QAPP Read E-Mail Receipt
Tony Pace	Project Manager		anothony.pace@westonsolutions.com
Gretchen Fodor	Project Chemist		gretchen.fodor@westonsolutions.com
Cathy Dover	Project Manager/CompuChem Laboratory		cdover@compuchemlabs.com
Sherif Mina	Data Validator		S.Mina@meridiancgi.com

QC – Quality Control
UXO – Unexploded Ordnance
VDEQ – Virginia Department of Environmental Quality

Worksheet 5 — Project Organizational Chart



Worksheet 6 — Communication Pathways

Communication Drivers	Responsible Entity	Name	Phone Number	Procedure (timing, pathways)
Point of Contact with USACE	WESTON Project Manager	Tony Pace	757-362-2461	Report project information to the USACE Project Managers through work plans, monthly progress reports, E-mail updates, teleconference calls, and meetings.
Manage All Project Phases	WESTON Project Manager	Tony Pace	757-362-2461	Primary modes of communication are telephone, E-mail, letter, document submittal; timing dependent on nature of communication and predefined schedules, as applicable, and as requested by agencies.
QAPP Changes in the Field, Daily Field Progress Reports, Field Corrective Action	WESTON Field Leader	Craig LaCosse	610-701-3734	Notify WESTON Project Manager and Project Chemist of changes to QAPP in the field and rationale for changes. Document changes in field daily progress reports and memoranda to WESTON, and USACE Project Managers. Field Engineer will complete daily field progress reports and forward to WESTON. Need for field corrective action will be determined by the Technical Manager and Project Manager and will be documented in the daily field progress reports and memoranda to WESTON and USACE Project Managers.
Reporting Laboratory Data Quality Issues	Empirical Laboratories Laboratory Project Manager	D. Rick Davis	877-345-1113	All Quality Assurance/Quality Control (QA/QC) issues with project field samples will be reported by the laboratory to the Project Chemist and Contractor QA Officer.

Worksheet 6 — Communication Pathways (Continued)

Communication Drivers	Responsible Entity	Name	Phone Number	Procedure (timing, pathways)
Laboratory Analytical Corrective Actions	Project Chemist Laboratory Project Manager	Gretchen Fodor D. Rick Davis	703-724-0544 877-345-1113	Need for laboratory corrective actions will be determined by the Project Chemist and/or laboratory Project Manager or QA Manager and will be documented in memoranda to WESTON and USACE Project Managers.
Data Tracking and Management, Release of Analytical Data, QAPP Amendments	Project Chemist	Gretchen Fodor	703-724-0544	Project Chemist or her delegated representative will track data from collection of samples through login at laboratory to delivery by technical report/sample data group and electronic data delivery into database. Final analytical data cannot be released until validation is complete and Project Chemist has approved release. Changes to the QAPP will be approved by the WESTON and USACE Project Managers.

Worksheet 7 — Personnel Responsibilities and Qualifications Table

Name	Title	Organizational Affiliation	Responsibilities	Education and Experience Qualifications
Gregory Daloisio, PMP	Program Manager	WESTON	Single Point of Contact (POC). Ensures satisfaction of all contractual requisites, such as cost/schedule/technical/quality goals. Communicates with USACE on Delivery Order (DO) cost/schedule/quality progress. Monitors small business (SB) participation. Develops/enforces systems for administrative quality control (QC), and DO closeout. Holds regular status meetings with USACE Program Manager/Contracting Officer's Representative (COR).	B.S., Mechanical Engineering; 27 years of environmental experience; more than 20 years of Project Management experience
Tony Pace	Project Manager	WESTON	Provides overall management of the contract including cost, schedule, and technical quality. Manages project staffing, day-to-day project operations and activities, deliverable completion, field investigations, quality control, and health and safety. Acts as the single POC for the contract. Maintains communication and coordination with USACE for the duration of the project, including progress and detailed cost reporting. Oversees the management and coordination between Contractor staff, subcontractors, and USACE.	B.S., Civil Engineering; 30 years of program and Project Management experience
Brian Guthrie	Site Geophysicist	WESTON	Responsible for the overall coordination of data acquisition and performing data processing and analysis. The Site Geophysicist will also be responsible for reviewing data, monitoring technical performance of field teams, and coordinating with the field teams in the development of field reports. The Site Geophysicist will be responsible for the preparation of target dig lists and dig sheets, coordination of target reacquisition, and review of the results of excavations.	B.S., Cartography, M.S., Fluvial Geomorphology/ Geophysics; more than 10 years of experience in geophysical surveying

Worksheet 7 — Personnel Responsibilities and Qualifications Table (Continued)

Name	Title	Organizational Affiliation	Responsibilities	Education and Experience Qualifications
Scott Collier	Senior Unexploded Ordnance (UXO) Supervisor/Site Manager	WESTON	Responsible for all aspects of UXO field activities, including management of munitions and explosives of concern (MEC)/Material Potentially Presenting an Explosive Hazard (MPPEH) and UXO field teams. Responsible for ensuring quality and safety during all field activities.	Graduate of Naval Explosive Ordnance Disposal (EOD) School, Indian Head; more than 20 years of experience as EOD/UXO Specialist and Supervisor
Dan Dorrell	UXO Safety Officer – UXO Quality Control Specialist/	WESTON	Single POC for on-site quality and safety issues. Will be responsible for monitoring site activities for compliance with plans, procedures, and regulations relative to the health and safety of employees, project members, land users, residents, and visitors. Reports to the WESTON PM for project-specific direction and will have a direct line of communication with the corporate MEC Operations Manager and Program Health and Safety Manager for administrative and technical direction on quality and health and safety matters.	Graduate of EOD School, Redstone Arsenal; more than 17 years of experience in the UXO/EOD field
Stacie Popp-Young	QA/QC Manager	WESTON	Responsible for program quality management, including training and programmatic quality processes and controls. Provides senior technical support on Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) process documents and sampling program design and implementation.	B.S., Chemical Engineering; M.S., Chemical Engineering; 25 years of experience in environmental assessments, including field laboratory method development, data quality reviews, QAPP preparation, and laboratory coordination.

Worksheet 8 — Special Personnel Training Requirements Table

The worksheet is included in the WFF Site-Wide UFP-QAPP. Special personnel training requirements cited in the site-wide UFP-QAPP were those in effect at the time of its writing. As any new procedure or criterion is required, addendums to this document will be issued.

Worksheet 9 — Project Scoping Session Participants Sheet

Project Name: Boat Basin, Visitors Information Center RI Projected Date(s) of Sampling: July/August, 2014 Project Manager: Sher Zaman, USACE Baltimore	Site Name: Wallops Flight Facility FUDS Site Location: Wallops Island, Virginia
Date of Session: 15 and 16 August 2012 **Scoping Session Purpose: Remedial Project Managers (RPM) Meeting**	
The scoping session between USACE and the stakeholders was held during the 15 and 16 August 2012 RPM Meeting. All participants and discussion notes are documented in the WFF FUDS August 2012 Final Meeting Minutes, which were emailed to all stakeholders on 13 November 2012.	

Comments/Decisions:

Scoping sessions will be an ongoing feature of the project as activities progress. Monthly project status meetings between the Contractor and USACE project personnel are conducted to discuss the following:

- Summary of progress for the project
- Key milestones/deliverables
- Upcoming site activities
- Issues
- Status of action items

Action Items:

None

Consensus Decisions:

Not Applicable

Worksheet 10 — Problem Definition

The problem to be addressed by the project: Determine the nature and extent of MEC and MC at the Boat Basin, Visitors Information Center. The problem definition will include the following:

Environmental Questions and Observations
Existing information from the SI and the 2006 UXO clearance is insufficient for the following environmental questions being asked:

- Has the extent of MEC been fully addressed?
- Has the nature and extent of MC been fully assessed?
- Is there chemical constituent contamination (in addition to MC) present at the site?
- Is there a MEC and MC/chemical constituent risk to human health or the environment at the site?

Implementation of the scope of work, the RI work plan, and this QAPP will address these questions.

Synopsis of secondary data or information from site reports
Historical investigations have included a UXO clearance conducted in January 2006 and most recently an SI conducted in December 2011. The SI was conducted at the Boat Basin, Visitors Information Center by HFA. Based on historical evidence and the results from the SI, it was concluded that evidence of MEC and MC is present at the Boat Basin, Visitors Information Center. An RI was recommended to address the presence of MEC and MC at the Boat Basin, Visitors Information Center. Details on the results of the previous investigations conducted are presented in Section 1.6 of the RI Work Plan.

The possible classes of contaminants and the affected matrices
This information has been determined from previous reports, including the Statement of Work and Site Investigation, and history of the activities. The class of contaminants that has been detected at elevated levels is metal analytes; however, classes of other potential contaminants, such as explosives, will continue to be included for analysis for the RI samples. If new or different information is obtained as a result of geophysical and other field investigation activities, then the sampling activities will be reevaluated.

The rationale for inclusion of chemical and nonchemical analyses
Environmental samples (including 15% QC samples) will be collected from surface soil, subsurface soil, sediment, surface water, and groundwater to characterize the nature and extent of environmental contamination resulting from historical munitions activities at the Boat Basin, Visitor's Center.

Environmental sampling in accordance with this QAPP includes discrete sampling and chemical analysis of surface soil for MC where MEC or significant MD is detected and where MC is suspected to be present based on the identification of a potential release (e.g., broken munitions, soil staining). If MEC or significant MD is identified, then MC sampling will be conducted at discrete sample locations as deemed necessary. Section 3.9 of the RI Work Plan provides the detailed sampling protocols to be followed.

Information concerning various environmental indicators

The site conceptual models will be based on information obtained from previous reports, and observations and data from the RI. If physical conditions are found to be different or if the anticipated future use of the Boat Basin, Visitor's Center changes, then the conceptual model will be revised. If MEC or MC, and/or chemicals of potential concern (South Bank Boat Basin and the Pyrotechnics Burn Area) are identified as a result of site investigation studies, then appropriate human health and ecological risk assessments will be performed to determine whether risks are within acceptable levels and/or whether follow-up actions are recommended.

Worksheet 11 — Project Quality Objectives/Systematic Planning Process Statements

Project quality and data quality objectives (DQOs) for MEC/MC characterization and systematic planning processes are presented in the DQO tables in Section 3.1.2 of the RI Work Plan and Appendix I (MC Sampling Rationale Memorandum) of the RI Work Plan while additional data management (e.g., field (field logs, sampling forms, etc.) and analytical data format and transmittal of all data to the USACE) is presented in Section 4.1 of the RI Work Plan. As any new procedure or criterion is required, addendums to this document will be issued.

Worksheet 12 — Measurement Performance Criteria Tables

Measurement Performance Criteria Methods cited in the WFF Site-Wide QAPP were those in effect at the time of its writing. Since then, versions of analytical methods have been updated and the following project-specific tables have been modified.

Worksheet 12.1a — Measurement Performance Criteria Table – Explosives in Water by SW-846 Method 8330A/B

Matrix	Water
Analytical Group	Explosive Compounds
Concentration Level	Low

Sampling Procedure	Analytical Method/SOP	Data Quality Indicators (DQIs)	Measurement Performance Criteria (MPC)	QC Samples and/or Activity to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S & A)
Explosives in Water Sample placed in amber glass jar with a Teflon®-lined cap.	SW8330 SW8330A/B A-13 (analysis) (SOPs in Attachment A)	Accuracy/Bias (Contamination)	No target compounds > ½ LOQ	Field Blanks and Equipment/Rinsate Blanks	S & A
		Accuracy/Bias (Contamination)	No target compounds > ½ LOQ	Method Blanks and Instrument Blanks	A
		Precision - Overall	RPD ≤ 30% when detects for both field duplicate samples are ≥ 2 x LOQ.	Field Duplicates	S & A
		Precision - Laboratory	**SW8330 and SW8330A**: RPD ≤ 30% when detects for both duplicates are > QL per acceptance criteria specified by DoD QSM 4.2 Table F-2, p.F-14. **SW8330B**: RPD < 20% when detects for both duplicates are > QL per acceptance criteria specified by DoD QSM 4.2 Table F-3 p.F-18.	Laboratory Duplicates * LCS/LCSD MS/MSD *	A
		Accuracy - Laboratory	Acceptance criteria specified by DoD QSM 4.2 Table G-12, p. G-15. If not specified, laboratory's in-house criteria, not to exceed ± 3 times the standard deviation of the mean LCS recovery (per Table F-2, p. F-13).	LCS MS*	A

Worksheet 12.1a — Measurement Performance Criteria Table – Explosives in Water by SW-846 Method 8330A/B (Continued)

Sampling Procedure	Analytical Method/SOP	Data Quality Indicators (DQIs)	Measurement Performance Criteria (MPC)	QC Samples and/or Activity to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S & A)
		Accuracy/Bias	Acceptance criteria specified by DoD QSM 4.2 Table G-3, p. G-5. If not specified, laboratory's in-house control limits.	Surrogate spikes	A
		Sensitivity	MDL 3 to 10 times < the LOQ	Annual Method Detection Limit (MDL) Study	A
		Accuracy/Representativeness	4°C ± 2°C	Cooler Temperature Indicator	S
		Data Completeness	90% Overall	Data Completeness Check	S & A

**If information varies within an analytical group, separate by individual analyte.*

Worksheet 12.1b — Measurement Performance Criteria Table – Explosives in Soil by SW-846 Method 8330A/B

Matrix	Soil
Analytical Group	Explosive Compounds
Concentration Level	Low

Sampling Procedure	Analytical Method/SOP	Data Quality Indicators (DQIs)	Measurement Performance Criteria (MPC)	QC Samples and/or Activity to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S & A)
Explosives in Soil Sample placed in a glass jar or amber jar with a Teflon-lined cap.	SW8330 SW8330A/B A-13 (analysis) (SOPs in Attachment A)	Accuracy/Bias (Contamination)	No target compounds > ½ LOQ	Field Blanks and Equipment/Rinsate Blanks	S & A
		Accuracy/Bias (Contamination)	No target compounds > ½ LOQ	Method Blanks, Grinding Blanks, and Instrument Blanks	A
		Precision - Overall	RPD ≤ 50% when detects for both field duplicate samples are ≥ 2 x LOQ.	Field Duplicates	S & A
		Precision - Laboratory	**SW8330 and SW8330A**: RPD ≤ 30% when detects for both duplicates are > QL per acceptance criteria specified by DoD QSM 4.2 Table F-2, p.F-14. **SW8330B:** RPD < 20% when detects for soil triplicates are > QL per acceptance criteria specified by DoD QSM 4.2 Table F-3 p.F-18.	Laboratory Duplicates LCS/LCSD MS/MSD * SW8330B: Laboratory triplicates	A
		Accuracy - Laboratory	Acceptance criteria specified by DoD QSM 4.2 Table G-13, p. G-16. If not specified, laboratory's in-house criteria, not to exceed ± 3 times the standard deviation of the mean LCS recovery (per Table F-2, p. F-13).	LCS MS*	A
		Accuracy/Bias	Acceptance criteria specified by DoD QSM 4.2 Table G-3, p. G-5. If not specified, laboratory's in-house control limits.	Surrogate spikes	A
		Sensitivity	MDL 3 to 10 times < the LOQ	Annual Method Detection Limit (MDL) Study	A
		Accuracy/Representativeness	4°C ± 2°C	Cooler Temperature Indicator	S
		Data Completeness	90% Overall	Data Completeness Check	S & A

**If information varies within an analytical group, separate by individual analyte.*

Worksheet 12.2a — Measurement Performance Criteria Table – Metals Analytes in Water by SW-846 Method 6010B/C and 6020A

Matrix	Water
Analytical Group	Metals (ICP-AES)
Concentration Level	Low

Sampling Procedure	Analytical Method/SOP	Data Quality Indicators (DQIs)	Measurement Performance Criteria	QC Samples and/or Activity Use to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)
Metals in Water Sample placed in a preserved plastic bottle.	SW6010B/C, SW6020A A-7(prep) A-9 (analysis) (SOPs in Attachment A)	Accuracy/Bias (Contamination)	No target compounds > ½ LOQ	Field Blanks and Equipment/Rinsate Blanks	S & A
		Accuracy/Bias (Contamination)	No target compounds > ½ LOQ	Method Blanks and Instrument Blanks	A
		Precision - Overall	RPD ≤ 30% when detects for both field duplicate samples are ≥ 5 x LOQ.	Field Duplicates	S & A
		Precision - Laboratory	RPD ≤ 20% when detects for both duplicates are > QL per acceptance criteria specified by DoD QSM 4.2 Table F-7, p.F-42. If not specified, laboratory's in-house control limits.	Laboratory Duplicates * LCS/LCSD MS/MSD *	A
		Accuracy - Laboratory	Acceptance criteria specified by DoD QSM 4.2 Table G-18, p. G-18. (per Table F-7, p. F-41 and F-42).	LCS MS*	A
		Sensitivity	MDL 3 to 10 times < the LOQ	Annual Method Detection Limit (MDL) Study	A
		Accuracy/Representativeness	4°C ± 2°C	Cooler Temperature Indicator	S
		Data Completeness	90% Overall	Data Completeness Check	S & A

**If information varies within an analytical group, separate by individual analyte.*

Worksheet 12.2b — Measurement Performance Criteria Table – Metals Analytes in Soil by SW-846 Method 6020A

Matrix	Soil
Analytical Group	Metals (ICP-AES)
Concentration Level	Low

Sampling Procedure	**Analytical Method/ SOP**	**Data Quality Indicators (DQIs)**	**Measurement Performance Criteria**	**QC Samples and/or Activity Use to Assess Measurement Performance**	**QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)**
Metals in Soil Sample placed in a glass jar or amber jar with a Teflon-lined cap.	SW6010B/C SW6020A A-8 (prep) A-9 (analysis) (SOPs in Attachment A)	Accuracy/Bias (Contamination)	No target compounds > ½ LOQ	Field Blanks and Equipment/Rinsate Blanks	S & A
		Accuracy/Bias (Contamination)	No target compounds > ½ LOQ	Method Blanks and Instrument Blanks	A
		Precision - Overall	RPD ≤ 50% when detects for both field duplicate samples are ≥ 5 x LOQ.	Field Duplicates	S & A
		Precision - Laboratory	RPD ≤ 20% when detects for both duplicates are > QL per acceptance criteria specified by DoD QSM 4.2 Table F-7, p.F-42. If not specified, laboratory's in-house control limits.	Laboratory Duplicates * LCS/LCSD MS/MSD *	A
		Accuracy - Laboratory	Acceptance criteria specified by DoD QSM 4.2 Table G-19, p. G-19. (per Table F-7, p. F-41 and F-42).	LCS MS*	A
		Sensitivity	MDL 3 to 10 times < the LOQ	Annual Method Detection Limit (MDL) Study	A
		Accuracy/Representativeness	4°C ± 2°C	Cooler Temperature Indicator	S
		Data Completeness	90% Overall	Data Completeness Check	S & A

**If information varies within an analytical group, separate by individual analyte.*

Worksheet 12.3a — Measurement Performance Criteria Table – Mercury in Water by SW-846 Method 7470A

Matrix	Water
Analytical Group	Mercury
Concentration Level	Low

Sampling Procedure	Analytical Method/SOP	Data Quality Indicators (DQIs)	Measurement Performance Criteria	QC Samples and/or Activity Use to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)
Mercury in Water Sample placed in a preserved plastic bottle.	SW7470A/ A-10 (prep), A-12 (prep) (SOPs in Attachment A)	Accuracy/Bias (Contamination)	No target compounds > ½ LOQ	Field Blanks and Equipment/Rinsate Blanks	S & A
		Accuracy/Bias (Contamination)	No target compounds > ½ LOQ	Method Blanks and Instrument Blanks	A
		Precision - Overall	RPD ≤ 30% when detects for both field duplicate samples are ≥ 5 x LOQ.	Field Duplicates	S & A
		Precision - Laboratory	RPD ≤ 20% when detects for both duplicates are > QL per acceptance criteria specified by DoD QSM 4.2 Table F-7, p.F-42.	Laboratory Duplicates * LCS/LCSD MS/MSD *	A
		Accuracy - Laboratory	Acceptance criteria specified by DoD QSM 4.2 Table G-18, p. G-18. (per Table F-7, p. F-41 and F-42).	LCS MS*	A
		Sensitivity	MDL 3 to 10 times < the LOQ	Annual Method Detection Limit (MDL) Study	A
		Accuracy/Representativeness	4°C ± 2°C	Cooler Temperature Indicator	S
		Data Completeness	90% Overall	Data Completeness Check	S & A

**If information varies within an analytical group, separate by individual analyte.*

Worksheet 12.3b — Measurement Performance Criteria Table – Mercury in Soil by SW-846 Method 7471B

Matrix	Soil
Analytical Group	Mercury
Concentration Level	Low

Sampling Procedure	Analytical Method/SOP	Data Quality Indicators (DQIs)	Measurement Performance Criteria	QC Samples and/or Activity Use to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)
Mercury in Soil Sample placed in a glass jar or amber jar with a Teflon-lined cap.	SW7471B A-11 (prep), A-12 (analysis) (SOPs in Attachment A)	Accuracy/Bias (Contamination)	No target compounds > ½ LOQ	Field Blanks and Equipment/Rinsate Blanks	S & A
		Accuracy/Bias (Contamination)	No target compounds > ½ LOQ	Method Blanks and Instrument Blanks	A
		Precision - Overall	RPD ≤ 50% when detects for both field duplicate samples are ≥ 5 x LOQ.	Field Duplicates	S & A
		Precision - Laboratory	RPD ≤ 20% when detects for both duplicates are > QL per acceptance criteria specified by DoD QSM 4.2 Table F-7, p.F-42.	Laboratory Duplicates * LCS/LCSD MS/MSD *	A
		Accuracy - Laboratory	Acceptance criteria specified by DoD QSM 4.2 Table G-19, p. G-19. (per Table F-7, p. F-41 and F-42).	LCS MS*	A
		Sensitivity	MDL 3 to 10 times < the LOQ	Annual Method Detection Limit (MDL) Study	A
		Accuracy/Representativeness	4°C ± 2°C	Cooler Temperature Indicator	S
		Data Completeness	90% Overall	Data Completeness Check	S & A

**If information varies within an analytical group, separate by individual analyte.*

Worksheet 12.4a — Measurement Performance Criteria Table – Volatile Organic Compounds (VOCs) in Water by SW-846 Method 8260B

Matrix	Water
Analytical Group	VOCs
Concentration Level	Low

Sampling Procedure	Analytical Method/ SOP	Data Quality Indicators (DQIs)	Measurement Performance Criteria	QC Samples and/or Activity Use to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)
VOCs in Water Samples collected in 40-mL volatile organic analysis (VOA) vials	SW8260B A-1 (SOPs in Attachment A)	Accuracy/Bias (Contamination)	No target compounds > ½ LOQ	Trip Blanks, Field Blanks, and Equipment/Rinsate Blanks	S & A
		Accuracy/Bias (Contamination)	No target compounds > ½ LOQ	Method Blanks and Instrument Blanks	A
		Precision - Overall	RPD ≤ 30% when detects for both field duplicate samples are ≥ 2 x LOQ.	Field Duplicates	S & A
		Precision - Laboratory	RPD ≤ 30% when detects for both duplicates are > QL per acceptance criteria specified by DoD QSM 4.2 Table F-4, p.F-25.	Laboratory Duplicates * LCS/LCSD MS/MSD *	A
		Accuracy - Laboratory	Acceptance criteria specified by DoD QSM 4.2 Table G-4, p. G-6. If not specified, laboratory's in-house criteria, not to exceed ± 3 times the standard deviation of the mean LCS recovery (per Table F-4, p. F-24).	LCS MS*	A
		Accuracy/Bias	Acceptance criteria specified by DoD QSM 4.2 Table G-3, p. G-5. If not specified, laboratory's in-house control limits.	Surrogate spikes	A
		Sensitivity	MDL 3 to 10 times < the LOQ	Annual Method Detection Limit (MDL) Study	A
		Accuracy/Representativeness	4°C ± 2°C	Cooler Temperature Indicator	S
		Data Completeness	90% Overall	Data Completeness Check	S & A

**If information varies within an analytical group, separate by individual analyte.*

Worksheet 12.4b — Measurement Performance Criteria Table – VOCs in Soil by SW-846 Method 8260B

Matrix	Soil
Analytical Group	VOCs
Concentration Level	Low

Sampling Procedure	Analytical Method/ SOP	Data Quality Indicators (DQIs)	Measurement Performance Criteria	QC Samples and/or Activity Use to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)
VOCs in Soil Sealed-Cap (Encore).	SW8260B/ A-2 (SOPs in Attachment A)	Accuracy/Bias (Contamination)	No target compounds > ½ LOQ	Trip Blanks, Field Blanks, and Equipment/Rinsate Blanks	S & A
		Accuracy/Bias (Contamination)	No target compounds > ½ LOQ	Method Blanks and Instrument Blanks	A
		Precision - Overall	RPD ≤ 50% when detects for both field duplicate samples are ≥ 2 x LOQ.	Field Duplicates	S & A
		Precision - Laboratory	RPD ≤ 30% when detects for both duplicates are > QL per acceptance criteria specified by DoD QSM 4.2 Table F-4, p.F-25.	Laboratory Duplicates * LCS/LCSD MS/MSD *	A
		Accuracy - Laboratory	Acceptance criteria specified by DoD QSM 4.2 Table G-5, p. G-8. If not specified, laboratory's in-house criteria, not to exceed ± 3 times the standard deviation of the mean LCS recovery (per Table F-4, p. F-24).	LCS MS*	A
		Accuracy/Bias	Acceptance criteria specified by DoD QSM 4.2 Table G-3, p. G-5. If not specified, laboratory's in-house control limits.	Surrogate spikes	A
		Sensitivity	MDL 3 to 10 times < the LOQ	Annual Method Detection Limit (MDL) Study	A
		Accuracy/Representativeness	4°C ± 2°C	Cooler Temperature Indicator	S
		Data Completeness	90% Overall	Data Completeness Check	S & A

**If information varies within an analytical group, separate by individual analyte.*

Worksheet 12.5a — Measurement Performance Criteria Table – Semivolatile Organic Compounds (SVOCs) in Water by SW-846 Method 8270C

Matrix	Water
Analytical Group	Semivolatile Organic Compounds (SVOCs)
Concentration Level	Low

Sampling Procedure	Analytical Method/SOP	Data Quality Indicators (DQIs)	Measurement Performance Criteria (MPC)	QC Samples and/or Activity to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S & A)
SVOCs in Water Sample placed in amber glass jar with a Teflon-lined cap.	SW-846 8270C A-4 (prep) A-6 (analysis) (SOPs in Attachment A)	Accuracy/Bias (Contamination)	No target compounds > ½ LOQ	Field Blanks and Equipment/Rinsate Blanks	S & A
		Accuracy/Bias (Contamination)	No target compounds > ½ LOQ	Method Blanks and Instrument Blanks	A
		Precision - Overall	RPD ≤ 30% when detects for both field duplicate samples are ≥ 2 x LOQ.	Field Duplicates	S & A
		Precision - Laboratory	RPD ≤ 30% when detects for both duplicates are > QL per acceptance criteria specified by DoD QSM 4.2 Table F-4, p.F-25.	Laboratory Duplicates * LCS/LCSD MS/MSD *	A
		Accuracy - Laboratory	Acceptance criteria specified by DoD QSM 4.2 Table G-6, p. G-9. If not specified, laboratory's in-house criteria, not to exceed ± 3 times the standard deviation of the mean LCS recovery (per Table F-4, p. F-24).	LCS MS*	A
		Accuracy/Bias	Acceptance criteria specified by DoD QSM 4.2 Table G-3, p. G-5. If not specified, laboratory's in-house control limits.	Surrogate spikes	A
		Sensitivity	MDL 3 to 10 times < the LOQ	Annual Method Detection Limit (MDL) Study	A
		Accuracy/Representativeness	4°C ± 2°C	Cooler Temperature Indicator	S
		Data Completeness	90% Overall	Data Completeness Check	S & A

**If information varies within an analytical group, separate by individual analyte.*

Worksheet 12.5b — Measurement Performance Criteria Table – SVOCs in Soil by SW-846 Method 8270C

Matrix	Soil
Analytical Group	SVOCs
Concentration Level	Low

Sampling Procedure	Analytical Method/SOP	Data Quality Indicators (DQIs)	Measurement Performance Criteria (MPC)	QC Samples and/or Activity to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S & A)
SVOCs in Soil Sample placed in a glass jar or amber jar with a Teflon-lined cap.	SW-846 8270C, A-3 and A-5 (prep) A-6 (analysis) (SOPs in Attachment A)	Accuracy/Bias (Contamination)	No target compounds > ½ LOQ	Field Blanks and Equipment/Rinsate Blanks	S & A
		Accuracy/Bias (Contamination)	No target compounds > ½ LOQ	Method Blanks and Instrument Blanks	A
		Precision - Overall	RPD ≤ 50% when detects for both field duplicate samples are ≥ 2 x LOQ.	Field Duplicates	S & A
		Precision - Laboratory	RPD ≤ 30% when detects for both duplicates are > QL per acceptance criteria specified by DoD QSM 4.2 Table F-4, p.F-25.	Laboratory Duplicates * LCS/LCSD MS/MSD *	A
		Accuracy - Laboratory	Acceptance criteria specified by DoD QSM 4.2 Table G-7, p. G-11. If not specified, laboratory's in-house criteria, not to exceed ± 3 times the standard deviation of the mean LCS recovery (per Table F-4, p. F-24).	LCS MS*	A
		Accuracy/Bias	Acceptance criteria specified by DoD QSM 4.2 Table G-3, p. G-5. If not specified, laboratory's in-house control limits.	Surrogate spikes	A
		Sensitivity	MDL 3 to 10 times < the LOQ	Annual Method Detection Limit (MDL) Study	A
		Accuracy/Representativeness	4°C ± 2°C	Cooler Temperature Indicator	S
		Data Completeness	90% Overall	Data Completeness Check	S & A

**If information varies within an analytical group, separate by individual analyte.*

Worksheet 12.6a — Measurement Performance Criteria Table – Dioxins and Furans in Water by SW-846 Method 8290

Matrix	Water
Analytical Group	Dioxin/Furan Compounds
Concentration Level	Low

Sampling Procedure	Analytical Method/SOP	Data Quality Indicators (DQIs)	Measurement Performance Criteria (MPC)	QC Samples and/or Activity to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S & A)
Dioxin/Furans in Water Sample placed in amber glass jar with a Teflon-lined cap.	SW-846 8290, A-14 (prep) A-15 (analysis) (SOPs in Attachment A)	Accuracy/Bias (Contamination)	Use project-specific criteria, if available. Otherwise, no analytes detected ≥ LOD for the analyte or ≥ 5% of the associated regulatory limit for the analyte or ≥ 5% of the sample result for the analyte, whichever is greater, per method.	Field Blanks and Equipment/Rinsate Blanks	S & A
		Accuracy/Bias (Contamination)	Use project-specific criteria, if available. Otherwise, no analytes detected ≥ LOD for the analyte or ≥ 5% of the associated regulatory limit for the analyte or ≥ 5% of the sample result for the analyte, whichever is greater, per method.	Method Blanks and Instrument Blanks	A
		Precision - Overall	RPD ≤ 30% when detects for both field duplicate samples are ≥ 2 x LOQ.	Field Duplicates	S & A
		Accuracy/Bias	QC acceptance criteria specified by DoD, if available. Otherwise use in-house control limits. In-house control limits may not be greater than ± 3 times the standard deviation of the mean LCS recovery.	LCS MS	A
		Precision - Laboratory	LCSD and MSD: RPD ≤ 20% (between the MS and MSD). Sample Duplicate: RPD ≤ 25%	Laboratory Duplicates LCS/LCSD MS/MSD *	A
		Sensitivity	MDL 3 to 10 times < the LOQ	Annual Method Detection Limit (MDL) Study	A
		Accuracy/ Representativeness	4°C ± 2°C	Cooler Temperature Indicator	S
		Data Completeness	90% Overall	Data Completeness Check	S & A

**If information varies within an analytical group, separate by individual analyte.*

Worksheet 12.6b — Measurement Performance Criteria Table – Dioxins and Furans in Soil by SW-846 Method 8290

Matrix	Soil
Analytical Group	Dioxin/Furan Compounds
Concentration Level	Low

Sampling Procedure	Analytical Method/SOP	Data Quality Indicators (DQIs)	Measurement Performance Criteria (MPC)	QC Samples and/or Activity to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S & A)
Dioxin/Furans in Soil Sample placed in a glass jar or amber jar with a Teflon-lined cap.	SW-846 8290, A-14 (prep) A-15 (analysis) (SOPs in Attachment A)	Accuracy/Bias (Contamination)	Use project-specific criteria, if available. Otherwise, no analytes detected ≥ LOD for the analyte or ≥ 5% of the associated regulatory limit for the analyte or ≥ 5% of the sample result for the analyte, whichever is greater, per method.	Field Blanks and Equipment/Rinsate Blanks	S & A
		Accuracy/Bias (Contamination)	Use project-specific criteria, if available. Otherwise, no analytes detected ≥ LOD for the analyte or ≥ 5% of the associated regulatory limit for the analyte or ≥ 5% of the sample result for the analyte, whichever is greater, per method.	Method Blanks and Instrument Blanks	A
		Precision - Overall	RPD ≤ 50% when detects for both field duplicate samples are ≥ 2 x LOQ.	Field Duplicates	S & A
		Accuracy/Bias	QC acceptance criteria specified by DoD, if available. Otherwise use in-house control limits. In-house control limits may not be greater than ± 3 times the standard deviation of the mean LCS recovery.	LCS MS	A
		Precision - Laboratory	LCSD and MSD: RPD ≤ 20% (between the MS and MSD). Sample Duplicate: RPD ≤ 25%	Laboratory Duplicates LCS/LCSD MS/MSD *	A
		Sensitivity	MDL 3 to 10 times < the LOQ	Annual Method Detection Limit (MDL) Study	A
		Accuracy/ Representativeness	4°C ± 2°C	Cooler Temperature Indicator	S
		Data Completeness	90% Overall	Data Completeness Check	S & A

**If information varies within an analytical group, separate by individual analyte.*

Worksheet 12.7 — Measurement Performance Criteria Table – Perchlorate in Water by SW-846 Method 6850

Matrix	Water
Analytical Group	Perchlorate Ion Chromatography - Mass Spectrometry (IC-MS) SW6850
Concentration Level	Low

Sampling Procedure	Analytical Method/SOP	Data Quality Indicators (DQIs)	Measurement Performance Criteria (MPC)	QC Samples and/or Activity to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S & A)
Perchlorate in Water Sample placed in HDPE container.	SW-846 6850 A-18 (analysis) (SOPs in Attachment A)	Accuracy/Bias (Contamination)	No target compounds > ½ LOQ or >1/10 sample concentration or >1/10 regulatory limit.	Method Blanks and Equipment/Rinsate Blanks	S & A
		Accuracy/Bias (Contamination)	No target compounds > ½ LOQ	Reagent Blank	A
		Precision - Overall	RPD ≤ 20% when detects for both field duplicate samples are ≥ 2 x LOQ.	Field Duplicates	S & A
		Precision - Laboratory	RPD < 15%MSD: Recovery within 80-120% or within laboratory generated limits, whichever is more stringent. Per acceptance criteria specified by DoD QSM 4.2 Table F-12. P F-61.	LCS/LCSD MS/MSD *	A
		Accuracy - Laboratory	RPD < 15%MSD: Recovery within 80-120% or within laboratory generated limits, whichever is more stringent to verify calibration and to check method performance. Per acceptance criteria specified by DoD QSM 4.2 Table F-12. P F-61.	LCS MS*	A
		Accuracy/Bias	RPD < 15%: Recovery within 80-120% or internal recovery and calibration standard (IRCS) 50-150%.	LCS/LCSD MS/MSD*	A
		Sensitivity	Lowest calibration standard less than or equal to limit of quantitation	Initial Calibration	A
		Accuracy/Representativeness	4°C ± 2°C	Cooler Temperature Indicator	S
		Data Completeness	90% Overall	Data Completeness Check	S & A

**If information varies within an analytical group, separate by individual analyte.*

Worksheet 13 — Secondary Data Criteria and Limitations Table

Secondary Data	Data Source (originating organization, report title and date)	Data Generator(s) (originating organization, data types, data generation / collection dates)	How Data Will Be Used	Limitations on Data Use
Visitor Center Unexploded Ordnance Clearance Report	Tetra Tech NUS, Inc., *Visitor Center Unexploded Ordnance Clearance Report, NASA Wallops Flight Facility, Wallops Island, Virginia*, May 2006	Background information on nature and distribution of MEC Geophysical and visual surveys indicating location and distribution of MEC, MD, and subsurface anomalies Identification of MRSs requiring further investigation	Background information assists in delineating areas potentially impacted by MEC and MC Guide MC sampling approach	Data gaps exist. Because of the age of the munitions used, insufficient information is available regarding MEC and MC potentially associated with munitions. No MC sampling conducted.
Final Site Inspection Report for Wallops Flight Facility Project 07, Accomack County, Virginia	TerranearPMC, LLC/Human Factors Applications, Inc., *Final Site Inspection Report for Wallops Flight Facility Project 07, Accomack County, Virginia*, June 2012	Background information on nature and distribution of MEC Geophysical and visual surveys indicating location and distribution of MEC, MD, and subsurface anomalies Identification of MRSs requiring further investigation	Background information assists in delineating areas potentially impacted by MEC and MC Guide MC sampling approach	Data gaps exist. Because of the age of the munitions used, insufficient information is available regarding MEC and MC potentially associated with munitions. MC sampling was not conducted in the Pyrotechnics Burn area. MC sampling was limited to a select list of analytes.

Worksheet 14 — Summary of Project Tasks

This worksheet provides the laboratory project tasks following MC sample collection and analysis, and is provided in the WFF Site-Wide UFP-QAPP. Section 3.9 of the Work Plan provides details of MC sampling project tasks (e.g., sampling, analysis, data management, document and record, and assessment tasks).

Worksheet 15 — Reference Limits and Evaluation Tables

Worksheet 15.1a — Reference Limits and Evaluation Table – Explosives Method SW-846 8330A (Soil/Sediment)

		Human Health Values		Recommended Ecological Values				Achievable Laboratory Limits		Precision and Accuracy Method Performance Criteria	
		EPA Residential RSL[1]	EPA Industrial RSL[1]	Ecological Screening Value[2]	Ecological Screening Value[3]	PAL[4]	PAL[4]	Project LOQ	LOD	LCS/MS/MSD[6] Recovery Limits	LCS/MS/MSD Precision
Analyte	CAS Number	Soil (mg/kg)	Soil (mg/kg)	Soil (mg/kg)	Sediment (mg/kg)	Soil (mg/kg)	Sediment (mg/kg)	Soil[5] (mg/kg)	Soil (mg/kg)	Soil %	Soil RPD ≤
HMX	2691-41-0	380	4,900	NA	NA	380	380	0.080	0.04	75-125	30
RDX	121-82-4	5.6	24	NA	NA	5.6	5.6	0.080	0.04	70-135	30
1,3,5-Trinitrobenzene	99-35-4	220	2,700	NA	NA	220	220	0.080	0.04	80-120	30
1,3-Dinitrobenzene	99-65-0	0.61	6.2	NA	NA	0.61	0.61	0.080	0.04	80-125	30
Nitrobenzene	98-95-3	4.8	24	NA	NA	4.8	4.8	0.080	0.04	75-125	30
Nitroglycerin	55-63-0	0.61	6.2	NA	NA	0.61	0.61	0.400	0.2	60-120	30
Tetryl	479-45-8	24	250	NA	NA	24	24	0.080	0.04	10-150	30
2,4,6-Trinitrotoluene	118-96-7	19	79	NA	NA	19	19	0.080	0.04	10-150	30
4-Amino-2,6-dinitrotoluene	19406-51-0	15	190	NA	NA	15	15	0.080	0.04	80-125	30
2-Amino-4,6-dinitrotoluene	35572-78-2	15	200	NA	NA	15	15	0.080	0.04	80-125	30
2,6-Dinitrotoluene	606-20-2	6.1	62	NA	NA	6.1	6.1	0.080	0.04	80-125	30
2,4-Dinitrotoluene	121-14-2	1.6	5.5	NA	NA	1.6	1.6	0.080	0.04	80-125	30
2-Nitrotoluene	88-72-2	2.9	13	NA	NA	2.9	2.9	0.080	0.04	80-125	30
4-Nitrotoluene	99-99-0	30	110	NA	NA	30	30	0.080	0.04	75-125	30
3-Nitrotoluene	99-08-1	0.61	6.2	NA	NA	0.61	0.61	0.080	0.04	75-120	30
1, 4-Dinitrobenzene (Surrogate)	100-25-4	NA	NA	NA	NA	NA	NA	NA	NA	39-132[7]	NA

[1] *Residential and Industrial Screening Levels were obtained from Oak Ridge National Laboratory (ORNL) Regional Screening Levels (RSLs) for Chemical Contaminants at Superfund Sites Table (April 2012). The RSLs are shown at a target risk (TR) of 1.0E-6. The target hazard quotient (THQ) has been adjusted to 0.1 for non-carcinogens to allow for potential additive toxicity of multiple contaminants.*

[2] *The Recommended Soil Screening Values were obtained from the EPA Ecological Soil Screening Level (EcoSSL) documents.*

Worksheet 15.1a — Reference Limits and Evaluation Table – Explosives Method SW-846 8330B (Soil/Sediment) (Continued)

[3] *The Recommended Ecological Sediment Screening Values were obtained from EPA Region 3 Biological Technical Assistance Group (BTAG) Marine Sediment Screening Benchmark Table (July 2006).*
[4] *For the purpose of contracting with the analytical laboratory, the Project Action Limit (PAL) is the lesser of "EPA Residential RSL" or "Recommended Ecological Screening Value".*
[5] *If % solids is <30%, additional sample needs to be analyzed to ensure the detection limits are met.*
[6] *Laboratory control sample (LCS)/matrix spike (MS)/matrix spike duplicate (MSD)*
[7] *Surrogate Control Limits*
NA = Not Applicable
CAS = Chemical Abstracts Service
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Worksheet 15.1b — Reference Limits and Evaluation Table – Explosives Method SW-846 8330B (Water)

		Human Health Values	Ecological Values	PAL[3]	Achievable Laboratory Limits		Precision and Accuracy Method Performance Criteria	
		EPA MCL[1]	Marine Screening Benchmark[2]		Project LOQ	LOD	LCS/MS/MSD[4] Recovery Limits	LCS/MS/MSD Precision
Analyte	CAS Number	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	%	RPD ≤
HMX	2691-41-0	78	NA	78	2.5	1.7	80-115	30
RDX	121-82-4	0.61	NA	0.61	2.5	0.50	50-160	30
1,3,5-Trinitrobenzene	99-35-4	46	NA	46	2.5	0.50	65-140	30
1,3-Dinitrobenzene	99-65-0	0.15	NA	0.15	2.5	0.50	45-160	30
Nitrobenzene	98-95-3	0.12	66.8	0.12	2.5	0.50	50-140	30
Nitroglycerin	55-63-0	0.15	NA	0.15	2.5	0.50	60-120	30
Tetryl	479-45-8	6.3	NA	6.3	5.0	0.75	20-175	30
2,4,6-Trinitrotoluene	118-96-7	2.2	100	2.2	2.5	0.50	50-145	30
4-Amino-2,6-dinitrotoluene	19406-51-0	3	NA	3	5.0	0.75	55-155	30
2-Amino-4,6-dinitrotoluene	35572-78-2	3	NA	3	5.0	0.75	50-155	30
2,6-Dinitrotoluene	606-20-2	1.5	NA	1.5	5.0	2.5	60-135	30
2,4-Dinitrotoluene	121-14-2	0.2	NA	0.2	2.5	0.50	60-135	30
2-Nitrotoluene	88-72-2	0.27	NA	0.27	5.0	1.00	45-135	30
4-Nitrotoluene	99-99-0	3.7	NA	3.7	5.0	0.75	50-130	30
3-Nitrotoluene	99-08-1	0.13	NA	0.13	5.0	0.75	50-130	30
1, 4-Dinitrobenzene (Surrogate)	100-25-4	NA	NA	NA	NA	NA	39-132[5]	NA

[1]Maximum Contaminant Levels (MCLs) were obtained from the ORNL RSLs for Chemical Contaminants at Superfund Sites Table (April 2012). The MCLs are shown at a TR of 1.0E-6. The THQ has been adjusted to 0.1 for non-carcinogens to allow for potential additive toxicity of multiple contaminants. For contaminants that do not have an MCL the RSL for Tap Water was used.

[2] The Marine Screening Benchmark Values were obtained from EPA Region 3 BTAG Marine Screening Benchmark Table (July 2006)

[3] For the purpose of contracting with the analytical laboratory, the PAL is the lesser of "EPA MCL" or "Marine Screening Benchmark".

[4] Laboratory control sample (LCS)/matrix spike (MS)/matrix spike duplicate (MSD)

[5] Surrogate control limits

NA = Not Applicable

Worksheet 15.2a — Reference Limits and Evaluation Table – Metals Methods SW-846 6010B/C, 6020A, and 7470A/7471B (Soil/Sediment)

		Human Health Values		Recommended Ecological Values				Achievable Laboratory Limits		Precision and Accuracy Method Performance Criteria	
		Residential RSL[1]	EPA Industrial RSL[1]	Ecological Screening Value[2]	Ecological Screening Value[3]	PAL[4]	PAL	Project LOQ	LOD	LCS/MS/MSD[6] Recovery Limits	LCS/MS/MSD Precision
Analyte	CAS Number	Soil	Soil	Soil	Sediment	Soil	Sediment	Soil[5]	Soil	Soil	Soil
		(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	%	RPD ≤
Aluminum *(Method SW-846 6010B/C)*	7429-90-5	7700	99,000	*	0.99	*	0.99	20.0	10.0	80-120	20
Antimony	7440-36-0	3.1	41	78	2	3.1	2	1.00	0.500	75-125	20
Arsenic	7440-38-2	0.4	1.6	46	9.8	1.00**	9.8	1.00	0.250	75-125	20
Barium	7440-39-3	1,500	19,000	2000	NA	1,500	NA	20.0	2.50	75-125	20
Beryllium	7440-41-7	16	200	34	NA	16	NA	0.500	0.250	75-125	20
Cadmium	7440-43-9	7	80	0.36	NA	0.36	NA	0.500	0.250	75-125	20
Calcium *(Method SW-846 6010B/C)*	7440-70-2	NA	NA	NA	NA	NA	NA	500	250	80-120	20
Chromium	7440-47-3	0.29	5.6	26	43.4	26	43.4	1.00	0.500	75-125	20
Cobalt	7440-48-4	0.4	30	230	50	2.3	50	2.00	0.250	75-125	20
Copper	7440-50-8	310	4,100	49	31.6	49	31.6	0.500	0.500	75-125	20
Iron *(Method SW-846 6010B/C)*	7439-89-6	552	72,000	NA	20,000	5,500	20,000	20.0	10.0	80-120	20
Lead	7439-92-1	270	800	56	35.8	56	35.8	1.00	0.250	75-125	20
Magnesium *(Method SW-846 6010B/C)*	7439-95-4	NA	NA	NA	NA	NA	NA	500	250	80-120	20
Manganese	7439-96-5	180	2,300.	4000	460	180	460	1.00	0.250	75-125	20
Mercury *(Method SW-846 7470A/7471B)*	7439-97-6	1	43	NA	0.18	1	0.18	0.0330	0.0150	80-120	20
Nickel	7440-02-0	39	2,000	NA	22.7	150	22.7	1.00	0.250	75-125	20
Potassium *(Method SW-846 6010B/C)*	7440-09-7	NA	NA	NA	NA	NA	NA	500	250	80-120	20
Selenium	7782-49-2	5	510	0.63	2	0.63	2	2.5	1.25	75-125	20

Worksheet 15.2a — Reference Limits and Evaluation Table – Metals Methods SW-846 6010B/C, 6020A, and 7470A/7471B (Soil/Sediment) (Continued)

		Human Health Values		Recommended Ecological Values				Achievable Laboratory Limits		Precision and Accuracy Method Performance Criteria	
		Residential RSL[1]	EPA Industrial RSL[1]	Ecological Screening Value[2]	Ecological Screening Value[3]	PAL[4]	PAL	Project LOQ	LOD	LCS/MS/MSD[6] Recovery Limits	LCS/MS/MSD Precision
Analyte	CAS Number	Soil	Soil	Soil	Sediment	Soil	Sediment	Soil[5]	Soil	Soil	Soil
		(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	%	RPD ≤
Silver	7440-22-4	1	510	14	1.0	14	1.0	0.500	0.250	75-125	20
Sodium *(Method SW-846 6010B/C)*	7440-23-5	NA	NA	NA	NA	NA	NA	500	250	80-120	20
Strontium	7440-24-6	4,700	61,000	NA	NA	4,700	NA	1200	600	83-114	20
Thallium	7440-28-0	0.08	1	0.057	NA	0.057	NA	3.00	0.250	75-125	20
Vanadium	7440-62-2	NA	NA	280	NA	55	NA	2.00	1.25	75-125	20
Zinc	7440-66-6	584	31,000	79	121	79	121	3.00	1.25	75-125	20

[1] Residential and Industrial Screening Levels were obtained from ORNL RSLs for Chemical Contaminants at Superfund Sites Table (April 2012). The RSLs are shown at a TR of 1.0E-6. The THQ has been adjusted to 0.1 for non-carcinogens to allow for potential additive toxicity of multiple contaminants.
[2] The Recommended Ecological Soil Screening Values were obtained from the USEPA EcoSSL
[3] The Recommended Ecological Sediment Screening Values were obtained from EPA Region 3 BTAG Marine Sediment Benchmark Table (July 2006)
[4] For the purpose of contracting with the analytical laboratory, the PAL is the lesser of "EPA Residential RSL" or "Recommended Ecological Soil Screening Value".
[5] If % solids is <30%, additional sample needs to be analyzed to ensure the detection limits are met.
[6] Laboratory control sample (LCS)/matrix spike (MS)/matrix spike duplicate (MSD)
**According to USEPA EcoSSL, Aluminum is identified as a constituent of potential concern only for soils with a soil pH less than 5.5.*
***The RSL for arsenic is typically below the naturally occurring background concentration and is below the laboratory LOQ. Therefore, the PAL has been set at the LOQ.*

Worksheet 15.2b — Reference Limits and Evaluation Table – Metals Methods SW-846 6010B/C, 6020A, and 7470A/7471B (Water)

		Human Health Values	Ecological Values	PAL[3]	Achievable Laboratory Limits		Precision and Accuracy Method Performance Criteria	
		EPA MCL[1]	Marine Screening Benchmark[2]		Project LOQ	LOD	LCS/MS/MSD[4] Recovery Limits	LCS/MS/MSD Precision
Analyte	CAS Number	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	%	RPD ≤
Aluminum *(Method SW-846 6010B/C)*	7429-90-5	1,600	NA	1,600	200	100	80-120	20
Antimony	7440-36-0	6	500	6	2.00	1.00	75-125	20
Arsenic	7440-38-2	10	12.5	10	10.0	0.500	75-125	20
Barium	7440-39-3	2,000	NA	2,000	200	5.00	75-125	20
Beryllium	7440-41-7	4	NA	4	1.00	0.500	75-125	20
Cadmium	7440-43-9	5	0.12	0.1	5.00	0.500	75-125	20
Calcium *(Method SW-846 6010B/C)*	7440-70-2	NA	NA	NA	5000	2500	80-120	20
Chromium	7440-47-3	100	57.5	58	10.0	1.00	75-125	20
Cobalt	7440-48-4	0.47	NA	0.5	1.0	0.500	75-125	20
Copper	7440-50-8	1,300	3.1	3	2.00	1.00	75-125	20
Iron *(Method SW-846 6010B/C)*	7439-89-6	1,100	NA	1,100	200	100	80-120	20
Lead	7439-92-1	15	8.1	8	1.00	0.500	75-125	20
Magnesium *(Method SW-846 6010B/C)*	7439-95-4	NA	NA	NA	5000	2500	80-120	20
Manganese	7439-96-5	32	NA	32	10.0	0.500	75-125	20
Mercury *(Method SW-846 7470A/7471B)*	7439-97-6	2	0.016	0.02	0.200	0.150	80-120	20
Nickel	7440-02-0	30	8.2	8	1.00	0.500	75-125	20
Potassium *(Method SW-846 6010B/C)*	7440-09-7	NA	NA	NA	5000	2500	80-120	20
Selenium	7782-49-2	50	71	50	10.0	2.50	75-125	20
Silver	7440-22-4	7.1	0.23	0.2	1.00	0.500	75-125	20
Sodium *(Method SW-846 6010B/C)*	7440-23-5	NA	NA	NA	5000	2500	80-120	20
Strontium (6010C)	7440-24-6	NA	NA	NA	6	3	90-113	20
Thallium	7440-28-0	2	21.3	2	1.00	0.500	80-120	20
Vanadium	7440-62-2	NA	NA	NA	20.0	2.50	80-120	20
Zinc[5]	7440-66-6	470	81	81	30.0	1.00	80-120	20

Worksheet 15.2b — Reference Limits and Evaluation Table – Metals Methods SW-846 6010B/C, 6020A, and 7470A/7471B (Water) (Continued)

[1] *MCLs were obtained from ORNL RSLs for Chemical Contaminants at Superfund Sites Table (April 2012) or VDEQ Groundwater Standards and Criteria regulations as applicable. The EPA MCLs are shown at a TR of 1.0E-6. The THQ has been adjusted to 0.1 for non-carcinogens to allow for potential additive toxicity of multiple contaminants. For contaminants that do not have an MCL the RSL for Tap Water was used.*
[2] *The Marine Screening Benchmark Values were obtained from EPA Region 3 BTAG Marine Screening Benchmark Table (July 2006)*
[3] *For the purpose of contracting with the analytical laboratory, the PAL is the lesser of "EPA MCL" or "Marine Screening Benchmark".*
[4] *Laboratory control sample (LCS)/matrix spike (MS)/matrix spike duplicate (MSD)*
NA = Not Applicable

Worksheet 15.3a — Reference Limits and Evaluation Table – VOCs by SW-846 Method 8260B (Soil)

Analyte	CAS Number	Human Health Values: EPA Residential RSL[1] Soil (mg/kg)	Human Health Values: EPA Industrial RSL[1] Soil (mg/kg)	Recommended Ecological Screening Value[2] Soil (mg/kg)	PAL[3] Soil (mg/kg)	Achievable Laboratory Limits: Project LOQ Soil[4] (mg/kg)	Achievable Laboratory Limits: LOD Soil (mg/kg)	Precision and Accuracy Method Performance Criteria: LCS/MS/MSD[5] Recovery Limits Soil %	Precision and Accuracy Method Performance Criteria: LCS/MS /MSD Precision Soil RPD ≤
1,1,1,2-Tetrachloroethane	630-20-6	1.9	9.3	NA	1.9	0.0050	0.001	75 - 125	30
1,1,1-Trichloro-2,2,2-trifluoroethane	354-58-5	NA	NA	NA	NA	0.0050	0.001	50 - 150	30
1,1,1-Trichloroethane	71-55-6	870	38,000	NA	870	0.0050	0.001	70 - 135	30
1,1,2,2-Tetrachloroethane	79-34-5	0.56	2.8	NA	0.56	0.0050	0.001	55 - 130	30
1,1,2-Trichloro-1,2,2-trifluoroethane	76-13-1	4,300	180,000	NA	4,300	0.0050	0.001	50 - 150	30
1,1,2-Trichloroethane	79-00-5	1.1	5.3	NA	1.1	0.0050	0.0025	60 - 125	30
1,1-Dichloroethane	75-34-3	3.3	17	NA	3.3	0.0050	0.001	75 - 125	30
1,1-Dichloroethene	75-35-4	24	110	NA	24	0.0050	0.0025	65 - 135	30
1,1-Dichloropropene	563-58-6	NA	NA	NA	NA	0.0050	0.001	70 - 135	30
1,2,3-Trichlorobenzene	87-61-6	4.9	490	NA	4.9	0.0050	0.00025	60 - 135	30
1,2,3-Trichloropropane	96-18-4	0.01	0.1	NA	0.01	0.0050	0.0025	65 - 130	30
1,2,4-Trichlorobenzene	120-82-1	22	99	NA	22	0.0050	0.001	65 - 130	30
1,2,4-Trimethylbenzene	95-63-6	6.2	260	NA	6.2	0.0050	0.001	65 - 135	30
1,2-Dibromo-3-Chloropropane	96-12-8	0.005	0.1	NA	0.005	0.0050	0.0025	40 - 135	30
1,2-Dibromoethane	106-93-4	0.034	0.2	NA	0.034	0.0050	0.00025	70 - 125	30
1,2-Dichlorobenzene	95-50-1	190	9,800	NA	190	0.0050	0.001	75 - 120	30
1,2-Dichloroethane	107-06-2	0.43	2.2	NA	0.43	0.0050	0.001	70 - 135	30
1,2-Dichloropropane	78-87-5	0.94	4.7	NA	0.94	0.0050	0.0025	70 - 120	30
1,3,5-Trimethylbenzene	108-67-8	78	10,000	NA	78	0.0050	0.0025	70 - 120	30
1,3-Dichlorobenzene	541-73-1	0.04	NA	NA	0.04	0.0050	0.001	70 - 125	30
1,3-Dichloropropane	142-28-9	160	20,000	NA	160	0.0050	0.001	75 - 125	30
1,4-Dichlorobenzene	106-46-7	2.4	12	NA	2.4	0.0050	0.00025	70 - 125	30
1,4-Dioxane	123-91-1	4.900	17	NA	4.900	0.0050	0.12	50 - 150	30
1-Chlorohexane	544-10-5	NA	NA	NA	NA	0.0050	0.00025	50 - 150	30
2,2-Dichloropropane	594-20-7	NA	NA	NA	NA	0.0050	0.001	65 - 135	30
2-Butanone	78-93-3	2,800	200,000	NA	2,800	0.0050	0.0025	30 - 160	30
2-Chloroethylvinyl ether	110-75-8	NA	NA	NA	NA	0.0050	0.0025	50 - 150	30
2-Chlorotoluene	95-49-8	160	20,000	NA	160	0.005	0.001	70 - 130	30
2-Hexanone	591-78-6	21	140	NA	21	0.012	0.0025	45 - 145	30

Worksheet 15.3a — Reference Limits and Evaluation Table – VOCs by SW-846 Method 8260B (Soil) (Continued)

Analyte	CAS Number	Human Health Values: EPA Residential RSL[1]	Human Health Values: EPA Industrial RSL[1]	Recommended Ecological Screening Value[2]	PAL[3]	Achievable Laboratory Limits: Project LOQ	Achievable Laboratory Limits: LOD	Precision and Accuracy Method Performance Criteria: LCS/MS/MSD[5] Recovery Limits	Precision and Accuracy Method Performance Criteria: LCS/MS /MSD Precision
		Soil	Soil	Soil	Soil	Soil[4]	Soil	Soil	Soil
		(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	%	RPD ≤
3-Chloropropene	107-05-1	0.7	3.4	NA	0.7	0.005	0.0025	50 - 150	30
4-Chlorotoluene	106-43-4	160	20,000	NA	160	0.005	0.001	75 - 125	30
4-Methyl-2-pentanone	108-10-1	530	53,000	NA	530	0.012	0.0025	45 - 145	30
Acetone	67-64-1	6100	630,000	NA	6100	0.012	0.0063	20 - 160	30
Acetonitrile	75-05-8	87	370	NA	87	0.005	0.0025	50 - 150	30
Acrolein	107-02-8	0.02	0	NA	0.02	0.050	0.01	50 - 150	30
Acrylonitrile	107-13-1	0.2	1.2	NA	0.2	0.050	0.01	50 - 150	30
Benzene	71-43-2	1.1	5.4	NA	1.1	0.005	0.001	75 - 125	30
Bromobenzene	108-86-1	30	1,800	NA	30	0.005	0.001	65 - 120	30
Bromochloromethane	74-97-5	16	68	NA	16	0.005	0.001	70 - 125	30
Bromodichloromethane	75-27-4	0.27	1	NA	0.27	0.005	0.001	70 - 130	30
Bromoform	75-25-2	62	220	NA	62	0.005	0.0025	55 - 135	30
Bromomethane	74-83-9	0.73	3	NA	0.73	0.005	0.001	30 - 160	30
Carbon disulfide	75-15-0	82	3,700	NA	82	0.005	0.00025	45 - 160	30
Carbon Tetrachloride	56-23-5	0.6	3	NA	0.6	0.005	0.001	65 - 135	30
Chlorobenzene	108-90-7	29	1,400	NA	29	0.005	0.00025	75 - 125	30
Chloroethane	75-00-3	1500	61,000	NA	1500	0.005	0.0025	40 - 155	30
Chloroform	67-66-3	0.3	1.5	NA	0.3	0.005	0.001	70 - 125	30
Chloromethane	74-87-3	12	50	NA	12	0.005	0.001	50 - 130	30
Chloroprene	126-99-8	0.01	0.05	NA	0.01	0.005	0.001	50 - 150	30
cis-1,2-Dichloroethene	156-59-2	16	200	NA	16	0.005	0.001	65 - 125	30
cis-1,3-Dichloropropene	10061-01-5	0.003	NA	NA	0.003	0.005	0.001	70 - 125	30
Cyclohexane	110-82-7	700	29,000	NA	700	0.005	0.001	50 - 150	30
Dibromochloromethane	124-48-1	0.7	3.3	NA	0.7	0.005	0.001	50 - 150	30
Dibromomethane	74-95-3	2.5	11	NA	2.5	0.005	0.0025	75 - 130	30
Dichlorodifluoromethane	75-71-8	9.4	40	NA	9.4	0.005	0.001	35 - 135	30
Ethylbenzene	100-41-4	5.4	27	NA	5.4	0.005	0.0025	75 - 125	30
Ethyl Methacrylate	97-63-2	150	7,500	NA	150	0.050	0.01	50 - 150	30
Hexachlorobutadiene	87-68-3	6.2	22	NA	6.2	0.005	0.0025	55 - 140	30

Worksheet 15.3a — Reference Limits and Evaluation Table – VOCs by SW-846 Method 8260B (Soil) (Continued)

Analyte	CAS Number	Human Health Values: EPA Residential RSL[1]	Human Health Values: EPA Industrial RSL[1]	Recommended Ecological Screening Value[2]	PAL[3]	Achievable Laboratory Limits: Project LOQ	Achievable Laboratory Limits: LOD	Precision and Accuracy Method Performance Criteria: LCS/MS/MSD[5] Recovery Limits	Precision and Accuracy Method Performance Criteria: LCS/MS/MSD Precision
		Soil	Soil	Soil	Soil	Soil[4]	Soil	Soil	Soil
		(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	%	RPD ≤
Iodomethane	74-88-4	NA	NA	NA	NA	0.005	0.001	50 - 150	30
Isobutyl alcohol	78-83-1	1,800	18,000	NA	1,800	0.250	0.05	50 - 150	30
Isopropylbenzene	89-82-8	NA	NA	NA	NA	0.005	0.00025	75 - 130	30
Isopropyl ether	108-20-3	240	10,000	NA	240	0.005	0.00025	50 - 150	30
m,p-Xylene	108-38-3	59	2,500	NA	59	0.010	0.0005	80 - 125	30
Methacrylonitrile	126-89-7	NA	NA	NA	NA	0.050	0.0025	50 - 150	30
Methyl acetate	79-20-9	7,800	1,000,000	NA	7,800	0.005	0.0025	50 - 150	30
Methylcyclohexane	108-87-2	109	NA	NA	109	0.005	0.001	50 - 150	30
Methylene Chloride	75-09-2	56	960	NA	56	0.005	0.001	55 - 140	30
Methyl Methacrylate	80-62-6	480	21,000	NA	480	0.050	0.01	50 - 150	30
Methyl-tert-butyl ether	1634-04-4	43	220	NA	43	0.005	0.001	55 - 140	30
Naphthalene	91-20-3	3.6	18	NA	3.6	0.005	0.001	40 - 125	30
n-Butylbenzene	104-51-8	390	51,000	NA	390	0.005	0.001	65 - 140	30
n-Hexane	110-54-3	57	2,600	NA	57	0.005	0.001	65 - 140	30
n-Propyl Benzene	103-65-1	340	21,000	NA	340	0.005	0.001	65 - 140	30
o-Xylene	95-47-6	69	3,000	NA	69	0.005	0.001	75 - 125	30
Pentachloroethane	76-01-7	5.4	19	NA	5.4	0.005	0.001	50 - 150	30
p-Isopropyltoluene	99-87-6	17.5	NA	NA	17.5	0.005	0.001	75 - 135	30
Propionitrile	107-12-0	NA	NA	NA	NA	0.250	0.013	50 - 150	30
sec-Butylbenzene	135-98-8	NA	NA	NA	NA	0.005	0.001	65 - 130	30
Styrene	100-42-5	630	36,000	NA	630	0.005	0.00025	75 - 125	30
Tert-Butylbenzene	98-06-6	NA	NA	NA	NA	0.005	0.00025	65 - 130	30
Tetrachloroethene	127-18-4	22	110	NA	22	0.005	0.0025	65 - 140	30
Tetrahydrofuran	109-99-9	1,800	9,500	NA	1,800	0.005	0.0025	65 - 140	30
Toluene	108-88-3	500	45,000	NA	500	0.005	0.001	70 - 125	30
trans-1,2-Dichloroethene	156-60-5	15	69	NA	15	0.005	0.0025	65 - 135	30
trans-1,3-Dichloropropene	10061-02-6	0.003	NA	NA	0.003	0.005	0.001	65 - 125	30
trans-1,4-Dichloro-2-butene	110-57-6	0.01	0.04	NA	0.01	0.020	0.004	50 - 150	30
Trichloroethene	79-01-6	0.9	6.4	NA	0.9	0.005	0.001	75 - 125	30

Worksheet 15.3a — Reference Limits and Evaluation Table – VOCs by SW-846 Method 8260B (Soil) (Continued)

Analyte	CAS Number	Human Health Values: EPA Residential RSL[1]	Human Health Values: EPA Industrial RSL[1]	Recommended Ecological Screening Value[2]	PAL[3]	Achievable Laboratory Limits: Project LOQ	Achievable Laboratory Limits: LOD	Precision and Accuracy Method Performance Criteria: LCS/MS/MSD[5] Recovery Limits	Precision and Accuracy Method Performance Criteria: LCS/MS /MSD Precision
		Soil	Soil	Soil	Soil	Soil[4]	Soil	Soil	Soil
		(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	%	RPD ≤
Trichlorofluoromethane	75-69-4	79	3,400	NA	79	0.005	0.001	25 - 185	30
Vinyl acetate	108-05-4	97	4,100	NA	97	0.005	0.00025	50 - 150	30
Vinyl Chloride	75-01-4	0.06	1.7	NA	0.06	0.005	0.001	60 - 125	30
Xylene (total)	1330-20-7	63	2,700	NA	63	0.005	0.001	60 - 125	30
Dibromofluoromethane (Surrogate)	1868-53-7	NA	NA	NA	NA	NA	0.001	71 – 141[6]	NA
1,2-Dichloroethane-d4 (Surrogate)	17060-07-0	NA	NA	NA	NA	NA	0.001	70 – 139[6]	NA
Bromofluorobenzene (Surrogate)	460-00-4	NA	NA	NA	NA	NA	0.001	85 – 115[6]	NA
Toluene-d8 (Surrogate)	2037-26-5	NA	NA	NA	NA	NA	0.001	85 – 120[6]	NA

[1] Residential and Industrial Screening Levels were obtained from ORNL RSLs for Chemical Contaminants at Superfund Sites Table (April 2012). The RSLs are shown at a TR of 1.0E-6. The THQ has been adjusted to 0.1 for non-carcinogens to allow for potential additive toxicity of multiple contaminants.
[2] The primary source for the Recommended Soil Screening Value is the EcoSSL
[3] For the purpose of contracting with the analytical laboratory, the PAL is the lesser of “EPA Residential RSL” or “Recommended Ecological Screening Value”.
[4] If % solids is <30%, additional sample needs to be analyzed to ensure the detection limits are met.
[5] Laboratory control sample (LCS)/matrix spike (MS)/matrix spike duplicate (MSD)
[6] Surrogate Control Limits
NA = Not Applicable

Worksheet 15.3b — Reference Limits and Evaluation Table – VOCs by SW-846 Method 8260B (Water)

		Human Health Values	PAL	Achievable Laboratory Limits		Precision and Accuracy Method Performance Criteria	
		EPA MCL[1]		Project LOQ	LOD	LCS/MS/MSD[2] Recovery Limits	LCS/MS/MSD Precision
Analyte	CAS Number	(µg/L)	(µg/L)	(µg/L)	(µg/L)	%	RPD ≤
1,1,1,2-Tetrachloroethane	630-20-6	0.5	0.5	0.5	0.08	80 - 130	30
1,1,1-Trichloro-2,2,2-trifluoroethane	354-58-5	NA	NA	0.5	0.08	50 - 150	30
1,1,1-Trichloroethane	71-55-6	200	200	0.5	0.08	65 - 130	30
1,1,2,2-Tetrachloroethane	79-34-5	0.07	0.07	0.5	0.08	65 - 130	30
1,1,2-Trichloro-1,2,2-trifluoroethane	76-13-1	5300	5300	0.5	0.08	50 - 150	30
1,1,2-Trichloroethane	79-00-5	5	5	0.5	0.08	75 - 125	30
1,1-Dichloroethane	75-34-3	2.4	2.4	0.5	0.08	70 - 135	30
1,1-Dichloroethene	75-35-4	7	7	0.5	0.08	70 - 130	30
1,1-Dichloropropene	563-58-6	NA	NA	0.5	0.08	75 - 130	30
1,2,3-Trichlorobenzene	87-61-6	1	1	0.5	0.08	55 - 140	30
1,2,3-Trichloropropane	96-18-4	0.0007	0.0007	0.5	0.3	75 - 125	30
1,2,4-Trichlorobenzene	120-82-1	70	70	0.5	0.08	65 - 135	30
1,2,4-Trimethylbenzene	95-63-6	1.5	1.5	0.5	0.08	75 - 130	30
1,2-Dibromo-3-Chloropropane	96-12-8	0.2	0.2	0.5	0.3	50 - 130	30
1,2-Dibromoethane	106-93-4	0.05	0.05	0.5	0.08	80 - 120	30
1,2-Dichlorobenzene	95-50-1	600	600	0.5	0.08	70 - 120	30
1,2-Dichloroethane	107-06-2	5	5	0.5	0.08	70 - 130	30
1,2-Dichloropropane	78-87-5	5	5	0.5	0.3	75 - 125	30
1,3,5-Trimethyl benzene	108-67-8	8.7	8.7	0.5	0.3	75 - 125	30
1,3-Dichlorobenzene	541-73-1	0.43	0.43	0.5	0.08	75 - 125	30
1,3-Dichloropropane	142-28-9	29	29	0.5	0.08	75 - 125	30
1,4-Dichlorobenzene	106-46-7	75	75	0.5	0.08	75 - 125	30
1,4-Dioxane	123-91-1	0.67	0.67	25	15	50 - 150	30
1-Chlorohexane	544-10-5	NA	NA	0.5	0.08	50 - 150	25
2,2-Dichloropropane	594-20-7	NA	NA	0.5	0.08	70 - 135	30
2-Butanone	78-93-3	490	490	2.5	0.4	30 - 150	30
2-Chloroethylvinyl ether	110-75-8	NA	NA	1	0.3	50 - 150	30
2-Chlorotoluene	95-49-8	18	18	0.5	0.08	75 - 125	30
2-Hexanone	591-78-6	3.4	3.4	2.5	1.5	55 - 130	30
3-Chloropropene	107-05-1	0.63	0.63	0.5	0.08	50 - 150	30
4-Chlorotoluene	106-43-4	19	19	0.5	0.08	75 - 130	30

Worksheet 15.3b — Reference Limits and Evaluation Table – VOCs by SW-846 Method 8260B (Water) (Continued)

		Human Health Values	PAL	Achievable Laboratory Limits		Precision and Accuracy Method Performance Criteria	
		EPA MCL[1]		Project LOQ	LOD	LCS/MS/MSD[2] Recovery Limits	LCS/MS/MSD Precision
Analyte	CAS Number	(µg/L)	(µg/L)	(µg/L)	(µg/L)	%	RPD ≤
4-Methyl-2-pentanone	108-10-1	100	100	2.5	1.5	60 - 135	30
Acetone	67-64-1	1200	1200	2.5	1.5	40 - 140	30
Acetonitrile	75-05-8	13	13	0.5	0.08	50 - 150	30
Acrolein	107-02-8	0.0041	0.0041	5	3	50 - 150	30
Acrylonitrile	107-13-1	0.045	0.045	5	0.8	50 - 150	30
Benzene	71-43-2	5	5	0.5	0.08	80 - 120	30
Bromobenzene	108-86-1	5.4	5.4	0.5	0.08	75 - 125	30
Bromochloromethane	74-97-5	8.3	8.3	0.5	0.08	65 - 130	30
Bromodichloromethane	75-27-4	0.12	0.12	0.5	0.08	75 - 120	30
Bromoform	75-25-2	7.9	7.9	0.5	0.08	70 - 130	30
Bromomethane	74-83-9	0.7	0.7	0.5	0.3	30 - 145	30
Carbon disulfide	75-15-0	72	72	0.5	0.08	35 - 160	30
Carbon Tetrachloride	56-23-5	5	5	0.5	0.08	65 - 140	30
Chlorobenzene	108-90-7	100	100	0.5	0.08	80 - 120	30
Chloroethane	75-00-3	2100	2100	0.5	0.3	60 - 135	30
Chloroform	67-66-3	0.19	0.19	0.5	0.08	65 - 135	30
Chloromethane	74-87-3	19	19	0.5	0.3	40 - 125	30
Chloroprene	126-99-8	0.016	0.016	0.5	0.08	50 - 150	30
cis-1,2-Dichloroethene	156-59-2	70	70	0.5	0.08	70 - 125	30
cis-1,3-Dichloropropene	10061-01-5	0.43	0.43	0.5	0.08	70 - 130	30
Cyclohexane	110-82-7	1300	1300	0.5	0.08	50 - 150	30
Dibromochloromethane	124-48-1	0.15	0.15	0.5	0.08	50 - 150	30
Dibromomethane	74-95-3	0.79	0.79	0.5	0.08	75 - 125	30
Dichlorodifluoromethane	75-71-8	19	19	0.5	0.08	30 - 155	30
Ethylbenzene	100-41-4	700	700	0.5	0.08	75 - 125	30
Ethyl Methacrylate	97-63-2	42	42	5	0.8	50 - 150	30
Hexachlorobutadiene	87-68-3	0.26	0.26	0.5	0.08	50 - 140	30
Iodomethane	74-88-4	NA	NA	0.5	0.08	50 - 150	30
Isobutyl alcohol	78-83-1	460	460	25	15	50 - 150	30
Isopropylbenzene	89-82-8	NA	NA	0.5	0.08	75 - 125	30
Isopropyl ether	108-20-3	150	150	0.5	0.08	50 - 150	30

Worksheet 15.3b — Reference Limits and Evaluation Table – VOCs by SW-846 Method 8260B (Water) (Continued)

		Human Health Values	PAL	Achievable Laboratory Limits		Precision and Accuracy Method Performance Criteria	
		EPA MCL[1]		Project LOQ	LOD	LCS/MS/MSD[2] Recovery Limits	LCS/MS/MSD Precision
Analyte	CAS Number	(µg/L)	(µg/L)	(µg/L)	(µg/L)	%	RPD ≤
m,p-Xylene	108-38-3	19	19	1	0.16	75 - 130	30
Methacrylonitrile	126-89-7	NA	NA	5	0.8	50 - 150	30
Methyl acetate	79-20-9	1600	1600	0.5	0.3	50 - 150	30
Methylcyclohexane	108-87-2	630	630	0.5	0.08	50 - 150	30
Methylene Chloride	75-09-2	5	5	0.5	0.08	55 - 140	30
Methyl Methacrylate	80-62-6	140	140	5	0.8	50 - 150	30
Methyl-tert-butyl ether	1634-04-4	12	12	0.5	0.08	55 - 140	30
Naphthalene	91-20-3	0.14	0.14	0.5	0.3	55 - 140	30
n-Butylbenzene	104-51-8	78	78	0.5	0.08	70 - 135	30
n-Hexane	110-54-3	25	25	0.5	0.08	70 - 135	30
n-Propyl Benzene	103-65-1	53	53	0.5	0.08	70 - 135	30
o-Xylene	95-47-6	19	19	0.5	0.08	80 - 120	30
Pentachloroethane	76-01-7	0.56	0.56	0.5	0.08	50 - 150	30
p-Isopropyltoluene	99-87-6	68	68	0.5	0.08	75 - 130	30
Propionitrile	107-12-0	NA	NA	25	4	50 - 150	30
sec-Butylbenzene	135-98-8	NA	NA	0.5	0.08	70 - 125	30
Styrene	100-42-5	100	100	0.5	0.08	65 - 135	30
Tert-Butylbenzene	98-06-6	NA	NA	0.5	0.08	70 - 130	30
Tetrachloroethene	127-18-4	5	5	0.5	0.08	45 - 150	30
Tetrahydrofuran	109-99-9	320	320	0.5	0.08	45 - 150	30
Toluene	108-88-3	1000	1000	0.5	0.08	75 - 120	30
trans-1,2-Dichloroethene	156-60-5	100	100	0.5	0.08	60 - 140	30
trans-1,3-Dichloropropene	10061-02-6	0.43	0.43	0.5	0.08	55 - 140	30
trans-1,4-Dichloro-2-butene	110-57-6	0.0012	0.0012	2	1.2	50 - 150	30
Trichloroethene	79-01-6	5	5	0.5	0.08	70 - 125	30
Trichlorofluoromethane	75-69-4	110	110	0.5	0.08	60 - 145	30
Vinyl acetate	108-05-4	41	41	1	0.16	50 - 150	30
Vinyl Chloride	75-01-4	2	2	0.5	0.08	50 - 145	30
Xylene (total)	1330-20-7	10000	10000	0.5	0.08	50 - 145	30
Dibromofluoromethane (Surrogate)	1868-53-7	NA	NA	NA	0.08	85 - 115[3]	NA
1,2-Dichloroethane-d4 (Surrogate)	17060-07-0	NA	NA	NA	0.08	70 – 120[3]	NA

Worksheet 15.3b — Reference Limits and Evaluation Table – VOCs by SW-846 Method 8260B (Water) (Continued)

		Human Health Values	PAL	Achievable Laboratory Limits		Precision and Accuracy Method Performance Criteria	
		EPA MCL[1]		Project LOQ	LOD	LCS/MS/MSD[2] Recovery Limits	LCS/MS/MSD Precision
Analyte	CAS Number	(µg/L)	(µg/L)	(µg/L)	(µg/L)	%	RPD ≤
Bromofluorobenzene (Surrogate)	460-00-4	NA	NA	NA	0.08	85 – 120[3]	NA
Toluene-d8 (Surrogate)	2037-26-5	NA	NA	NA	0.08	75 – 120[3]	NA

[1] *MCLs were obtained from ORNL RSLs for Chemical Contaminants at Superfund Sites Table (April 2012) or VDEQ Groundwater Standards and Criteria regulations as applicable. The EPA MCLs are shown at a TR of 1.0E-6. The THQ has been adjusted to 0.1 for non-carcinogens to allow for potential additive toxicity of multiple contaminants. For contaminants that do not have an MCL the RSL for Tap Water was used.*
[2] *Laboratory control sample (LCS)/matrix spike (MS)/matrix spike duplicate (MSD)*
[3] *Surrogate Control Limits*
NA = Not Applicable

Worksheet 15.4a — Reference Limits and Evaluation Table – SVOCs by SW-846 Method 8270D (Soil)

Analyte	CAS Number	Human Health Values: EPA Residential RSL[1] Soil (mg/kg)	Human Health Values: EPA Industrial RSL[1] Soil (mg/kg)	Recommended Ecological Screening Value[2,3] Soil (mg/kg)	PAL[4] Soil (mg/kg)	Achievable Laboratory Limits: Project LOQ Soil[5] (mg/kg)	Achievable Laboratory Limits: LOD Soil (mg/kg)	Precision and Accuracy Method Performance Criteria: LCS/MS/MSD[6] Recovery Limits Soil %	Precision and Accuracy Method Performance Criteria: LCS/MS/MSD Precision Soil RPD ≤
N-Nitrosodimethylamine	62-75-9	0.0023	0.034	NA	0.0023	0.17	0.068	20 - 115	30
Pyridine	110-86-1	7.8	100	NA	7.8	0.17	0.068	20 - 150	30
Benzaldehyde	100-52-7	780	100,000	NA	780	0.17	0.068	20 - 150	30
Phenol	108-95-2	1,800	18,000	NA	1,800	0.33	0.068	40 - 100	30
Bis(2-chloroethyl)ether	111-44-4	0.21	1	NA	0.21	0.17	0.033	40 - 105	30
2-Chlorophenol	95-57-8	39	510.0	NA	39	0.33	0.068	45 - 105	30
1,3-Dichlorobenzene	541-73-1	0.045	NA	NA	0.045	0.17	0.068	40 - 100	30
1,4-Dichlorobenzene	106-46-7	2.4	12	NA	2.4	0.17	0.068	35 - 105	30
Benzyl Alcohol	100-51-6	610	6,200	NA	610	0.17	0.033	45 - 125	30
1,2-Dichlorobenzene	95-50-1	190	9,800	NA	190	0.17	0.033	45 - 100	30
2-Methylphenol	95-48-7	310	3,100	NA	310	0.33	0.068	40 - 105	30
2,2'-oxybis(1-Chloropropane)	108-60-1	4.6	22	NA	4.6	0.17	0.068	20 - 150	30
Acetophenone	98-86-2	780	100,000	NA	780	0.17	0.033	20 - 150	30
3-Methylphenol	108-39-4	310	3,100	NA	310	0.17	0.068	20 - 150	30
4-Methylphenol	106-44-5	610	6,200	NA	610	0.17	0.068	45 - 110	30
N-Nitroso-di-N-propylamine	62-64-7	NA	NA	NA	NA	0.17	0.068	40 - 115	30
Hexachloroethane	67-72-1	12	43	NA	12	0.17	0.068	35 - 110	30
Nitrobenzene	98-95-3	4.8	24	NA	4.8	0.17	0.068	40 - 115	30
Isophorone	78-59-1	510	1,800	NA	510	0.17	0.068	45 - 110	30
2-Nitrophenol	88-75-5	NA	NA	NA	NA	0.33	0.033	40 - 110	30
2,4-Dimethylphenol	105-67-9	120	1,200	NA	120	0.33	0.068	30 - 105	30
Bis(2-chloroethoxy)methane	111-91-1	18	180	NA	18	0.17	0.068	45 - 110	30
2,4-Dichlorophenol	120-83-2	18	180	NA	18	0.33	0.068	45 - 110	30
1,2,4-Trichlorobenzene	120-82-1	22	99	NA	22	0.17	0.033	45 - 110	30
Naphthalene	91-20-3	3.6	18	NA	3.6	0.17	0.068	20 - 150	30
4-Chloroaniline	106-47-8	2.4	9	NA	2.4	0.33	0.068	20 - 150	30
Hexachlorobutadiene	87-68-3	6.2	22	NA	6.2	0.17	0.068	40 - 115	30
Caprolactam	105-60-2	3,100	31,000	NA	3,100	0.17	0.068	20 - 150	30
4-Chloro-3-methylphenol	59-50-7	610	6,200	NA	610	0.33	0.068	45 - 115	30

Worksheet 15.4a — Reference Limits and Evaluation Table – SVOCs by SW-846 Method 8270D (Soil) (Continued)

Analyte	CAS Number	Human Health Values: EPA Residential RSL[1] Soil (mg/kg)	Human Health Values: EPA Industrial RSL[1] Soil (mg/kg)	Recommended Ecological Screening Value[2,3] Soil (mg/kg)	PAL[4] Soil (mg/kg)	Achievable Laboratory Limits: Project LOQ Soil[5] (mg/kg)	Achievable Laboratory Limits: LOD Soil (mg/kg)	Precision and Accuracy Method Performance Criteria: LCS/MS/MSD[6] Recovery Limits Soil %	Precision and Accuracy Method Performance Criteria: LCS/MS/MSD Precision Soil RPD ≤
2-Methylnaphthalene	61-57-6	NA	NA	NA	NA	0.17	0.068	45 - 105	30
1-Methylnaphthalene	90-12-0	16	53	NA	16	0.17	0.068	20 - 150	30
Hexachlorocyclopentadiene	77-47-4	37	370	NA	37	0.17	0.033	20 - 150	30
2,4,6-Trichlorophenol	88-06-2	44	160	NA	44	0.33	0.068	45 - 110	30
2,4,5-Trichlorophenol	95-95-4	610	6,200	NA	610	0.33	0.068	50 - 110	30
1,1'-Biphenyl	92-52-4	5.1	21	NA	5.1	0.33	0.068	50 - 110	30
2-Chloronaphthalene	91-58-7	630	82,000	NA	630	0.17	0.14	45 - 105	30
2-Nitroaniline	88-74-4	61	600	NA	61	0.33	0.068	45 - 120	30
Dimethylphthalate	131-11-3	NA	NA	NA	NA	0.17	0.068	50 - 110	30
2,6-Dinitrotoluene	606-20-2	6.1	62	NA	6.1	0.17	0.068	20 - 150	30
Acenaphthylene	208-96-8	133	NA	NA	133	0.17	0.068	45 - 105	30
3-Nitroaniline	99-09-2	NA	NA	NA	NA	0.33	0.068	25 - 110	30
Acenaphthene	83-32-9	340	3,300	NA	340	0.17	0.068	45 - 110	30
2,4-Dinitrophenol	51-28-5	12	120	NA	12	0.33	0.068	15 - 130	30
4-Nitrophenol	100-02-7	NA	NA	NA	NA	0.33	0.068	15 - 140	30
2,4-Dinitrotoluene	121-14-2	1.6	6	NA	1.6	0.17	0.068	50 - 115	30
Dibenzofuran	132-64-9	7.8	1,000	NA	7.8	0.17	0.068	50 - 105	30
Diethyl phthalate	84-66-2	4,900	49,000	NA	4,900	0.17	0.068	50 - 115	30
4-Chlorophenyl-phenylether	7005-72-3	NA	NA	NA	NA	0.17	0.068	45 - 110	30
Fluorene	86-76-7	NA	NA	NA	NA	0.17	0.068	50 - 110	30
4-Nitroaniline	100-01-6	24	86	NA	24	0.33	0.068	35 - 115	30
4,6-Dinitro-2-methylphenol	534-52-1	0.49	5	NA	0.49	0.33	0.068	30 - 135	30
N-Nitrosodiphenylamine	86-30-6	99	350	NA	99	0.17	0.068	40 - 115	30
1,2-Diphenylhydrazine	122-66-7	0.61	2.2	NA	0.61	0.17	0.033	45 - 100	30
4-Bromophenyl-phenylether	101-55-3	NA	NA	NA	NA	0.17	0.068	45 - 115	30
Hexachlorobenzene	118-74-1	0.3	1	NA	0.3	0.17	0.068	45 - 120	30
Atrazine	1912-24-9	2.1	8	NA	2.1	0.17	0.068	55 - 105	30
Pentachlorophenol	87-86-5	0.89	3	NA	0.89	0.33	0.068	25 - 120	30
Phenanthrene	85-01-8	170	NA	NA	170	0.17	0.068	50 - 110	30

Worksheet 15.4a — Reference Limits and Evaluation Table – SVOCs by SW-846 Method 8270D (Soil) (Continued)

Analyte	CAS Number	Human Health Values: EPA Residential RSL[1]	Human Health Values: EPA Industrial RSL[1]	Recommended Ecological Screening Value[2,3]	PAL[4]	Achievable Laboratory Limits: Project LOQ	Achievable Laboratory Limits: LOD	Precision and Accuracy Method Performance Criteria: LCS/MS/MSD[6] Recovery Limits	Precision and Accuracy Method Performance Criteria: LCS/MS/MSD Precision
		Soil	Soil	Soil	Soil	Soil[5]	Soil	Soil	Soil
		(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	%	RPD ≤
Anthracene	120-12-7	1,700	17,000	NA	1,700	0.17	0.068	55 - 105	30
Carbazole	87-74-8	NA	NA	NA	NA	0.17	0.068	45 - 115	30
Di-n-butylphthalate	84-74-2	610	6,200	NA	610	0.17	0.068	55 - 110	30
Fluoranthene	206-44-0	230	2,200	NA	230	0.17	0.068	55 - 115	30
Benzidine	98-87-5	NA	NA	NA	NA	0.17	0.068	20 - 150	30
Pyrene	129-00-0	170	1,700	NA	170	0.17	0.068	45 - 125	30
Butylbenzylphthalate	85-68-7	260	910	NA	260	0.17	0.068	50 - 125	30
3,3'-Dichlorobenzidine	91-94-1	1.1	4	NA	1.1	0.17	0.068	20 - 150	30
bis(2-ethylhexyl)Phthalate	117-81-7	35	120	NA	35	0.17	0.068	45 - 125	30
Benzo(a)anthracene	56-55-3	0.15	2	NA	0.15	0.17	0.068	40 - 125	30
Chrysene	218-01-9	15	210	NA	15	0.17	0.068	55 - 110	30
Di-n-octylphthalate	117-84-0	NA	NA	NA	NA	0.17	0.068	40 - 130	30
Benzo(b)fluoranthene	205-99-2	0.15	2	NA	0.15	0.17	0.068	40 - 125	30
Benzo(k)fluoranthene	207-08-9	1.5	21	NA	1.5	0.17	0.033	45 - 125	30
Benzo(a)pyrene	50-32-8	0.015	0.21	NA	0.015	0.17	0.068	40 - 125	30
Indeno(1,2,3-c,d)pyrene	193-39-5	0.15	2	NA	0.15	0.17	0.068	35 - 110	30
Dibenzo(a,h)anthracene	53-70-3	0.015	0.21	NA	0.015	0.17	0.068	40 - 125	30
Benzo(g,h,i)perylene	191-24-2	170	NA	NA	170	0.17	0.068	40 - 125	30
Phenyl Ether	108-60-1	4.6	22	NA	4.6	0.33	0.068	40 - 100	30
Vernolate	98-86-2	780	100,000	NA	NA	NA	NA	NA	NA
2-Fluorophenol (Surrogate)	367-12-4	NA	NA	NA	NA	NA	NA	35 - 105	NA
Phenol-d5 (Surrogate)	4165-62-2	NA	NA	NA	NA	NA	NA	40 - 100	NA
Nitrobenzene-d5 (Surrogate)	4165-60-0	NA	NA	NA	NA	NA	NA	35 - 100	NA
2-Fluorobiphenyl (Surrogate)	321-60-8	NA	NA	NA	NA	NA	NA	45 - 105	NA
2,4,6-Tribromophenol (Surrogate)	118-79-6	NA	NA	NA	NA	NA	NA	35 - 125	NA
Terphenyl-d14 (Surrogate)	98904-43-9	NA	NA	NA	NA	NA	NA	30 - 125	NA

[1] Residential and Industrial Screening Levels were obtained from ORNL RSLs for Chemical Contaminants at Superfund Sites Table (April 2012). The RSLs are shown at a TR of 1.0E-6. The THQ has been adjusted to 0.1 for non-carcinogens to allow for potential additive toxicity of multiple contaminants.
[2] The primary source for the Recommended Soil Screening Value is the EcoSSL

Worksheet 15.4a — Reference Limits and Evaluation Table – SVOCs by SW-846 Method 8270D (Soil) (Continued)

[3] *Constituents detected above the LOQ will be averaged for those of high and low molecular weights and compared against the applicable soil screening value presented in the EcoSSL for total polynuclear aromatic hydrocarbons.*
[4] *For the purpose of contracting with the analytical laboratory, the PAL is the lesser of "EPA Residential RSL" or "Recommended Ecological Screening Value".*
[5] *If % solids is <30%, additional sample needs to be analyzed to ensure the detection limits are met.*
[6] *Laboratory control sample (LCS)/matrix spike (MS)/matrix spike duplicate (MSD)*
NA = Not Applicable

Worksheet 15.4b — Reference Limits and Evaluation Table – SVOCs by SW-846 Method 8270D (Water)

Analyte	CAS Number	Human Health Values: EPA MCL[1] (µg/L)	PAL (µg/L)	Achievable Laboratory Limits: Project LOQ (µg/L)	Achievable Laboratory Limits: LOD (µg/L)	Precision and Accuracy Method Performance Criteria: LCS/MS/MSD[2] Recovery Limits %	Precision and Accuracy Method Performance Criteria: LCS/MS/MSD Precision RPD ≤
N-Nitrosodimethylamine	62-75-9	0.00042	0.00042	5.0	2.0	25 - 110	30
Pyridine	110-86-1	1.5	1.5	5.0	2.0	20 - 150	30
Benzaldehyde	100-52-7	150	150	5.0	1.5	20 - 150	30
Phenol	108-95-2	450	450	10	1.5	20 - 150	30
Bis(2-chloroethyl)ether	111-44-4	0.012	0.012	5.0	2.0	35 - 110	30
2-Chlorophenol	95-57-8	7.1	7.1	10	2.0	35 - 105	30
1,3-Dichlorobenzene	541-73-1	0.43	0.43	5.0	2.0	30 - 100	30
1,4-Dichlorobenzene	106-46-7	75	75	5.0	2.0	30 - 100	30
Benzyl Alcohol	100-51-6	150	150	5.0	3.0	45 - 125	30
1,2-Dichlorobenzene	95-50-1	600	600	5.0	2.0	35 - 100	30
2-Methylphenol	95-48-7	72	72	10	2.0	40 - 110	30
2,2'-oxybis(1-Chloropropane)	108-60-1	0.31	0.31	5.0	2.0	20 - 150	30
Acetophenone	98-86-2	150	150	5.0	2.0	20 - 150	30
3-Methylphenol	108-39-4	72	72	5.0	2.0	20 - 110	30
4-Methylphenol	106-44-5	140	140	5.0	2.0	50 - 110	30
N-Nitroso-di-N-propylamine	62-64-7	NA	NA	5.0	2.0	35 - 130	30
Hexachloroethane	67-72-1	0.79	0.79	5.0	2.0	30 - 100	30
Nitrobenzene	98-95-3	0.12	0.12	5.0	2.0	45 - 110	30
Isophorone	78-59-1	67	67	5.0	2.0	50 - 110	30
2-Nitrophenol	88-75-5	NA	NA	10	2.0	40 - 115	30
2,4-Dimethylphenol	105-67-9	27	27	10	2.0	30 - 110	30
Bis(2-chloroethoxy)methane	111-91-1	4.7	4.7	5.0	2.0	45 - 105	30
2,4-Dichlorophenol	120-83-2	3.5	3.5	10	2.0	50 - 105	30
1,2,4-Trichlorobenzene	120-82-1	70	70	5.0	2.0	35 - 105	30
Naphthalene	91-20-3	0.14	0.14	5.0	2.0	40 - 100	30
4-Chloroaniline	106-47-8	0.32	0.32	10	2.0	15 - 110	30
Hexachlorobutadiene	87-68-3	0.26	0.26	5.0	2.0	25 - 105	30
Caprolactam	105-60-2	770	770	5.0	3.0	20 - 150	30
4-Chloro-3-methylphenol	59-50-7	110	110	10	2.0	45 - 110	30
2-Methylnaphthalene	61-57-6	NA	NA	5.0	2.0	45 - 105	30
1-Methylnaphthalene	90-12-0	0.97	0.97	5.0	2.0	20 - 150	30

Worksheet 15.4b — Reference Limits and Evaluation Table – SVOCs by SW-846 Method 8270D (Water) (Continued)

		Human Health Values	PAL	Achievable Laboratory Limits		Precision and Accuracy Method Performance Criteria	
		EPA MCL[1]		Project LOQ	LOD	LCS/MS/MSD[2] Recovery Limits	LCS/MS/MSD Precision
Analyte	CAS Number	(µg/L)	(µg/L)	(µg/L)	(µg/L)	%	RPD ≤
Hexachlorocyclopentadiene	77-47-4	50	50	5.0	2.0	20 - 150	30
2,4,6-Trichlorophenol	88-06-2	3.5	3.5	10	2.0	50 - 115	30
2,4,5-Trichlorophenol	95-95-4	89	89	10	1.5	50 - 110	30
1,1'-Biphenyl	92-52-4	0.083	0.083	5.0	1.5	20 - 150	30
2-Chloronaphthalene	91-58-7	55		5.0	2.0	50 - 105	30
2-Nitroaniline	88-74-4	15		10	2.0	50 - 115	30
Dimethylphthalate	131-11-3	NA	NA	5.0	2.0	25 - 125	30
2,6-Dinitrotoluene	606-20-2	1.5	1.5	5.0	2.0	50 - 115	30
Acenaphthylene	208-96-8	110	110	5.0	2.0	50 - 105	30
3-Nitroaniline	99-09-2	NA	NA	10	2.0	20 - 125	30
Acenaphthene	83-32-9	40	40	5.0	2.0	45 - 110	30
2,4-Dinitrophenol	51-28-5	3	3	10	6.0	15 - 140	30
4-Nitrophenol	100-02-7	NA	NA	10	10	20 - 150	30
2,4-Dinitrotoluene	121-14-2	0.2	0.2	5.0	2.0	50 - 120	30
Dibenzofuran	132-64-9	0.58	0.58	5.0	2.0	55 - 105	30
Diethyl phthalate	84-66-2	1100	1100	5.0	2.0	40 - 120	30
4-Chlorophenyl-phenylether	7005-72-3	NA	NA	5.0	2.0	50 - 110	30
Fluorene	86-76-7	NA	NA	5.0	2.0	50 - 110	30
4-Nitroaniline	100-01-6	3.3	3.3	10	2.0	35 - 120	30
4,6-Dinitro-2-methylphenol	534-52-1	0.12	0.12	10	1.5	40 - 130	30
N-Nitrosodiphenylamine	86-30-6	10	10	5.0	2.0	35 - 130	30
1,2-Diphenylhydrazine	122-66-7	0.067	0.067	5.0	2.0	35 - 100	30
4-Bromophenyl-phenylether	101-55-3	NA	NA	5.0	2.0	50 - 115	30
Hexachlorobenzene	118-74-1	1	1	5.0	2.0	50 - 110	30
Atrazine	1912-24-9	3	3	5.0	1.5	20 - 150	30
Pentachlorophenol	87-86-5	1	1	10	2.0	40 - 115	30
Phenanthrene	85-01-8	110	110	5.0	2.0	50 - 115	30
Anthracene	120-12-7	130	130	5.0	2.0	55 - 110	30
Carbazole	87-74-8	NA	NA	5.0	2.0	50 - 115	30
Di-n-butylphthalate	84-74-2	67	67	5.0	3.0	55 - 115	30
Fluoranthene	206-44-0	63	63	5.0	2.0	55 - 115	30
Benzidine	98-87-5	NA	NA	5.0	1.5	20 - 150	30

Worksheet 15.4b — Reference Limits and Evaluation Table – SVOCs by SW-846 Method 8270D (Water) (Continued)

		Human Health Values	PAL	Achievable Laboratory Limits		Precision and Accuracy Method Performance Criteria	
		EPA MCL[1]		Project LOQ	LOD	LCS/MS/MSD[2] Recovery Limits	LCS/MS/MSD Precision
Analyte	CAS Number	(µg/L)	(µg/L)	(µg/L)	(µg/L)	%	RPD ≤
Pyrene	129-00-0	8.7	8.7	5.0	3.0	50 - 130	30
Butylbenzylphthalate	85-68-7	14	14	5.0	3.0	45 - 115	30
3,3'-Dichlorobenzidine	91-94-1	0.11	0.11	5.0	2.0	20 - 110	30
bis(2-ethylhexyl)Phthalate	117-81-7	6	6	5.0	4.0	40 - 125	30
Benzo(a)anthracene	56-55-3	0.029	0.029	5.0	3.0	40 - 125	30
Chrysene	218-01-9	2.9	2.9	5.0	3.0	55 - 110	30
Di-n-octylphthalate	117-84-0	NA	NA	5.0	3.0	35 - 135	30
Benzo(b)fluoranthene	205-99-2	0.029	0.029	5.0	3.0	40 - 125	30
Benzo(k)fluoranthene	207-08-9	0.29	0.29	5.0	3.0	45 - 125	30
Benzo(a)pyrene	50-32-8	0.2	0.2	5.0	3.0	40 - 125	30
Indeno(1,2,3-c,d)pyrene	193-39-5	0.029	0.029	5.0	2.0	30 - 100	30
Dibenzo(a,h)anthracene	53-70-3	0.0029	0.0029	5.0	3.0	40 - 125	30
Benzo(g,h,i)perylene	191-24-2	110	110	5.0	3.0	40 - 125	30
Phenyl Ether	108-60-1	0.31	0.31	10	1.5	20 - 150	30
Vernolate	98-86-2	150	150	NA	NA	NA	NA
2-Fluorophenol (Surrogate)	367-12-4	NA	NA	NA	2.0	20 - 110	NA
Phenol-d5 (Surrogate)	4165-62-2	NA	NA	NA	2.0	10 - 110	NA
Nitrobenzene-d5 (Surrogate)	4165-60-0	NA	NA	NA	1.5	40 - 110	NA
2-Fluorobiphenyl (Surrogate)	321-60-8	NA	NA	NA	2.0	50 - 110	NA
2,4,6-Tribromophenol (Surrogate)	118-79-6	NA	NA	NA	2.0	40 - 125	NA
Terphenyl-d14 (Surrogate)	98904-43-9	NA	NA	NA	2.0	50 - 135	NA

[1] *MCLs were obtained from ORNL RSLs for Chemical Contaminants at Superfund Sites Table (April 2012) or VDEQ Groundwater Standards and Criteria regulations as applicable. The EPA MCLs are shown at a TR of 1.0E-6. The THQ has been adjusted to 0.1 for non-carcinogens to allow for potential additive toxicity of multiple contaminants. For contaminants that do not have an MCL the RSL for Tap Water was used.*

[2] *Laboratory control sample (LCS)/matrix spike (MS)/matrix spike duplicate (MSD)* *NA = Not Applicable*

Worksheet 15.5a — Reference Limits and Evaluation Table – Dioxin/Furans Method SW-846 8290 (Soil)

		Human Health Values		Recommended Ecological Screening Value[2]	PAL[3]	Achievable Laboratory Limits		Precision and Accuracy Method Performance Criteria	
		EPA Residential RSL[1]	EPA Industrial RSL[1]			Project LOQ	LOD	LCS/MS/MSD[5] Recovery Limits	LCS/MS/MSD Precision
Analyte	CAS Number	Soil (mg/kg)	Soil (mg/kg)	Soil (mg/kg)	Soil (mg/kg)	Soil[4] (pg/g)	Soil (pg/g)	Soil %	Soil RPD ≤
2378-TCDD	1746-01-6	0.0000045	0.000018	NA	0.0000045	0.000001	0.00000015	60 - 138	20
12378-PeCDD	40321-76-4	0.0000045	0.0000045	NA	0.0000045	0.000005	0.00000075	70 - 122	20
123478-HxCDD	57653-85-7	0.00000045	0.00000045	NA	0.00000045	0.000005	0.00000075	60 - 138	20
123678-HxCDD	39227-28-6	0.00000045	0.00000045	NA	0.00000045	0.000005	0.00000075	68 - 136	20
123789-HxCDD	19408-74-3	0.00000045	0.00000045	NA	0.00000045	0.000005	0.00000075	68 - 138	20
1234678-HpCDD	35822-46-9	0.000000045	0.000000045	NA	0.000000045	0.000005	0.00000075	71 - 128	20
OCDD	3268-87-9	1.35E-09	1.35E-09	NA	1.35E-09	0.00001	0.000004	70 - 128	20
2378-TCDF	51207-31-9	0.000000045	0.000000045	NA	0.000000045	0.000001	0.00000015	56 - 158	20
12378-PeCDF	57117-41-6	0.000000135	0.000000135	NA	0.000000135	0.000005	0.00000075	69 - 134	20
23478-PeCDF	57117-31-4	0.00000135	0.00000135	NA	0.00000135	0.000005	0.00000075	70 - 131	20
123478-HxCDF	57117-44-9	0.00000045	0.00000045	NA	0.00000045	0.000005	0.00000075	74 - 128	20
123678-HxCDF	72918-21-9	0.00000045	0.00000045	NA	0.00000045	0.000005	0.00000075	67 - 140	20
123789-HxCDF	70648-26-9	0.00000045	0.00000045	NA	0.00000045	0.000005	0.00000075	71 - 137	20
234678-HxCDF	60851-34-5	0.00000045	0.00000045	NA	0.00000045	0.000005	0.00000075	72 - 134	20
1234678-HpCDF	67562-39-4	0.000000045	0.000000045	NA	0.000000045	0.000005	0.00000075	71 - 134	20
1234789-HpCDF	55673-89-7	0.000000045	0.000000045	NA	0.000000045	0.000005	0.00000075	68 - 129	20
OCDF	39001-02-0	1.35E-09	1.35E-09	NA	1.35E-09	0.00001	0.0000015	63 - 141	20
Total Tetra-Dioxins	NA	NA	NA	NA	NA	NA	NA	40 - 135	NA
Total Penta-Dioxins	NA	NA	NA	NA	NA	NA	NA	40 - 135	NA
Total Hexa-Dioxins	NA	NA	NA	NA	NA	NA	NA	40 - 135	NA
Total Hepta-Dioxins	NA	NA	NA	NA	NA	NA	NA	40 - 135	NA
Total Tetra-Furans	NA	NA	NA	NA	NA	NA	NA	40 - 135	NA
Total Penta-Furans	NA	NA	NA	NA	NA	NA	NA	40 - 135	NA
Total Hexa-Furans	NA	NA	NA	NA	NA	NA	NA	40 - 135	NA
Total Hepta-Furans	NA	NA	NA	NA	NA	NA	NA	40 - 135	NA

Worksheet 15.5a — Reference Limits and Evaluation Table – Dioxin/Furans Method SW-846 8290 (Soil) (Continued)

[1] Residential and Industrial Screening Levels were obtained from ORNL RSLs for Chemical Contaminants at Superfund Sites Table (April 2012). The RSLs are shown at a TR of 1.0E-6. The THQ has been adjusted to 0.1 for non-carcinogens to allow for potential additive toxicity of multiple contaminants.
[2] The primary source for the Recommended Soil Screening Value is the EcoSSL
[3] For the purpose of contracting with the analytical laboratory, the PAL is the lesser of "EPA Residential RSL" or "Recommended Ecological Screening Value".
[4] If % solids is <30%, additional sample needs to be analyzed to ensure the detection limits are met.
[5] Laboratory control sample (LCS)/matrix spike (MS)/matrix spike duplicate (MSD)
[6] Surrogate Control Limits
pg/g = petagram per gram
NA = Not Applicable

Worksheet 15.5b — Reference Limits and Evaluation Table – Dioxin/Furans Method SW-846 8290 (Water)

		Human Health Values	PAL	Achievable Laboratory Limits		Precision and Accuracy Method Performance Criteria	
		EPA MCL[1]		Project LOQ	LOD	LCS/MS/MSD[2] Recovery Limits	LCS/MS/MSD Precision
Analyte	CAS Number	(µg/L)	(µg/L)	(pg/L)	(pg/L)	%	RPD ≤
2378-TCDD	1746-01-6	0.00003	0.00003	0.00001	0.0000025	72 - 144	20
12378-PeCDD	40321-76-4	0.0000045	0.0000045	0.00005	0.0000065	79 - 125	20
123478-HxCDD	57653-85-7	0.00000045	0.00000045	0.00005	0.0000125	65 - 144	20
123678-HxCDD	39227-28-6	0.00000045	0.00000045	0.00005	0.0000125	78 - 137	20
123789-HxCDD	19408-74-3	0.00000045	0.00000045	0.00005	0.0000125	74 - 142	20
1234678-HpCDD	35822-46-9	0.000000045	0.000000045	0.00005	0.0000125	81 - 132	20
OCDD	3268-87-9	1.35E-09	1.35E-09	0.0001	0.00005	80 - 129	20
2378-TCDF	51207-31-9	0.000000045	0.000000045	0.00001	0.0000025	73 - 150	20
12378-PeCDF	57117-41-6	0.000000135	0.000000135	0.00005	0.0000065	79 - 137	20
23478-PeCDF	57117-31-4	0.00000135	0.00000135	0.00005	0.0000065	76 - 137	20
123478-HxCDF	57117-44-9	0.00000045	0.00000045	0.00005	0.0000065	86 - 126	20
123678-HxCDF	72918-21-9	0.00000045	0.00000045	0.00005	0.0000065	79 - 137	20
123789-HxCDF	70648-26-9	0.00000045	0.00000045	0.00005	0.0000065	80 - 138	20
234678-HxCDF	60851-34-5	0.00000045	0.00000045	0.00005	0.0000065	72 - 145	20
1234678-HpCDF	67562-39-4	0.000000045	0.000000045	0.00005	0.0000065	81 - 135	20
1234789-HpCDF	55673-89-7	0.000000045	0.000000045	0.00005	0.0000065	72 - 140	20
OCDF	39001-02-0	1.35E-09	1.35E-09	0.0001	0.000025	65 - 145	20
Total Tetra-Dioxins	NA	NA	NA	NA	NA	40 - 135	NA
Total Penta-Dioxins	NA	NA	NA	NA	NA	40 - 135	NA
Total Hexa-Dioxins	NA	NA	NA	NA	NA	40 - 135	NA
Total Hepta-Dioxins	NA	NA	NA	NA	NA	40 - 135	NA
Total Tetra-Furans	NA	NA	NA	NA	NA	40 - 135	NA
Total Penta-Furans	NA	NA	NA	NA	NA	40 - 135	NA
Total Hexa-Furans	NA	NA	NA	NA	NA	40 - 135	NA
Total Hepta-Furans	NA	NA	NA	NA	NA	40 - 135	NA

[1] *MCLs were obtained from ORNL RSLs for Chemical Contaminants at Superfund Sites Table (April 2012) or VDEQ Groundwater Standards and Criteria regulations as applicable. The EPA MCLs are shown at a TR of 1.0E-6. The THQ has been adjusted to 0.1 for non-carcinogens to allow for potential additive toxicity of multiple contaminants. For contaminants that do not have an MCL the RSL for Tap Water was used.*
[2] *Laboratory control sample (LCS)/matrix spike (MS)/matrix spike duplicate (MSD)*
pg/L = petagram per liter
NA = Not Applicable

Worksheet 15.6 — Reference Limits and Evaluation Table – Perchlorate Method SW-846 6850 (Water)

		Human Health Values	Ecological Values	PAL[3]	Achievable Laboratory Limits		Precision and Accuracy Method Performance Criteria	
		EPA MCL[1]	Marine Screening Benchmark[2]		Project LOQ	LOD	LCS/MS/MSD[4] Recovery Limits	LCS/MS/MSD Precision
Analyte	CAS Number	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	%	RPD ≤
Perchlorate	14797-73-0	15	NA	15	2	1	84-119[5]	15

[1]Maximum Contaminant Levels (MCLs) were obtained from the ORNL RSLs for Chemical Contaminants at Superfund Sites Table (April 2012). The MCLs are shown at a TR of 1.0E-6. The THQ has been adjusted to 0.1 for non-carcinogens to allow for potential additive toxicity of multiple contaminants. For contaminants that do not have an MCL the RSL for Tap Water was used.

[2] The Marine Screening Benchmark Values were obtained from EPA Region 3 BTAG Marine Screening Benchmark Table (July 2006)

[3] For the purpose of contracting with the analytical laboratory, the PAL is the lesser of "EPA MCL" or "Marine Screening Benchmark".

[4] Laboratory control sample (LCS)/matrix spike (MS)/matrix spike duplicate (MSD)

[5] Surrogate control limits

NA = Not Applicable

Worksheet 16 — Project Schedule/Timeline Table

Activities	Organization	Dates (MM/DD/YY)		Deliverable	Deliverable Due Date
		Anticipated Dates(s) of Initiation	Anticipated Date of Completion		
Preliminary Draft Boat Basin, Visitors Information Center RI WP	WESTON	09/14/12	11/12/12	Preliminary Draft Boat Basin, Visitors Information Center RI WP with Appendices	11/20/12
Army Review / Comments – Draft Boat Basin, Visitors Information Center RI WP	CENAB	11/14/12	01/12/13	Written Review Comments	01/13/13
Draft Boat Basin, Visitors Information Center RI WP	WESTON	02/18/13	03/07/13	Draft Boat Basin, Visitors Information Center RI WP with Appendices	03/08/13
Stakeholder Review/Comment – Draft Boat Basin, Visitors Information Center RI WP	EPA Region III/VDEQ/NASA	03/09/13	05/07/13	Written Review Comments	05/08/13
Technical Project Planning (TPP) Meeting 1 (RI Draft Work Plan)	WESTON, USACE	04/15/13	04/15/13	Written Meeting Agenda Written Meeting Minutes	04/15/13
Final Boat Basin, Visitors Information Center RI WP	WESTON	07/12/13	06/18/14	Final Boat Basin, Visitors Information Center RI WP with Appendices	06/18/14
Boat Basin, Visitors Information Center RI Fieldwork (MEC)	WESTON	06/16/14	07/11/14	Safety and field logs and forms, photographic log, data table, daily reports, to be included in the appendices to the RI Report	NA
Boat Basin, Visitors Information Center RI Fieldwork (MC)	WESTON	06/16/14	07/11/14	MC Sampling Logs, Data Analysis to be included in RI Report	NA

Worksheet 16 — Project Schedule/Timeline Table (Continued)

Activities	Organization	Dates (MM/DD/YY)		Deliverable	Deliverable Due Date
		Anticipated Dates(s) of Initiation	Anticipated Date of Completion		
Boat Basin, Visitors Information Center RI Fieldwork Expanded Field Investigations	WESTON	08/01/14	10/03/14	Sampling Logs, Data Analysis to be included in RI Report	NA
Boat Basin, Visitors Information Center RI Risk Assessment	WESTON	10/08/14	11/19/14	Baseline HHRA, Screening Level ERA to be included in RI Report	NA
Preliminary Draft Boat Basin, Visitors Information Center RI Report	WESTON	09/26/14	12/25/14	Preliminary Draft Boat Basin, Visitors Information Center RI Report	12/26/14
Army Review/Comments – Preliminary Draft Boat Basin, Visitors Information Center RI Report	CENAB	12/29/14	03/20/15	Written Review Comments	03/20/15
Draft Boat Basin, Visitors Information Center RI Report	WESTON	09/26/14	12/25/14	Draft Boat Basin, Visitors Information Center RI Report	12/26/14
Army Review/Comments – Draft Boat Basin, Visitors Information Center RI Report	CENAB	12/29/14	03/20/15	Written Review Comments	11/16/13
Draft Final Boat Basin, Visitors Information Center RI Report	WESTON	06/16/15	07/18/15	Draft Final Boat Basin, Visitors Information Center RI Report with Appendices	03/15/14
Stakeholder Review/Comment – Draft Final Boat Basin, Visitors Information Center RI Report	EPA Region III, VDEQ,NASA	07/19/15	09/16/15	Written Review Comments	09/16/15

Worksheet 16 — Project Schedule/Timeline Table (Continued)

Activities	Organization	Dates (MM/DD/YY)		Deliverable	Deliverable Due Date
		Anticipated Dates(s) of Initiation	Anticipated Date of Completion		
TPP Meeting (RI Draft Work Plan Tech Memo #2)	WESTON, USACE	09/15/14	09/15/14	Written Meeting Agenda Written Meeting Minutes	09/15/14
Final Boat Basin, Visitors Information Center RI Report	WESTON	11/03/15	12/12/15	Final Boat Basin, Visitors Information Center RI Report with Appendices	12/15/15
Boat Basin, Visitors Information Center RI EDD	WESTON	12/01/15	12/01/15	Electronic data submittals	12/01/15

Worksheet 17 — Sampling Design and Rationale

The objectives of the field investigations are to determine the nature and extent of MEC and conduct environmental sampling to determine the nature and vertical extent contaminants in soil, sediment (as applicable), surface water (as applicable), and groundwater at the Pyrotechnics Burn Area, Gun Butt Nos. 1 and 2, and South Bank Boat Basin.

MEC will be characterized at all investigative areas (Gun Butt Nos. 1 and 2, South Bank Boat Basin, and Pyrotechnics Burn Area) within the Boat Basin, Visitors Information Center by use of several investigation methods to determine the nature and extent of MEC. MEC investigation activities will include digital geophysical mapping using the EM61 to determine the nature and extent of surface and subsurface MEC. MEC investigations identifying geophysical anomalies and observed MEC will be investigated through intrusive activities and identification methods using trained and qualified unexploded ordnance (UXO) personnel.

The media to be analyzed during the RI are surface and subsurface soil, sediment, surface water, and groundwater. During the RI, MC and other chemical constituent investigations at the Boat Basin, Visitors Information Center will be initiated when any of the following conditions are encountered:

- Individual or multiple MEC items or significant MD locations (e.g., on the surface, in burial pits) or areas where soil staining or visible evidence of a potential MC release is observed.

- Known munitions disposal areas, including the Pyrotechnics Burn Area, that potentially contain MC or other chemical constituents with or without indicators of a MEC release.

- Locations required to delineate the horizontal and vertical extent of MC or munitions-related contaminants, including the potential for sampling in biased and unbiased locations in the Gun Butt Areas to assess potential widespread contamination resulting from the dispersion of the former berm area.

Evidence of MEC or significant MD at locations will warrant additional investigations through the collection of MC analytical samples. A detailed explanation of and rationale for MC sampling is presented in **Appendix I** of the RI Work Plan. MC analytes include select explosives, select metals, and perchlorate constituents based on site use and results of the Site Inspection (SI), as follows:

- Explosives constituents include 2,4-dinitrotoluene (DNT); 2,6-DNT; 2-nitrotoluene; 3-nitrotoluene; 2-amino-4,6- DNT; 4- amino-2,6-DNT; and 4-nitrotoluene; 2,4,6-Trinitrotoluene (TNT); 1,3,5-trinitrobenzene; 1,3-dinitrobenzene; pentaerythritol tetranitrate (PETN), hexahydro-1,3,5- trinitro-1,3,5-triazine (RDX), nitrobenzene, tetryl, and nitroglycerin (NG).

- Metals constituents include antimony, copper, iron, lead, magnesium, strontium, and zinc.

An appropriate number of environmental samples (to be determined by investigation results) will be biased in locations where MEC or significant MD are uncovered or during past disposal activities (i.e., burning within the Pyrotechnics Burn Area) as discussed below. Details on sampling protocols are presented in Section 3.9 of the RI Work Plan. Sampling locations are anticipated as follows:

- Discrete soil sampling will be conducted at individual MEC item locations, significant MD areas, or at locations where soil staining or other visible evidence of an MC release is observed. To fully define the nature and extent of MC contamination in soils and based on initial MC sampling results, direct push technology (DPT) will be used to collect two soil samples at each boring location to determine the lateral and vertical extent of MC contamination in soils. DPT temporary wells will be installed in areas to assess potential MC contamination in groundwater. Additionally, permanent monitoring wells will be installed and sampled in required areas (based on the groundwater data from the temporary DPT wells) to further identify the nature and extent of MC contamination in groundwater.

- Discrete sediment sampling will be conducted at individual MEC item or significant MD locations in the waterways. Based on the initial surficial sediment sample results, additional discrete sediment samples may be warranted to assess the lateral and vertical extent of MC contamination.

- Due to the high volume of surface water exchange present in the boat basin because of the tidal cycles, a potential release of MC from an individual MEC item would not be expected to substantially impact water quality; therefore, surface water sampling is not anticipated.

- If multiple MEC/MPPEH, significant MD, or DMM items are discovered clustered on the surface or in burial pits, a discrete sample will be collected within the pit at a depth below the items and after such items have either been removed from the pit or blown-in-place. Additional samples may be necessary to assess MEC items or significant MD areas that are separated within the pits. To fully define the nature and extent of MC contamination in soils and based on initial MC discrete results, DPT will be used to collect two soil samples at each boring location to determine the lateral and vertical extent of MC contamination in soils. DPT temporary wells will be installed in areas to assess potential MC contamination in groundwater. Additionally, permanent monitoring wells will be installed and sampled in required areas (based on the groundwater data from the temporary DPT wells) to further identify the nature and extent of MC contamination in groundwater.

- If clustered MEC/MPPEH items are discovered in waterways, multiple discrete samples will be collected after such items have either been removed or blown-in-place. Based on the initial sediment sample results, additional discrete sediment samples may be warranted to assess the lateral and vertical extent of MC contamination.

- Surface water samples will be collected only if sediment results for the multiple discrete samples exceed sediment screening criteria. If warranted, three discrete surface water samples will be collected at the mid-depth of the waterway, each within 10 lateral feet of the sample location where the sediment results indicated exceedances of screening criteria.

- To fully define the nature and extent of chemical constituent contamination in soils at the Pyrotechnics Burn Area and other areas of the Boat Basin, Visitors Information Center, DPT will be used if warranted to collect two soil samples at each boring location to determine the lateral and vertical extent of chemical constituent contamination in soils. DPT temporary wells will be installed at each DPT boring to assess potential chemical constituent contamination in groundwater. Additionally, permanent monitoring wells will be installed and sampled in required areas (based on the groundwater data from the temporary DPT wells) to further identify the nature and extent of chemical constituent contamination in groundwater.

The results of the investigations and sampling will determine whether additional investigations are required to further delineate the nature and extent of contamination. If required, additional sampling will be performed at the Boat Basin, Visitors Information Center. Following field investigation activities to define the nature and extent of contamination at the Boat Basin, Visitors Information Center, a MEC Hazard Analysis (HA), Baseline Human Health Risk Assessment (BHHRA), and Screening Level Ecological Risk Assessment (SLERA) will be performed to determine whether or not unacceptable risk to human health and the environment is present at the Boat Basin, Visitors Information Center.

Worksheet 18 — Sampling Locations and Methods/SOP Requirements Table

MC sample locations will be selected in the field based on intrusive investigation and visual observation. Discrete samples will be collected at each location based on visual observation. Each MC sample will be analyzed for target analyte list (TAL) metals and explosives. Chemical constituent samples will be collected at select locations within each area and analyzed for metals, VOCs, PAHs, perchlorate (groundwater only), and dioxins/furans. **Table 18-1** lists the number of environmental samples anticipated.

Table 18-1 Samples Expected

Boat Basin, Visitors Information Center Area	Sampling Location / ID Number[1]	Matrix	Depth (inches/ feet)	Analytical Group	Number of Samples/Sample Type[2] (identify field duplicates)	Sampling SOP Reference	Rationale for Sampling Location
All MC sample locations	WFF-SB##/MW##-TYPE-Depth	Soil/ Sediment and Ground/ Surface water	TBD	Select TAL Metals, Select Explosives	100, D (*Duplicates 15%, field blank 1X day)*	Worksheet 21, Table 21-1	Sample location based on results of MEC intrusive investigation.
Chemical Constituent (Pyrotechnics Burn Area)	WFF-SB##-TYPE-Depth	Soil/ Sediment	TBD	TCL VOCs and SVOCs	20, D (*Duplicates 15%, field blank 1X day)*	Worksheet 21, Table 21-1	Sample location based on MC sampling results.
Chemical Constituent (Pyrotechnics Burn Area)	WFF-SB##-TYPE-Depth	Soil/ Sediment	TBD	Dioxins/Furans	6, D (*Duplicates 15%, field blank 1X day)*	Worksheet 21, Table 21-1	Sample location based on MC sampling results.
Chemical Constituent (site-wide)	WFF-SB##-TYPE-Depth	Soil/ Sediment	TBD	Select TAL Metals	30, D (*Duplicates 15%, field blank 1X day)*	Worksheet 21, Table 21-1	Sample location based on MC sampling results.
Chemical Constituent (Pyrotechnics Burn Area)	WFF-MW##-TYPE-Depth	Ground water	TBD	TCL VOCs and SVOCs	10, D (*Duplicates 15%, field blank 1X day)*	Worksheet 21, Table 21-1	Sample location based on MC sampling results.
Chemical Constituent (Pyrotechnics Burn Area)	WFF-MW##-TYPE-Depth	Ground water	TBD	Dioxins/Furans	3, D (*Duplicates 15%, field blank 1X day)*	Worksheet 21, Table 21-1	Sample location based on MC sampling results.
Chemical Constituent (site-wide)	WFF-MW##-TYPE-Depth	Ground water	TBD	Select TAL Metals, Perchlorate	15, D (*Duplicates 15%, field blank 1X day)*	Worksheet 21, Table 21-1	Sample location based on MC sampling results.

[1] *See Section 27 of the WFF Site-Wide UFP-QAPP for sample identification procedures*
[2] *D = Discrete Sample, estimated number of samples*

Worksheet 19 — Analytical SOP Requirements Table

Analytical Standard Operating Procedures (SOP) Requirements cited in the WFF Site-Wide QAPP were those in effect at the time of its writing. Since then, versions of analytical methods have been updated and the following project-specific requirements have been modified.

Matrix	Analytical Group	Analytical and Preparation Method / SOP Reference	Containers (number, size, and type)	Sample volume[1] (units)	Preservation Requirements (chemical, temperature, light protected)	Maximum Holding Time[2] (preparation / analysis)
Water	VOCs	SW5030B and SW8260B / A-1	3 x 40-mL VOA vials	5 mLs	HCl to pH < 2, 4°C	14 days to Analysis
Water	VOCs	SW5030B and SW8260B / A-1	3 x 40-mL VOA vials	5 mLs	4°C (no acid preservation if acid causes effervescence)	7 days to Analysis
Soil	VOCs	SW5035 and SW8260B / A-2	• 2 x 40-mL tared VOA vials containing 5 g of soil added to 5 mLs of DI water and stir-bar • 1 x 40-mL tared VOA vial containing 5 g of soil added to 5 mLs of methanol • If VOC only sample, add 1 x 2-oz jar for % solid	5 g	Cool to 4°C	14 days to analyze
Soil	VOCs	SW5035 and SW8260B / A-2	• 3 x 5-g EnCores • If VOC is only parameter for sample, add 1 x 2-oz jar for % solid	5 g	Cool to 4°C, methanol and DI water (in lab)	48 hours to preserve,14 days to Analyze
Water	SVOCs	SW3510C and SW8270D/ A-6A-4 and A-6	2 x 1-L amber glass jars	1000 mL	4°C	7 days to Extract / 40 days to Analysis
Soil	SVOCs	SW3545A and SW8270D/ A-6A-5 and A-6	1 x 4-oz glass jar	20 g	4°C	14 days to Extract / 40 days to Analysis
Water	Explosives	SW3535 and SW8330A / L-76 and A-13	1 x 1-L amber glass jar	500 mL	4°C	7 days to Extract / 40 days to Analysis

Worksheet 19 — Analytical SOP Requirements Table (Continued)

Matrix	Analytical Group	Analytical and Preparation Method / SOP Reference	Containers (number, size, and type)	Sample volume[1] (units)	Preservation Requirements (chemical, temperature, light protected)	Maximum Holding Time[2] (preparation / analysis)
Soil	Explosives	SW3535 and SW8330A / L-76 and A-13	1 x 4-oz glass jar	10 g	4°C	14 days to Extract / 40 days to Analysis
Water	Metals by ICP-AES	SW3005A or SW3010A, SW6010B/C / A-7 and A-9, SW6020A, and SW6020A	1 x 500-mL HDPE	50 mLs	HNO3 to pH < 2, 4°C	180 days to Digest / 180 days to Analysis
Soil	Metals by ICP-AES	SW3050B and SW6010B/C, SW6020A, and SM2340B / A-7 and A-9	1 x 2-oz glass jar	0.5 g	4°C	180 days to Digest / 180 days to Analysis
Water	Mercury	SW7470A / A-10 (Prep), A-12 (analysis)	1 x 500-mL HDPE	25 mLs	HNO3 to pH < 2, 4°C	28 days to Digest / 28 days to Analysis
Soil	Mercury	SW7471B / A-10 (prep), A-12 (analysis)	1 x 2-oz glass jar	0.25 g	4°C	28 days to Digest / 28 days to Analysis
Water	Perchlorate	SW6850 / SOP-A-18	1 x 120-mL HDPE	10 mL	4°C	28 days to analysis
Water	Dioxin/Furans	SW8290, A-14 and A-15	2 x 1-L amber glass with Teflon-lined lid	1000 mLs	4°C	30 days to extract/45 days to analysis
Soil	Dioxin/Furans	SW8290, A-14 and A-15	250-mL amber glass	30 grams	4°C	30 days to extract/45 days to analysis

[1]*Provide the minimum sample volume or mass requirement if it differs from the container volume.*
[2]*Maximum holding time is calculated from the time the sample is collected. If two holding times are indicated, the first holding time is the sample preparation/extraction holding time and the second holding time is the analysis holding time (from sample preparation/extract to its analysis). If only one holding time is provided, the holding time is the time from sampling to final analysis.*

Abbreviations:
AES = Atomic Emission Spectroscopy
DI = deionized
HCl = Hydrochloric acid
HDPE = High density polyethylene
HNO_3 = Nitric acid
ICP = Inductively-Coupled Plasma
L = Liter
mL = milliliter
SVOCs = Semivolatile Organic Compounds
SW method prefix = EPA SW-846
SM method prefix = Standard Methods
VOA = Volatile Organic Analysis
VOCs = Volatile Organic Compounds

Worksheet 20 — Field Quality Control Sample Summary Table

This worksheet is included in the WFF Site-Wide UFP-QAPP. Field quality control requirements cited in the site-wide UFP-QAPP are those in effect at the time of its writing. As any new procedure or criterion is required, addendums to this document will be issued.

Addendum for Boat Basin, Visitors Information Center:

For the anticipated work at the Boat Basin, Visitors Information Center, it is assumed based on the Statement of Work that 100 total environmental samples (including 15% QC samples) will be collected from surface soil, subsurface soil, sediment, surface water, and groundwater to support the characterization of the Boat Basin, Visitors Information Center. QC samples will include the following: duplicates, trip blanks, equipment rinsate, and matrix spike (MS)/matrix spike duplicate (MSD). Exact numbers will be specified following completion of the field studies and the geophysical investigation. In the event that samples will be collected using multi-increment sampling (MIS), the appropriate triplicate sampling will be performed.

QC Samples for Boat Basin, Visitors Information Center

Sample Type	Field Duplicate	MS/MSD	Equipment Rinsate	Trip Blanks
Surface soil, subsurface soil, and sediment	1 per 10 or 5% minimum	Minimum 1 set per 20, or per batch or 5%	One per sampling tool per sampling event	1 per cooler containing VOC water samples
Groundwater/surface water	1 per 10 or 5% minimum	Minimum 1 per 20, or per batch or 5%	One per sampling tool per sampling event	1 per cooler containing VOC water samples

Worksheet 21 — Project Sampling SOP References Table

The Boat Basin, Visitors Information Center FIP (WESTON, 2012) provides detailed procedures related to the collection of soil, sediment, surface water and groundwater samples, and other field activities at the Boat Basin, Visitors Information Center. The FIP also meets requirements set forth in the USACE Engineer Manual EM 200-1-3 *Requirements for the Preparation of Sampling and Analysis Plans* (USACE, 2001). The purpose of the FIP is to provide a compilation of the field sampling methods, sample handling procedures, and QA/QC procedures for the successful execution of the project-specific scope of work. All related standard operating procedures are provided in an appendix to the WFF Site-Wide UFP-QAPP (WESTON, 2011). **Table 21-1** lists applicable SOPs.

Table 21-1 List of Applicable SOPs

WESTON SOP NO.	TASK
GENERAL SOPs	
G-1	Field Documentation
G-3	Field Sample Numbering
G-4	Quality Assurance/Quality Control Sampling
G-6	Decontamination
G-7	Management of Investigation Derived Waste (IDW)
G-8	Sample Chain-of-Custody
G-9	Sample Packing and Shipping
G-10	Surveying
G-11	MEC Anomaly Avoidance
MEDIA-SPECIFIC SOPs	
Soil and Sediment	
SS-2	Soil Sampling Using Direct-Push Technology
SS-3	Sediment Sampling
SS-4	Soil Sampling (Post Blow-in-Place Sampling)
Groundwater	
GW-1	Monitoring Well Abandonment
GW-2	Low Flow Groundwater Purging and Sampling
GW-3	Monitoring Well Installation
GW-4	Monitoring Well Development
GW-9	Water Level and Well Depth Measurements
Surface Water	
SW-1	Surface Water Sampling

Worksheet 22 — Field Sampling Equipment Calibration, Maintenance, Testing, and Inspection Table

This worksheet is included in the WFF Site-Wide UFP-QAPP. Field sampling equipment calibration, maintenance, testing, and inspection requirements cited in the site-wide UFP-QAPP are those in effect at the time of its writing. As any new procedure or criterion is required, addendums to this document will be issued.

Worksheet 23 — Analytical SOP References Table

Reference Number	Title, Revision Date, and/or Number	Definitive or Screening Data	Analytical Group	Instrument	Organization Performing Analysis	Modified for Project Work (Y/N)
A-1	Analysis of Volatile Organic Compounds in Aqueous and Medium/High Concentration Soil Samples by SW-846, Rev.	Definitive	Volatiles	Gas Chromatograph/ Mass Spectrometer (GC/MS)	CompuChem	N
A-2	GC/MS Analysis of Low Concentration Volatiles in Soil/Sediment/Sludge Samples by SW-846, Rev. 04/17/2012	Definitive	Volatiles	GC/MS	CompuChem	N
A-3	Preparation of Soil/Sediment/Sludge Samples for the Analysis of Low-Level Semivolatiles by SW-846, Rev. 06/22/2010	Definitive	Semivolatiles	Sonication	CompuChem	N
A-4	Preparation of Water Samples for the Analysis of Semivolatiles by SW-846 Method 3510C and EPA 625, Rev. 10/26/2011	Definitive	Semivolatiles	Separatory Funnel	CompuChem	N
A-5	Preparation of Soil/Sediment/Sludge Samples for the Analysis of Low-Level Semivolatiles by SW-846, Rev. 04/17/2012	Definitive	Semivolatiles	Sonication	CompuChem	N
A-6	GC/MS Analysis of Extractable Semivolatiles in Aqueous and Solid Samples by SW-846, Rev. 04/11/2012	Definitive	Semivolatiles	GC/MS	CompuChem	N
A-7	Digestion Block Preparation of Aqueous Samples for Inductively Coupled Plasma (ICP) Analysis of Total or Dissolved Metals by SW-846, Methods for the Chemical Analysis of Water and Wastes (MCAWW), and Standard Methods, Rev. 01/30/2011	Definitive	Metals	Acid Digestion	CompuChem	N
A-8	Digestion Block Preparation of Soil Samples for ICP Determination of Total Metals by SW-846 Method 3050B, Rev. 01/28/2011	Definitive	Metals	Acid Digestion	CompuChem	N
A-9	Inductively Coupled Plasma Atomic Emission Spectroscopy by SW-846 Method 6010B, Rev. 10/18/11	Definitive	Metals	ICP	CompuChem	N
A-10	Mercury in Water, Manual Digestion Procedure for EPA (CLP), SW-846 and MCAWW, Rev. 04/05/2011	Definitive	Mercury	Manual Digestion	CompuChem	N
A-11	Solid Sample Mercury Digestion by SW-846 Method 7471A, Rev. 01/18/2011	Definitive	Mercury	Cold Vapor	CompuChem	N
A-12	Automated Cold Vapor Determination for Mercury by Contract Laboratory Program (CLP), SW-846, MCAWW, Rev. 04/06/2011	Definitive	Mercury	Cold Vapor	CompuChem	N

Worksheet 23 — Analytical SOP References Table (Continued)

Reference Number	Title, Revision Date, and/or Number	Definitive or Screening Data	Analytical Group	Instrument	Organization Performing Analysis	Modified for Project Work (Y/N)
A-13	Sample analysis: HPLC Determination of Nitroaromatics and Nitramines at Mid-Trace Levels—EPA Method 8330 (Explosives), 5/6/2012, Rev.22	Definitive	Explosives	HPLC/DAD	Empirical Laboratories, LLC	N
A-14	Preparation of Samples for Analysis of Polychlorinated Dioxins and Furans or Analysis HRGC/HRMS [Methods 8290, 8290A & TO-9A], SOP No. WS-IDP-0005, Rev. 1.4, 03/20/2012	Definitive	Dioxins/Furans	HRGC/HRMS	TestAmerica	N
A-15	Analysis of Samples for polychlorinated Dioxins and Furans by HRGC/HRMS [Methods 8290, 8290A & TO-9A], SOP No. WS-ID-0005, Rev. 7.4, 01/14/2011	Definitive	Dioxins/Furans	HRGC/HRMS	TestAmerica	N
A-16	Metals Digestion/Preparation References: Methods 3005A, 3010A, 3050B and EPA 200.7 12/19/2013 R25	Preparation	Metals	Acid Digestion	Empirical Laboratories, LLC	N
A-17	Metals by Inductively Coupled Plasma-Atomic Emission Spectrometry (ICP-AES) Technique SW-846 6010B; SW-846 6010C, EPA 200.7, SM 2340 B-2011 for Hardness Calculation 07/01/2013 R20	Definitive	Metals	ICP	Empirical Laboratories, LLC	N
A-18	Perchlorate in Water, Soil, and Solid Waste Using High Performance Liquid Chromatography/ Electrospray Ionization/ Mass Spectrometry by SW846 Method 6850 08/01/2013 R10	Definitive	Perchlorate	LC/MS	Empirical Laboratories, LLC	N

AES = Atomic Emission Spectroscopy
DAD = Diode Array Detector
HPLC = High Performance Liquid Chromatography
HRGC/HRMS = high resolution gas chromatography/high resolution mass spectrometry
ICP = Inductively-Coupled Plasma
LC/MS = Liquid Chromatography/Mass Spectrometry
NA = Not applicable

Worksheet 24 — Analytical Instrument Calibration Table

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Person Responsible for CA	SOP Reference
Gas Chromatograph/ Mass Spectrometer (GC/MS) – VOCs by SW8260B (soil and water)	Minimum five-point initial calibration for all analytes (ICAL)	Initial calibration prior to sample analysis	**1.** Avg response factor (RF) for VOC System Performance Check Compounds (SPCCs): 0.30 for chlorobenzene and 1,1,2,2-tetrachloroethane and 0.10 for chloromethane, 1,1-dichloromethane, and bromoform. **2.** RSD for RFs for Calibration Check Compounds (CCCs) 1,1-dichloroethene: chloroform, 1,2-dichloropropane, vinyl, chloride, toluene, and ethyl benzene ≤ 30% and one option below: • Option 1: RSD for target analytes ≤ 15%; • Option 2: linear least squares regression r ≥ 0.995 • Option 3: non-linear regression – coefficient of determination (COD) $r^2 \geq 0.99$ (6 points used for quadratic (second) order, and 7 points for third order polynomial)	Correct problem then repeat initial calibration.	Group Analyst	A-1
	Second source calibration verification (ICV)	Once after each initial calibration	Project analytes within ± 20% of expected value (initial source)	Correct problem and verify second source standard. Rerun second source verification. If that fails, correct problem and repeat initial calibration.	Group Analyst	A-1
	Calibration verification (CCV)	Daily, before sample analysis, and every 12 hours of analysis time	**1.** Avg RF for VOC SPCCs: ≥ 0.30 for chlorobenzene and 1,1,2,2-tetrachloroethane; ≥ 0.1 for chloromethane, bromoform, and 1,1-dichloroethane. **2.** %Difference/Drift for all VOC target compounds and surrogates: ≤ 20%D (Difference when using RFs or Drift when using least squares regression or non-linear calibration)	Correct problem, then rerun CCV. If that fails, repeat initial calibration.	Group Analyst	A-1
	Evaluation of relative retention times (RRT)	With each sample	RRT of each target analyte in each calibration standard within 0.06 RRT units.	Correct problem, then rerun ICAL.	Group Analyst	A-1
	Retention time window established for each analyte and surrogate	Once per ICAL	Position shall be set using the midpoint standard of the initial calibration curve when ICAL is performed. On days when ICAL is not performed, the initial CCV shall be used.	NA	Group Analyst	A-1

Worksheet 24 — Analytical Instrument Calibration Table (Continued)

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Person Responsible for CA	SOP Reference
Gas Chromatograph/ Mass Spectrometer (GC/MS) – SVOCs by SW8270D (soil and water)	Minimum five-point initial calibration for all analytes (ICAL)	Initial calibration prior to sample analysis	**1.** Avg response factor (RF) for VOC System Performance Check Compounds (SPCCs): 0.050. **2.** RSD for RFs for Calibration Check Compounds (CCCs): ≤ 30% and one option below: • Option 1: RSD for target analytes ≤ 15%; • Option 2: linear least squares regression r > 0.995 • Option 3: non-linear regression – coefficient of determination (COD) r2 > 0.99 (6 points used for quadratic (second) order, and 7 points for third order polynomial)	Correct problem then repeat initial calibration.	Group Analyst	A-6A-6
	Second source calibration verification (ICV)	Once after each initial calibration	All project analytes within ± 20% of true value	Correct problem and verify second source standard. Rerun second source verification. If that fails, correct problem and repeat ICAL.	Group Analyst	A-6A-6
	Continuing Calibration Verification (CCV)	Daily, before sample analysis, and every 12 hours of analysis time	**1.** Average RF for SPCCs: ≥ 0.050. **2.** %Difference/Drift for all SVOC target compounds and surrogates: ≤ 20%D (Difference when using RFs or Drift when using least squares regression or non-linear calibration)	Correct problem, then rerun CCV. If that fails, repeat ICAL. Reanalyze all samples since last acceptable CCV.	Group Analyst	A-6A-6
	Evaluation of relative retention times (RRT)	With each sample	RRT of each target analyte in each calibration standard within ± 0.06 RRT units.	Correct problem, then rerun ICAL.	Group Analyst	A-6A-6
	Retention time window established for each analyte and surrogate	Once per ICAL	Position shall be set using the midpoint standard of the initial calibration curve when ICAL is performed. On days when ICAL is not performed, the initial CCV shall be used.	NA	Group Analyst	A-6A-6

Worksheet 24 — Analytical Instrument Calibration Table (Continued)

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Person Responsible for CA	SOP Reference
High Performance Liquid Chromatograph (HPLC) / Diode Array Detector (DAD) – Explosives by SW8330	Retention time Window position establishment for each analyte and surrogate	Once per ICAL and at the beginning of the analytical shift	Position shall be set using the midpoint standard of the ICAL curve when ICAL is performed. On days when ICAL is not performed, the initials CCV is used.	NA	Group Analyst	A-13
	Minimum five-point initial calibration for all analytes (ICAL)	Initial calibration prior to sample analysis	One of the options below: Option 1: RSD for each analyte ≤ 20% Option 2: linear least squares regression: r ≥ 0.995 Option 3: non-linear regression: coefficient of determination (COD) r2 ≥ 0.99 (6 points shall be used for second order, 7 points shall be used for third order)	Correct problem then repeat ICAL.	Group Analyst	A-13
	Second source calibration verification (ICV)	Immediately following ICAL	All project analytes within established retention time windows. Project analytes within ± 15% of expected value from the ICAL	Correct problem, rerun ICV. If that fails, repeat ICAL.	Group Analyst	A-13
	Continuing Calibration Verification (opening CCV and closing CCV) and Retention Time verification	Daily, prior to sample analysis, after every 10 field samples, and at the end of the analysis sequence	All project analytes and surrogates within established retention time windows. All project analytes within ± 15% of expected value from the ICAL	Correct problem, then rerun CCV. If that fails, then repeat ICAL. Reanalyze all samples since last successful CCV.	Group Analyst	A-13

Worksheet 24 — Analytical Instrument Calibration Table (Continued)

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Person Responsible for CA	SOP Reference
Inductively Coupled Plasma (ICP) – Atomic Emission Spectroscopy (ICP-AES) for Metals by SW6010B/C and SW6020A	Linear Dynamic range/High level Check standard	Initial set up and every 6 months	Within ± 10% of true value	NA	Group Analyst	A-9
	Initial calibration (ICAL) for all analytes - minimum one high standard and a calibration blank	Daily initial calibration prior to sample analysis	If more than one calibration standards is used, r ≥ 0.995.	Correct problem and repeat ICAL.	Group Analyst	A-9
	Low-level calibration check standard (CRI)	Daily, after one-point ICAL	Within ± 20% of true value	Correct problem, then reanalyze.	Group Analyst	A-9, SOP 105
	Continuing Calibration Verification (CCV)	After every 10 field samples and at the end of the analysis sequence	Within ± 10% of true value	Correct problem, rerun CCV. If that fails, then repeat ICAL. Reanalyze all samples since the last successful CCV.	Group Analyst	A-9
Flow Injection Mercury Systems (FIMS) – Mercury by Cold Vapor Atomic Absorption (CVAA) by SW7470/7470A and 7471A/7471B	Initial calibration (ICAL) for mercury: minimum 5 standards and a calibration blank	Daily ICAL prior to sample analysis	r ≥ 0.995	Correct problem, then repeat ICAL.	Group Analyst	A-12
	Second source calibration verification (ICV)	Once after each ICAL, prior to beginning sample run	Value of second source for all analyte(s) within ±10% of true value	Correct problem and verify second source standard. Rerun ICV. If that fails, correct problem and repeat ICAL.	Group Analyst	A-12
	Continuing Calibration Verification (CCV)	After every 10 field samples and at the end of the analysis sequence	Within ± 20% of true value	Correct problem, rerun calibration verification. If that fails, then repeat ICAL. Reanalyze all samples since the last successful calibration verification.	Group Analyst	A-12

Worksheet 24 — Analytical Instrument Calibration Table (Continued)

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Person Responsible for CA	SOP Reference
High Resolution Gas Chromatograph/ High Resolution Mass Spectrometer (High Res GC/ High Res MS) for Dioxins/Furans	Initial calibration (ICAL) for all analytes in method	Initial calibration prior to sample analysis and as needed after failure of the calibration verification standard	Ion abundance ratios in accordance with criteria in Table 8 of Method 8290; Signal to Noise (S/N ratio ≥ 10 for all target analyte ions and RSD for each analyte ≤ 20% for all Response Factors (RFs) for all 17 unlabeled standards and RSD ≤ 20% for the RFs for the 9 labeled Internal Standards (IS)	If the acceptance criteria were not met, re-calibration is performed before any samples may be analyzed.	Group Analyst	A-15
	Calibration verification	At the beginning of each 12-hour period, and at the end of each analytical sequence.	Ion abundance ratios in accordance with criteria in Table 8 of Method 8290; and for unlabeled standards, RF within ± 20%D of RF established in the ICAL; and RF for labeled standards, RF within ± 30%D of RF established in the ICAL	Correct problem, repeat calibration verification standard. If that fails, repeat ICAL and reanalyze all samples analyzed since last successful CCV. End of run CCV: If the RF for unlabeled standards ≤ 25% D and the RF for labeled standards ≤ 35% D (relative to the RF established in the ICAL, the mean RF from the two daily CCVs must be used for quantitation of impacted samples instead of the ICAL mean RF value. If the starting and ending CCV RFs differ by more than 25% RPD for unlabeled compounds or 35% D for labeled compounds, the sample may be quantitated against a new ICAL if it is analyzed within two hours. Otherwise, reanalyze samples with positive detections if necessary. Flag data, as needed, as specified in QSM 4.2 table F-6, page F-35.	Group Analyst	A-15

Worksheet 24 — Analytical Instrument Calibration Table (Continued)

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Person Responsible for CA	SOP Reference
HPLC/MS Perchlorate (6850)	Tuning	Prior to ICAL	Must contain the analytes of interest and meet SOP criteria.	Re-tune and/or clean source	Analyst/ Supervisor	SOP A-18
	Initial Calibration	Upon instrument receipt, for major instrument changes, or when continuing calibration verification (CCV) does not meet criteria	Min 5 pt. initial Calibration for all analytes (6 pts. for non-linear) % relative standard deviation (%RSD) <20%; or Linear regression R-Squared >0.990 (R>0.995); or Non-linear regression R-Squared ≥ 0.990 (6 pts. for non-linear). Concentration at Y-intercept must be <LOD	Repeat Calibration if criteria is not met	Analyst/ Supervisor	SOP A-18
	Initial Calibration Verification	After Calibration	%D < 15%	Evaluate, repeat, if still failing, recalibrate.	Analyst/ Supervisor	SOP A-18
	Limit of detection verification (LODV)	Prior to samples and at the end of the analysis sequence. Can be analyzed after every 10 field samples.	%D < 30%	If analyte exceeds with a positive bias and is non-detect, results will be qualified. Detected analytes and analytes with negative bias will be requested for qualification/ narration with client. If client approval is not received, correct problem, then rerun LODV. If that fails, then repeat ICAL. Reanalyze all samples since last acceptable LODV. If reanalysis cannot be performed, data must be qualified and explained in the case narrative.	Analyst/ Supervisor	SOP A-18
	Continuing Calibration	Prior to samples then after every 10 field samples.	%D < 15%	If analyte exceeds with a positive bias and is non-detect, results will be qualified. Detected analytes and analytes with negative bias will be requested for qualification/ narration with client. If client approval is not received, correct problem, then rerun CCV. If that fails, then repeat ICAL. Reanalyze all samples since last acceptable CCV. If reanalysis cannot be performed, data must be qualified and explained in the case narrative.	Analyst/ Supervisor	SOP A-18

Worksheet 24 — Analytical Instrument Calibration Table (Continued)

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Person Responsible for CA	SOP Reference
ICP-AES Strontium (SW846 6010C)	Linear dynamic range or high-level check standard	Every 6 months	Within ±10% of true value.	N/A	Analyst/ Supervisor	SOP105
	Initial Calibration (ICAL) - minimum one high standard and a calibration blank for all analytes	Daily ICAL prior to sample analysis.	If more than one calibration standard is used, correlation coefficient (r) ≥ 0.995 (r2>0.990)	Correct problem, then repeat ICAL. Flagging criteria are not appropriate.	Analyst/ Supervisor	SOP105
	Second Source Calibration Verification (ICV)	Once after each ICAL, prior to beginning a sample run.	Value of second source for all analytes(s) within ±10% of true value.	Correct problem and verify second source standard. Rerun ICV. If that fails, correct problem and repeat ICAL. Flagging criteria are not appropriate.	Analyst/ Supervisor	SOP105
	Continuing Calibration Verification (CCV)	After every 10 field samples and at the end of the analysis sequence.	Within ± 10% of true value.	If analyte exceeds with a positive bias and is non-detect, no corrective action will be performed. Detected analytes and analytes with negative bias will be requested for qualification/narration with client. If client approval is not received, correct problem, then rerun CCV. If that fails, then repeat ICAL. Reanalyze all samples since last acceptable CCV. If reanalysis cannot be performed, data must be qualified and explained in the case narrative.	Analyst/ Supervisor	SOP105
	Low-level calibration check standard	Daily, after one-point ICAL.	Within ±20% of true value.	Correct problem, then reanalyze. Flagging criteria are not appropriate.	Analyst/ Supervisor	SOP105
	Calibration Blank	Before beginning a sample run, after every 10 samples, and at end of the analysis sequence.	No analytes detected > LOD.	Correct problem. Re-prep and reanalyze calibration blank. All samples following the last acceptable calibration blank must be reanalyzed. Apply B-flag to all results for specific analyte(s) in all samples associated with the blank.	Analyst/ Supervisor	SOP105
	Interference check solutions (ICS)	After beginning of the analytical run	ICS-A: Absolute value of concentration for all non-spiked analytes < LOD ICS-AB: Within 20% of true value	Terminate analysis; locate and correct problem; reanalyze ICS, reanalyze all samples. If corrective action fails, Q qualify all associated analyte results.	Analyst/ Supervisor	SOP105

Worksheet 25 — Analytical Instrument and Equipment Maintenance, Testing, and Inspection Table

Instrument/ Equipment	Maintenance Activity	Testing Activity	Inspection Activity	Frequency	Acceptance Criteria	Corrective Action	Responsible Person	SOP Reference
Gas Chromatograph/ Mass Spectrometer (GC/MS)	Check purge and trap for leaks	VOCs by SW8260B	Poor chromatography, peak shape, analyte response	Vols: monthly, as required	Leak free	Repair leak	Group Analyst	A-1
	Clean ion source	VOCs by SW8260B	Poor chromatography, peak shape, analyte response	As required	Pass tune criteria, SPCC,CCC response	Clean ion source	Group Analyst	A-1
	Change vacuum pump oil	VOCs by SW8260B	Visual inspection	6 Months, as required	6 Months, as required	Change vacuum pump oil	Group Analyst	A-1
	Change PFTBA vial	VOCs by SW8260B	Visual inspection, problems tuning	1 Year	1 year old	Replenish	Group Analyst	A-1
	Change gases	VOCs by SW8260B	Visual inspection	Daily/Auto Switch	More than 100 PSI	Change gas cylinder	Group Analyst	A-1
	Change gold seals	VOCs by SW8260B	Poor chromatography, peak shape, analyte response	As needed	Improved chromatography, peak shape, analyte response	Change Gold Seal	Group Analyst	A-1
	Change injection port liner/septum	VOCs by SW8260B	Poor chromatography, peak shape, analyte response, known contamination	As needed	Improved chromatography, peak shape, analyte response	Change liner/septum	Group Analyst	A-1
	Check Autosampler	VOCs by SW8260B	Poor chromatography, peak shape, analyte response, known sample contamination, jammed vials, missed vials, not gripping vials	As needed	Leak free, better analyte response and peak shape, good response for purge flow sensitive analytes, not missing or losing vials during runs	Repair leak, adjust flows, change/inspect purge sparge needles for cracks/clogs, recalibrate autosampler, fill flush bottle	Group Analyst	A-1

Worksheet 25 — Analytical Instrument and Equipment Maintenance, Testing, and Inspection Table (Continued)

Instrument/ Equipment	Maintenance Activity	Testing Activity	Inspection Activity	Frequency	Acceptance Criteria	Corrective Action	Responsible Person	SOP Reference
Gas Chromatograph/ Mass Spectrometer (GC/MS)	Check for leaks	VOCs by SW8260B	Poor chromatography, peak shape, analyte response	As needed	Leak free	Repair leak	Group Analyst	A-1
	Check gas flows/head pressure	VOCs by SW8260B	Poor chromatography, peak shape, analyte response	As needed	Leak free, adjusted flows	Repair leak, adjust flows	Group Analyst	A-1
	Change column	VOCs by SW8260B	Poor chromatography, peak shape, analyte response, known contamination	As needed	Better analyte response and peak shape, pass tune criteria, SPCC and CCC analytes meet criteria	Change column	Group Analyst	A-1
	Change PFTBA vial	SVOCs by SW8270D	Visual inspection, problems tuning	1 Year	1 year old	Replenish	Group Analyst	A-6
	Clean ion source	SVOCs by SW8270D	Poor chromatography, peak shape, analyte response	As required	Pass tune criteria, SPCC, CCC response	Clean ion source	Group Analyst	A-6
	Change vacuum pump oil	SVOCs by SW8270D	Visual inspection	6 Months, as required	6 Months, as required	Change vacuum pump oil	Group Analyst	A-6
	Change autosampler wash solvents	SVOCs by SW8270D	Visual inspection	Daily	More than 1/2 full, clean	Fill with solvent	Group Analyst	A-6
	Check auto injector mount and needle	SVOCs by SW8270D	Visual inspection, poor chromatography, peak shape, analyte response	Daily	Operates freely	Change	Group Analyst	A-6
	Change gold seals	SVOCs by SW8270D	Poor chromatography, peak shape, analyte response	Monthly, as required	Poor chromatography, peak shape, analyte response	Change gold seal	Group Analyst	A-6

Worksheet 25 — Analytical Instrument and Equipment Maintenance, Testing, and Inspection Table (Continued)

Instrument/ Equipment	Maintenance Activity	Testing Activity	Inspection Activity	Frequency	Acceptance Criteria	Corrective Action	Responsible Person	SOP Reference
High Performance Liquid Chromatograph (HPLC)	Change gases	Explosives by SW8330A/B	Visual inspection	Daily	More than 100 PSI	Change gas cylinder	Group Analyst	A-13
	Change/verify mobile phase solvents	Explosives by SW8330A/B	Visual inspection	Daily	More than 1/2 full	Fill with solvent	Group Analyst	A-13
	Check flows/head pressure	Explosives by SW8330A/B	Poor chromatography, peak shape, analyte response	Daily	Leak free	Repair leak or clog	Group Analyst	A-13
	Check Autosampler	Explosives by SW8330A/B	Poor chromatography, peak shape, analyte response, known sample contamination, jammed vials, missed vials, not gripping vials	As needed	Leak free, better analyte response and peak shape, good response for purge flow sensitive analytes, not missing or losing vials during runs	Repair leak, adjust flows, change/inspect purge sparge needles for cracks/clogs, recalibrate autosampler, fill flush bottle	Group Analyst	A-13
	Check for leaks	Explosives by SW8330A/B	Poor chromatography, peak shape, analyte response	Daily	Leak free	Repair leak or clog	Group Analyst	A-13
	Clean detector	Explosives by SW8330A/B	Poor chromatography, peak shape, analyte response	As needed	Good flows, improved chromatography, acceptable ICAL and SSC	Clean system with isopropyl alcohol (IPA) or other rinsing solvents or dilute acid solution	Group Analyst	A-13
	Change column	Explosives by SW8330A/B	Poor chromatography, peak shape, analyte response, known contamination	As needed	Better analyte response and peak shape, acceptable ICAL and SSC	Change column	Group Analyst	A-13

Worksheet 25 — Analytical Instrument and Equipment Maintenance, Testing, and Inspection Table (Continued)

Instrument/ Equipment	Maintenance Activity	Testing Activity	Inspection Activity	Frequency	Acceptance Criteria	Corrective Action	Responsible Person	SOP Reference
Inductively Coupled Plasma-Atomic Absorption Spectroscopy (ICP-AES)	Check condition of the torch	ICP-AES metals by SW6010B/C and SW 6020A	Visual inspection	As necessary	Free of burns or serious discoloration	Clean or replace	Group Analyst	A-9
	Full instrument Preventative Maintenance	ICP-AES metals by SW6010B/C and SW 6020A	Pre-scheduled; Preventative Action not based on Inspection Activity	Semi-Annually	Manufacturer list of checks	NA	Manufacturer	A-9
	Clean purge windows	ICP-AES metals by SW6010B/C and SW 6020A	Visual inspection	As necessary	Free of residue or burns	Clean or replace	Group Analyst	A-9
	Check Nebulizer Flow	ICP-AES metals by SW6010B/C and SW 6020A	Visual inspection	Daily	Full/thick cloud	Clean or replace	Group Analyst	A-9
	Check condition of the injector	ICP-AES metals by SW6010B/C and SW 6020A	Visual inspection	As necessary	Free of deposits or discoloration on the tip	Clean or replace	Group Analyst	A-9
	Check Sample Introduction Tubing	ICP-AES metals by SW6010B/C and SW 6020A	Visual inspection	Daily	Acceptable if not flattened or discolored	Replace	Group Analyst	A-9
Flow Injection Mercury/Hydride - Atomic Absorption (FIMS)	Check condition of cell	Mercury by SW7140A and SW7141B	Visual inspection	As necessary	Signs of moisture	Replace	Group Analyst	A-10 (prep), A-12 (analysis)
	Check Sample Introduction Tubing	Mercury by SW7140A and SW7141B	Visual inspection	Daily	Acceptable if not flattened or discolored	Replace	Group Analyst	A-10 (prep), A-12 (analysis)
	Clean or replace windows	Mercury by SW7140A and SW7141B	Visual inspection	As necessary	Free of residue or burns	Replace	Group Analyst	A-10 (prep), A-12 (analysis)
	Replace filter on mixing manifold	Mercury by SW7140A and SW7141B	Visual inspection	Daily	No moisture in tubing past manifold	Replace	Group Analyst	A-10 (prep), A-12 (analysis)

Worksheet 25 — Analytical Instrument and Equipment Maintenance, Testing, and Inspection Table (Continued)

Instrument/ Equipment	Maintenance Activity	Testing Activity	Inspection Activity	Frequency	Acceptance Criteria	Corrective Action	Responsible Person	SOP Reference
High Performance Liquid Chromatography/ Mass Spectrometer	Check pressure and gas supply daily – change when <200psi, change analytical column as needed, change mobile phase when insufficient for run or contamination, change inlet filters as needed for contamination. Clean the source and replace the filaments.	Perchlorate	Check pump pressure, check for leaks, check for adequate mobile phase.	Source cleaning is performed when the instrument response deteriorates. Other instrument maintenance is carried out as needed to keep the instrument performing at peak performance.	CCV < 15% difference.	Recalibrate and/or perform necessary equipment maintenance. Check calibration standards. Reanalyze affected data.	Analyst/ Supervisor	SOP A-18
High Performance Liquid Chromatography/ Ultraviolet Detector	Check pressure and gas supply daily – change when <200psi, change analytical column as needed, change mobile phase when insufficient for run or contamination, change inlet filters as needed for contamination.	Dinitrotoluenes and Nitroglycerin	Check pump pressure, check for leaks, check for adequate mobile phase.	Prior to initial calibration or as necessary.	CCV ≤ 15% difference.	Recalibrate and/or perform necessary equipment maintenance. Check calibration standards. Reanalyze affected data.	Analyst/ Supervisor	SOP 327

Worksheet 26 — Sample Handling System

The worksheet is included in the WFF Site-Wide UFP-QAPP. Sample handling requirements cited in the site-wide UFP-QAPP are those in effect at the time of its writing. As any new procedure or criterion is required, addendums to this document will be issued.

Worksheet 27 — Sample Custody Requirements

The worksheet is included in the WFF -Wide UFP-QAPP. Sample custody requirements cited in the site-wide UFP-QAPP are those in effect at the time of its writing. As any new procedure or criterion is required, addendums to this document will be issued.

Worksheet 28 — QC Samples Tables

QC samples tables are included in the WFF Site-Wide UFP-QAPP. Project-specific analytical methods include explosive compounds by Method 8330A/B, metals by Method 6010B/C and 6020A, mercury by Method 7471A/B, VOCs by Method 8260B, SVOCs by 8270D, dioxins/furans by Method 8290, and perchlorate by Method 6850. Methods cited in the site-wide UFP-QAPP are those in effect at the time of its writing. As any new procedure or criterion is required, addendums to this document will be issued.

Worksheet 29 — Project Documents and Records Table

This worksheet is provided in the WFF Site-Wide UFP-QAPP. Documents and records cited in the site-wide UFP-QAPP are those in effect at the time of its writing. As any new procedure or criterion is required, addendums to this document will be issued.

Worksheet 30 — Analytical Services Table

Matrix	Analytical Group	Concentration Level	Sample Locations/ ID Number	Analytical Method[1]	Data Package Turnaround Time	Laboratory / Organization (name and address, contact person and telephone number)	Backup Laboratory / Organization (name and address, contact person and telephone number)
Soil, Water	Explosives	Low	TBD	SW8330A/B	Level IV 21 calendar days	CompuChem 501 Madison Ave. Cary, N.C. 27513 Attn: Cathy Dover 919-379-4089 office 919-379-4050 fax SW8290: TestAmerica Sacramento 880 Riverside Parkway West Sacramento, CA 95605 Attn: Karlo Bucher 916-373-5600 Fax: 916-372-1059 SW8330A/B, SW6850, SW6010C Empirical Laboratories (EL) at 621 Mainstream Drive, Suite 270, Nashville, Tennessee 37228 877-345-1113	Test America – Denver 4955 Yarrow Street Arvada, CO 80002 303-736-0100 Fax: 303-431-7171
	TAL Metals	Low		SW6010B/C and SW6020A			
	Mercury	Low		SW7470A/7471A			
	VOCs	Low		SW8260B			
	SVOCs	Low		SW8270D			
	Dioxins/Furans	Low		SW8290			
	Perchlorate	Low		SW6850			

[1] *See Worksheet 19 for a complete list of applicable methods, including preparation and analysis.*

Worksheet 31 — Planned Project Assessments Table

Assessment Type	Frequency	Internal or External	Organization Performing Assessment[1]	Person(s) Responsible for Performing Assessment[1] (title and organizational affiliation)	Person(s) Responsible for Responding to Assessment Findings[1] (title and organizational affiliation)	Person(s) Responsible for Identifying and Implementing Corrective Actions (CA)[1] (title and organizational affiliation)	Person(s) Responsible for Monitoring Effectiveness of CA[1] (title and organizational affiliation)
Review of QAPP with Field Staff	1/prior to sampling startup	Internal	WESTON	Gregory Zynda Project Engineer WESTON	Gregory Zynda Project Engineer WESTON	Gregory Zynda Project Engineer WESTON	Gregory Zynda Project Engineer WESTON
Daily Logbook and Field Forms	Daily	Internal	WESTON	Gregory Zynda Project Engineer WESTON	Gregory Zynda Project Engineer WESTON	Gregory Zynda Project Engineer WESTON	Gregory Zynda Project Engineer WESTON
Laboratory Assessment for Appropriate Certifications, Capacity and QAPP Review with Staff	1/prior to sampling startup	Internal	WESTON	Gretchen Fodor Project Chemist WESTON	Kenneth Grzybowski Laboratory Director CompuChem Cathy Dover Project Manager CompuChem	Kenneth Grzybowski Laboratory Director CompuChem Cathy Dover Project Manager CompuChem	Gretchen Fodor Project Chemist
Daily Tailgate Safety Meeting	Daily	Internal	WESTON	Bill Bounds SSHO WESTON	Bill Bounds SSHO WESTON	Bill Bounds SSHO WESTON	Bill Bounds SSHO WESTON
Field Sampling and COC Review Against QAPP Requirements	Daily	Internal	WESTON	Gretchen Fodor Project Chemist WESTON	Greg Zynda Project Engineer WESTON	Greg Zynda Project Engineer WESTON	Gretchen Fodor Project Chemist WESTON
Laboratory Report Deliverables and Analytical Results Against QAPP Requirements	Per Sample Delivery Group	Internal	WESTON	Gretchen Fodor Project Chemist WESTON	Kenneth Grzybowski Laboratory Director CompuChem Cathy Dover Project Manager CompuChem	Kenneth Grzybowski Laboratory Director CompuChem Cathy Dover Project Manager CompuChem	Gretchen Fodor Project Chemist WESTON
Validation	Per Sample Delivery Group	Internal	MCGI*	Sherif Mina Data Validator MCGI	Jennifer Rebman QA Manager CompuChem	Jennifer Rebman QA Manager CompuChem	Sherif Mina Data Validator MCGI

**Meridian Consultant Group, Inc. (MCGI), 1997 Annapolis Exchange Parkway, Suite 300, Annapolis, MD 21401.*
TBD – To be determined based on laboratory-specific project assignments.

Worksheet 32 — Assessment Findings and Corrective Action Responses Table

Assessment Type	Nature of Deficiencies Documentation	Individual(s) Notified of Findings[1] (name, title, organization)	Timeframe of Notification	Nature of Corrective Action Response Documentation	Individual(s) Receiving Corrective Action Response (name, title, organization)	Timeframe for Response
Review of QAPP with Field Staff	Contained with written report Daily QC Report for that day.	Anthony Pace Project Manager WESTON Gregory Zynda Project Engineer WESTON	Immediately; not to exceed 24 hours.	Daily QC Report would be amended with corrective action.	Gretchen Fodor Project Chemist WESTON	Immediate within 24 hours.
Laboratory Assessment for Appropriate Certifications, Capacity and QAPP Review with Staff	Receipt of copies of certifications. Email traffic concerning laboratory capacity prior to sampling startup. QAPP sign-off sheet received from laboratory.	Anthony Pace Project Manager WESTON	Immediate.	Response to email.	Anthony Pace Project Manager WESTON Gregory Zynda Project Engineer WESTON	48 hours after notification.
Daily Safety Meeting	Verbal debriefing and daily sign off log. If a safety violation occurs, a Supervisor Injury Employee Report is completed.	Bill Bounds SSHO WESTON	Immediately; not to exceed 24 hours.	Included as part of the process of the Supervisor Injury Employee Report.	Bill Bounds SSHO WESTON	Immediate within 24 hours.
Daily Field Reporting and Field Forms	Contained with written report.	Dan Dorrell UXOSO Bill Bounds SSHO WESTON	Immediately; not to exceed 24 hours.	Daily QC Report would be amended with corrective action.	Dan Dorrell UXOSO Bill Bounds SSHO WESTON	Immediate within 24 hours.
Field Sampling and COC Review Against QAPP Requirements	Communication may be in the form of email traffic	Anthony Pace Project Manager WESTON Gregory Zynda Project Engineer WESTON	24 hours after sampling.	Response to email.	Anthony Pace Project Manager WESTON Gregory Zynda Project Engineer WESTON	48 hours after notification.

Worksheet 32 — Assessment Findings and Corrective Action Responses (Continued)

Assessment Type	Nature of Deficiencies Documentation	Individual(s) Notified of Findings[1] (name, title, organization)	Timeframe of Notification	Nature of Corrective Action Response Documentation	Individual(s) Receiving Corrective Action Response (name, title, organization)	Timeframe for Response
Laboratory Report Deliverables and Analytical Results Against QAPP Requirements	Communication may be in the form of email traffic	Anthony Pace Project Manager WESTON Gregory Zynda Project Engineer WESTON	24 hours after completion of analytical	If required, laboratory reports will be amended and corrections noted in the analytical narrative.	Anthony Pace Project Manager WESTON Gregory Zynda Project Engineer WESTON	72 hours after notification.
Data Verification	Communication may be in the form of email traffic requesting additional laboratory forms, backup data that may be missing, and/or clarification of the analytical report.	Jennifer Rebman QA Manager CompuChem	24 hours after finding deficiency.	If required, laboratory reports will be amended and corrections noted in the analytical narrative and contained with the validation report.	Gretchen Fodor Project Chemist WESTON	Up to 7 days.
Validation	Communication may be in the form of email traffic requesting additional laboratory forms, backup data that may be missing, and/or clarification of the analytical report.	Cathy Dover Project Manager CompuChem	24 hours after finding deficiency.	If required, laboratory reports will be amended and corrections noted in the analytical narrative and contained with the validation report.	Sherif Mina Data Validator MCGI	Up to 7 days.

Worksheet 33 — QA Management Reports Table

Type of Report	**Frequency** (daily, weekly monthly, quarterly, annually, etc.)	**Projected Delivery Date(s)**	**Person(s) Responsible for Report Preparation** (title and organizational affiliation)	**Report Recipient(s)** (title and organizational affiliation)
Progress Reports	Monthly Progress Reports	Monthly after project startup	Anthony Pace Project Manager WESTON	Sher Zaman Project Manager USACE Baltimore
Validation Report	For all soil and groundwater samples	30 days after completion of analytical data	Sherif Mina – Data Validator MCGI	Gretchen Fodor Project Chemist WESTON
Final Report	Completed as Draft, Draft Final, and Final RI Report	To be determined (TBD)	Anthony Pace Project Manager WESTON Gregory Zynda Project Engineer WESTON	Sher Zaman Project Manager USACE Baltimore

Worksheet 34 — Sampling and Analysis Verification (Step I) Process Table

Verification Input	Description[1]	Internal / External	Responsible for Verification (name, organization)
Field Staff Training	Personnel assigned to the project, including field personnel and subcontractors, are qualified to perform the tasks to which they are assigned. Field personnel have basic field investigation knowledge for multimedia sampling. This includes, but is not limited to, basic sampling techniques, field testing methodology, monitoring wells installation, task-specific sampling methods, decontamination of field sampling equipment, maintenance of environmental paperwork, and how to avoid cross-contamination. In addition to education and experience, specific training may be required to qualify individuals to perform certain activities. Training will be documented appropriately and the forms placed in the project file as a record. Project personnel will receive an orientation to the full Sampling and Analysis Plan (SAP) and the Accident Prevention Plan (APP) as appropriate to their responsibilities before participation in project activities. Training of field personnel will be provided by the Site Supervisor, the QA Officer, or by a qualified designee.	Internal	Anthony Pace, WESTON Gregory Zynda, WESTON Gretchen Fodor, WESTON
QAPP	A copy of the reviewed and approved version of the QAPP will be distributed to the laboratory and be available for review by all WESTON/personnel involved in this project. It is the responsibility of the WESTON Project Chemist to ensure delivery of a copy of the QAPP to the laboratory. The Laboratory QA Manager is responsible for review of the QAPP with laboratory staff. The WESTON Project Manager and Project Geologist are responsible for ensuring that all staff have reviewed the final QAPP.	Internal/ External	Anthony Pace, WESTON Gregory Zynda, WESTON Gretchen Fodor, WESTON Cathy Dover, CompuChem, Cary, NC Jennifer Rebman, CompuChem, Cary, NC
Laboratory Quality Assurance Manual	Empirical Laboratories has a detailed Quality Manual, Rev. 27, dated 22 August 2011, which is designed to meet the quality program requirements of National Environmental Laboratories Accreditation Conference (NELAC) and ISO Guide 25. This Quality Manual is included in **Appendix C** of the Site-Wide QAPP.	Internal/ External	Kenneth Grzybowski, CompuChem, Cary, NC Jennifer Rebman, CompuChem, Cary, NC Gretchen Fodor, WESTON, Marianne Walker, Empirical Labs, Nashville, TN

Worksheet 34 – Sampling and Analysis Verification (Step I) Process Table (Continued)

Verification Input	Description[1]	Internal / External	Responsible for Verification (name, organization)
Laboratory Staff Training	Laboratory senior management staff retains oversight responsibility for the data integrity program and retain the ultimate responsibility for execution of the data integrity program elements. Senior laboratory management staff are responsible for providing the resources required to conduct SOPs, ethics training, and data integrity evaluation procedures. Laboratory's employees receive technical ethics training during new employee orientation. All employees are required to attend ethics refresher training and to sign an ethical conduct agreement annually, which verifies their understanding of the laboratory ethics policy and the analyst's ethical responsibilities. Training on data integrity procedures and SOPs are conducted by the individual department group leaders within the laboratory. All records of training are retained at the laboratory in the individual staff training folders and are maintained by the laboratory quality assurance officer. All information related to staff qualifications, experience, external training courses, and education are placed into the individual's training file. Verification documentation for laboratory orientation, health and safety, and quality assurance training is also maintained with the training file. Additional training documentation is added to the files as it occurs. Documentation includes data for initial and continuing demonstrations of proficiency, performance evaluations, study data and notes, and attendance lists from individual and group training sessions.	Internal	Organic and Inorganic Section Managers* Kenneth Grzybowski, CompuChem, Cary, NC Marianne Walker, Empirical Labs, Nashville, TN
Laboratory Certifications	CompuChem is a NELAC certified (DoD ELAP Certification, 12 August 2010 through 23 April 2013).	Internal/ External	Kenneth Grzybowski, CompuChem, Cary, NC Gretchen Fodor, WESTON, Marianne Walker, Empirical Labs, Nashville, TN
Field Logbooks	The sample number will be traceable to the site, location, and depth (where applicable). The sample identification and description will be recorded by the Task Order Manager or representative in the sample collection logs. The Task Order Manager will perform daily reviews of field log books each day of sampling.	Internal	Gregory Zynda, WESTON
Sample Location Verification	The Task Order Manager will verify that the sample technicians have collected the samples from the proper locations and depths as described in Worksheet 18.	Internal	Gregory Zynda, WESTON
Chain-of-Custody-Field Level	WESTON sample coordinator will generate COC forms prior to field sampling in accordance with the sample matrices and analytical tests required as described in Worksheet 19. Upon completion of the COC forms by the field technicians and prior to placement in the cooler, the Task Order Manager will review the COC forms against the field logbooks, Worksheet 18, and Worksheet 19 to ensure that the samples, sample volumes, and sample nomenclature match the COC forms and the required analytical tests have been notated. A review of the COC form for completeness will also be conducted.	Internal	Gregory Zynda, WESTON

Worksheet 34 – Sampling and Analysis Verification (Step I) Process Table (Continued)

Verification Input	Description[1]	Internal / External	Responsible for Verification (name, organization)
Chain-of-Custody-WESTON Project Chemist	Upon completion of the COC form, the field technician will either fax or email the completed COC form to the WESTON Project Chemist. A review of the COC form against Worksheet 18 and Worksheet 19 will be conducted to ensure the proper analytical tests have been requested.	Internal	Gretchen Fodor, WESTON
Chain-of-Custody-Analytical Laboratory	All samples to be analyzed by the fixed-base laboratory will be shipped via overnight courier service. Upon receipt, a representative of the laboratory will check the integrity of the custody seals, then locate, sign, and date the COC Form. The laboratory is responsible for verifying that the COC Form and containers are in agreement. The COC Form, a Cooler Receipt Form, and information regarding any discrepancies between the COC and bottle labels will be faxed to the Project Chemist prior to preparation for analysis. The Laboratory Information Management System (LIMS) will provide evidence of sample custody from receipt by the laboratory until appropriate disposal.	Internal	CompuChem and Empirical Lab Sample Management Technicians*
LIMS Login – Analytical Laboratory	A review of the COC form against the LIMS login and the project analytical requirement as presented in Worksheet 19 will be conducted to ensure proper analytical tests have been assigned, and a review of the login for correctness will be conducted.	Internal	Cathy Dover, CompuChem, Cary, NC Marianne Walker, Empirical Labs, Nashville, TN,
LIMS Login –WESTON Project Chemist	A secondary review of the COC form against the LIMS login and the project analytical requirement as presented in Worksheet 19 will be conducted to ensure proper analytical tests have been assigned, and a review of the login for correctness will be conducted.	External	Gretchen Fodor, WESTON
Sample Receipt Form – WESTON Project Chemist	The designated laboratory will provide within 48 hours of receipt of samples a copy of the sample receipt form. Any discrepancies between the COC and the sample containers will be noted and maintained as part of the analytical record.	External	Gretchen Fodor, WESTON
Laboratory Corrective Action and Report Procedure	Routine corrective action is defined as procedures used to return out-of-control analytical systems back to control. This level of corrective action applies to all analytical quality control parameters and analytical system specification as defined in the laboratory SOPs. Bench analysts have full responsibility and authority for performing routine corrective action. Routine corrective actions are documented as part of the analytical record. Defective processes, holding time violations, systematic errors, and quality defects that occur are to be reported by the bench chemist immediately to the section supervisor and a non-conformance record initiated. The section supervisor will notify the designated Laboratory Project Manager who will then notify the WESTON Project Chemist (Gretchen Fodor). All notifications must be made in a timely manner. The non-conformance record should become part of the analytical record.	Internal/ External	Cathy Dover, CompuChem, Cary, NC Gretchen Fodor, WESTON, Marianne Walker, Empirical Labs, Nashville, TN

Worksheet 34 – Sampling and Analysis Verification (Step I) Process Table (Continued)

Verification Input	Description[1]	Internal / External	Responsible for Verification (name, organization)
Analytical Data Package – Laboratory	All data produced by the laboratory will be required to undergo several levels of review, which will include two levels of management review at the laboratory. The laboratory will review the data packages internally for completeness and verify that all of the required forms and raw data are included for each data package type. Random data packages may be chosen by the designated laboratory QA Officers for additional audits.	Internal	Cathy Dover, CompuChem, Cary, NC Kenneth Grzybowski, CompuChem, Cary, NC, Marianne Walker, Empirical Labs, Nashville, TN
Analytical Data Package / Laboratory Quality Control – WESTON Project Chemist	The WESTON Project Chemist will verify that data have been received for all samples that have been sent to the laboratory. An evaluation of the data will be performed to determine whether the laboratory met the QC requirements for the analytical tests as stated in the analytical methods and laboratory SOPs. Refer to Worksheets 19 and 28.	External	Gretchen Fodor, WESTON
Laboratory Electronic Data Deliverables	The laboratory will provide electronic data deliverables in Staged Electronic Data Deliverable (SEDD) EDD format. The WESTON Project Chemist will review these files for correctness and completeness. Project-specific action goals as defined in Worksheet 15 will be added and evaluated. Any quality control issues that may impact the data use will be evaluated. The Project Manager and Site Manager will be notified immediately of any samples that exceed the project action goals.	External	Gretchen Fodor, WESTON

** Refer to the Laboratory QAM in **Appendix C** of the Site-Wide QAPP.*
[1] Any worksheets referenced within these fields that are not presented in this document can be found in the WFF Site-Wide QAPP.

Worksheet 35 — Sampling and Analysis Validation (Steps IIa and IIb) Process Table

Step IIa / IIb	Validation Input	Description[1]	Responsible for Validation (name, organization)
IIa	Field Sampling	Ensure that all sampling protocols were followed according to the SAP (reference document).	Gregory Zynda, WESTON
IIa	Analytical SOPs	Ensure that all laboratory analytical SOPs were followed.	Kenneth Grzybowski, CompuChem, Cary, NC, Marianne Walker, Empirical Labs, Nashville, TN
IIa	Documentation of Method QC Results	Establish that all method quality control samples were analyzed for and in control as listed in the analytical SOPs. If method QA was not in control, the laboratory will inform WESTON of the non-conformant situation prior to report generation.	Gretchen Fodor, WESTON
IIa/IIb	Documentation of QAPP QC Samples Results	Establish that all QAPP-required QC samples were collected. Establish that the collected QC samples met the required limits as established in the QAPP.	Gregory Zynda, WESTON Gretchen Fodor, WESTON
IIa/IIb	Documentation of Analytical Reports for Completeness	Ensure that from the generation of chain-of-custody forms in the field to the delivery of the analytical data that the appropriate analytical samples have been collected, appropriate site identifications have been used, and the correct analytical methods have been applied. Review the analytical reports to establish that all required forms, case narratives, samples, chain-of-custody forms, logbooks, and raw data have been included.	Gretchen Fodor, WESTON
IIb	Project Quantitation Limits	Review laboratory analytical results and verify that they meet the project quantitation limits specified in QAPP Worksheet 15.	Gretchen Fodor, WESTON
IIa/IIb	Project Action Limits	Review and add project action limits to the laboratory electronic data deliverable. Flag samples and notify Project Manager of samples that exceed the project action limits.	Gretchen Fodor, WESTON
IIa/IIb	Data Verification	Data verification will be performed on all samples. Data verification that sample analysis was performed as stated in the QAPP and in accordance with the laboratory SOPs.	Gretchen Fodor, WESTON

Worksheet 35 — Sampling and Analysis Validation (Steps IIa and IIb) Process Table (Continued)

Step IIa / IIb	Validation Input	Description[1]	Responsible for Validation (name, organization)
IIa/IIb	Data Validation	Validation will be performed on all samples. Project validation criteria in accordance with QAPP Worksheets 12, 19, 28, and 37 in the Site-Wide QAPP (WESTON, 2011) and Worksheet 15 within this document and EPA SW-846 methodologies. Validation qualifiers are applied as EPA Region III Level M3 for organic compounds and Level IM2 for inorganic compounds following the most recent version of the EPA *National Functional Guidelines* (NFG) for organic and inorganic data review. Methods for which no data validation guidelines exist will be validated following the NFG deemed most appropriate by the data validator. The data validator will receive all laboratory packages and analytical results electronically. Additionally, the validator will be required to submit final validation reports via pdf format and must provide an annotated laboratory analytical result EDD with applicable data validation qualifiers and/or result value modifications	Sherif Mina, MCGI, Data Validator

[1] *Any worksheets referenced within these fields that are not presented in this document can be found in the WFF Site-Wide QAPP.*

Worksheet 36 — Sampling and Analysis Validation (Steps IIa and IIb) Summary Table

Step IIa/IIb	Matrix	Analytical Group	Validation Level	Validation Criteria[1]	Data Validator (title and organizational affiliation)
IIa/IIb	Soil/Water	Explosives 8330B ICP Metals SW6010B/C and SW6020A VOCs SW8260B SVOCs SW8270C Dioxins/Furans SW8290 Mercury SW7470A, SW7471A Perchlorate SW6850	Tier III	Project validation criteria in accordance with QAPP worksheets 12, 19, 28, and 37 in the Site-Wide QAPP (WESTON, 2011) and worksheet 15 within this document and cited EPA SW-846 methodology. Validation qualifiers applied in accordance with Manual Level M3 for organic compounds and Manual Level IM2 for inorganic compounds following the most recent version of the EPA *National Functional Guidelines* (NFG) for organic and inorganic data review, and Appendix A USACE Norfolk District Data Validation Scope of Work. Methods for which no data validation guidelines exist will be validated following the NFG deemed most appropriate by the data validator.	Sherif Mina, MCGI Validator

[1] *Any worksheets referenced within these fields that are not presented in this document can be found in the WFF Site-Wide QAPP.*

Worksheet 37 — Data Usability Assessment

The worksheet is included in the WFF Site-Wide UFP-QAPP. Data usability assessment requirements cited in the site-wide UFP-QAPP are those in effect at the time of its writing. As any new procedure or criterion is required, addendums to this document will be issued.

ATTACHMENT A

ANALYTICAL STANDARD OPERATING PROCEDURES

(Click here to open the SOPs in a separate file [pdf portfolio])

ATTACHMENT B

COMPUCHEM LABORATORY QUALITY MANUAL

LABORATORY ACCREDITATION BUREAU

Certificate of Accreditation

ISO/IEC 17025:2005 Certificate Number L2251

CompuChem, a Division of Liberty Analytical Corp, Inc

501 Madison Avenue
Cary, NC 27513

has met the requirements set forth in L-A-B's policies and procedures, all requirements of ISO/IEC 17025:2005 "General Requirements for the competence of Testing and Calibration Laboratories" and the U.S. Department of Defense Environmental Laboratory Accreditation Program (DoD ELAP).*

The accredited lab has demonstrated technical competence to a defined "Scope of Accreditation" and the operation of a laboratory quality management system (refer to joint ISO-ILAC-IAF Communiqué dated 8 January 2009).

Accreditation Granted through: April 23, 2013

R. Douglas Leonard, Jr., Managing Director
Laboratory Accreditation Bureau
Presented the 23rd of April 2010

*See the laboratory's Scope of Accreditation for details of the DoD ELAP requirements
Laboratory Accreditation Bureau is found to be in compliance with ISO/IEC 17011:2004 and recognized by ILAC (International Laboratory Accreditation Cooperation) and NACLA (National Cooperation for Laboratory Accreditation).

Quality Manual

CompuChem
A Division Of
Liberty Analytical Corp.

Revision 11
June 23, 2008

501 Madison Ave.
Cary, North Carolina 27513
www.compuchemlabs.com

CompuChem's mission is to work towards a cleaner environment, providing quality analytical services economically and efficiently. Our highly trained staff members work as partners to our clients to support and facilitate environmental solutions.

Environmental Testing Laboratories
CompuChem
A Division Of
Liberty Analytical Corp.

Quality Manual for
CompuChem, a Division of Liberty Analytical Corporation

501 Madison Avenue
Cary, NC 27513

Revision **11**

Prepared by:

Valgena Respass
Quality Assurance Manager

Effective Date: **June 23, 2008**

6/21/08
Robert E. Meierer, Vice President and General Manager, **Lab Manager**

6/20/08
Valgena Respass, Quality Assurance Officer

062108
James Feldhaus, Supervisor of Inorganics

6/20/08
Cathy Dover, Supervisor of Project Management Shipping and Receiving

6/23/08
Teresa Jennings, Supervisor of GC/HPLC

6/20/08
Teresa Grant, Manager of Sample Preparation

6-21-8
Kenneth Grzybowski, Supervisor of Volatile Organics

6/21/08
Jennifer Rebman, Supervisor of Semivolatiles Organics

TABLE OF CONTENTS

TABLE OF CONTENTS
(continued)

TABLE OF CONTENTS
(continued)

TABLE OF CONTENTS
(continued)

TABLES

FIGURES

FIGURES (continued)

APPENDICES

1.0 Statement of Policy

This Quality Manual summarizes the policies and operational procedures associated with CompuChem, a **Division** of Liberty Analytical Corporation, in Cary, North Carolina. Specific protocols for sample handling and storage, chain-of-custody, and laboratory analyses, data reduction, corrective action, and reporting are described. All policies and procedures have been structured in accordance with the National Environmental Laboratory Accreditation Conference (NELAC) and applicable EPA requirements, regulations, guidance, and technical standards. This manual has been prepared in accordance with the guidance documents listed further in Section 14. Further details on these policies and procedures are contained in SOPs and related documents. This Quality Manual, SOPs, and related documentation describe the quality system for CompuChem.

CompuChem performs chemical analyses for inorganic and organic constituents in water and soil. CompuChem's goal, and primary QA objective, is to produce data that are scientifically valid, defensible, and of known and documented quality in accordance with standards adopted by NELAC and any applicable state or EPA regulations or requirements.

CompuChem analyzes Proficiency Test (PT) samples at a minimum of two times per year for each field of proficiency testing following the requirements for PT providers and laboratories in Chapter 2.0 of the NELAC standards. Samples are obtained from a A2LA accredited PT provider. The specific analytes and matrices analyzed are based on the current scope of the laboratory services and accreditations and are documented in a laboratory SOP on PT sample analyses and in QA PT study files.

CompuChem has been a participant in the Contract Laboratory Program (CLP) since its inception and has established a long-standing rapport with the U.S. Environmental Protection Agency (USEPA) Program Office in Washington, DC, through our CLP Project Officer, and with the Region IV support division office. The EPA administers organic and inorganic Quarterly Blind PT studies for CLP analytes.

The technical and service requirements of all requests to provide analytical services are thoroughly evaluated and summarized by the Vice President of Quality Assurance and Technology. Marketing, Customer Services, Project Management, and Laboratory Operations review the summary before commitments are made to accept the work and before the project begins. This includes a review of facilities and instrumentation, current sample load, staffing, and any special method, QC or reporting requirements. All measurements are made using published reference methods or methods developed by CompuChem. Competence with all methods is demonstrated according to the procedure described in Appendix B of this Quality Manual prior to use.

The management of CompuChem is fully and firmly committed to the quality assurance program described in this Quality Manual. **The company's policies on ethical practices and its organizational hierarchy ensures that all if its employees are free from undue pressures that may adversely affect the quality of their work.** Each director, manager and supervisor, as well as their staff, is assigned, in accordance with this plan, responsibilities and objectives. Key aspects of procedures for sample receiving, chain-of-custody, sample preparation, laboratory analysis, data verification, and reporting are described in this Quality Manual and detailed the laboratory's SOPs. This manual and the SOP's document the elements of CompuChem's QA program.

The QA program is maintained and expanded or modified as necessary, to ensure all reported data are of uncompromising quality. In order to determine whether QA objectives are met, sufficient quality control will be generated. To meet the objectives of the QA program, senior management supports a program designed to:

- assess the capabilities of analytical methods for meeting users' needs in terms of accuracy, precision, completeness, representativeness, and comparability.
- establish and monitor the routine operational performance of the laboratory through appropriate systems checks to ensure that all aspects of the QA program are operative.
- assure that corrective actions are taken and that system control has been restored before resuming sample analysis whenever QC acceptance criteria are not met.

CompuChem has developed a proactive program for prevention of improper, unethical or illegal actions. Components of this program include the following:

- proficiency testing (single blinds).
- electronic data audits and post-analysis data audits by the QA staff.
- QA audit of the data management software audit trail for organics analyses.
- a signed Code of Ethics statement (Figure 1-1) issued and signed at employee orientation **and reaffirmed annually by each employee with their signature**.
- reaffirmation through an annual review and sign-off by all technical and support staff of the laboratory policies pertaining to manual integrations, instrument data system time, and SOP compliance.
- periodic supplemental company-wide training such as the Laboratory Fraud Detection and Deterrence presentation provided by EPA Region X.
- written SOPs addressing issues such as performing manual peak integrations and proper ethical conduct.

1.1 CODE OF ETHICS

CompuChem, a **Division** of Liberty Analytical Corporation, provides analytical services to a variety of clients involved in the assessment of toxicants in environment samples. Our commitment to meeting client expectations and providing data of the highest quality has been, and will continue to be, a distinguishing feature of our service. Consistent with the commitment to quality data is the underlying, assumed attribute of integrity as it relates to all aspects of our service business. Because clients put their trust in the testing laboratory's ability to provide impeccable results, CompuChem's policies and philosophy will be never to put that trust in jeopardy.

CompuChem's Standard Operating Procedures (SOPs) provide appropriate instructions for completing the required tasks in the laboratory and support areas. Additional guidance is provided by Good Laboratory Practice (glp) standards, the Quality Manual and appropriate laboratory policy memos. Training programs within each area also supply added assistance that supplements the direction provided by the SOPs. Within the contents of the aforementioned documentation, and in any training programs, provisions are included which govern the situations that allow for changes to written data (including chain-of-custody documentation) or instrument output. Situations requiring change must be appropriately documented and the requirements for this are set forth in the Quality Manual or appropriate SOPs.

In absolutely no circumstances do CompuChem's policies, philosophy, SOPs, or training programs allow for inappropriate manipulation (falsification) within the analytical testing process that would compromise the validity of that process. This practice constitutes fraud and is grounds for termination. CompuChem's management feels very strongly about this position since we value the trust that clients place in the quality and integrity of the data we produce for them.

____
Vice President & General Manager

~~~~~~

I, ____________________________________, have read and understand this Code of Ethics, and will act appropriately.

______________________________ _______________
Employee Signature Date
~~~~~~

1.2 Scope of the Quality Assurance Program Outlined in this Manual

The quality assurance plan described in this document applies specifically to CompuChem, a **Division** of Liberty Analytical Corporation, at 501 Madison Avenue in Cary, North Carolina. The plan pertains to the following major topics:

Policy
Organization and Responsibilities
Quality Assurance Objectives
Sample Handling
Test Methods and Standard Operating Procedures
Reference Standard Preparation and Instrument Calibration
Data Quality
Data Reduction, Review, and Reporting
Performance and System Audits and Frequency
Corrective Action
Facilities, Equipment, Security and Waste Management
Subcontracting and Support Services and Supplies

1.3 Concurrence with Quality Assurance program

The management of CompuChem is committed to the laboratory's quality system and to its continued improvement. **The management of** CompuChem understands and acknowledges that the laboratory is required to be continually in compliance with the National Environmental Laboratory Accreditation Program (NELAP) Standards. **All** of CompuChem's responsible parties document their concurrence with the policies and procedures detailed in this document **by their signatures on its Title Page.**

1.4 Procedures for Review of Requests, Tenders, and Contracts

Prior to **CompuChem entering into a contract to provide analytical testing services, the Vice President of Sales and Marketing reviews the request for bid (tender) and the Request for Proposal (RFP) or Scope of Work (SOW) presented by the client. The RFP or SOW detail the technical and service requirements associated with requests to provide analytical services. During or prior to the bidding process the Vice President of Sales and Marketing forwards the RFP or SOW to** the Vice President **and General Manager** or the Manager of Quality Assurance **who thoroughly review the technical aspects of the request**. After the review has been completed, a written summary is prepared and distributed to Laboratory Operations, Marketing, and Project Management for review. **This summary documents the review of the following**:

- Verification that the sample container and preservation requirements and the extraction and analyses holding times are consistent with method requirements.
- Verification that the laboratory has the requisite laboratory instrumentation, equipment, and personnel to perform the analytical services.
- Verification that the laboratory performs the analytical methods required for the project.

- Verification that the QC requirements presented are consistent with the method and that the laboratory has the ability to achieve them.

- Verification that the laboratory meets any identified accreditation/certification requirements.

- Verification that the laboratory can achieve all method detection limit (MDL) and practical quantitation limit (PQL) requirements.

- Verification that the laboratory is able to meet the hard copy and electronic data deliverable (EDD) requirements.

The review also identifies any items that need to be resolved with the client. **These** may include errors identified during the review of the client-supplied documentation or suggestions on alternative analytical approaches that would meet the project objectives. **These observations and suggestions are also documented in the summary. All information pertaining to requests, tenders and contracts are maintained by the laboratory in the applicable project file, the Laboratory Information Management System (LIMS), the intranet server, and the quality assurance department.**

2.0 Organization and Responsibility

2.1 Introduction

CompuChem offers the scientific and technical expertise needed to service the chemical laboratory needs of our customers. In addition to experienced analytical laboratory personnel who have skills in organic and inorganic methodologies, CompuChem utilizes a computer systems staff that manages software systems for data reporting and sample scheduling and control. To ensure that all the needs of our clients are met, a project manager is assigned to each account, providing a liaison between the customer and the laboratory.

A laboratory organizational chart of key personnel is shown as Figures 2-1. This chart includes all individuals discussed further in this section. The Human Resources department maintains job descriptions for all employees. Job descriptions for positions shown on the organizational chart are found in Figure 2-3. Resumes of key management staff are found as Figure 2-4.

This section describes the operational and functional responsibilities of key lab personnel, including the duties and services performed for product quality. The roles and responsibilities of the Quality Assurance Department and its organizational relationship to lab management are identified.

The Quality Assurance staff monitors and reviews all laboratory units and operates independently of production. All quality control criteria are documented, and compliance is verified at each level of laboratory data review. Standard Operating Procedures (SOPs) for in-lab data evaluation and independent QA auditing describe the details of these quality control functions. The QA Department is responsible for verifying the integrity of these functions and documenting performance for lab management review.

2.2 Assignment of Responsibilities

The following is a brief summary of the responsibilities and authorities assigned to each of the QA staff, laboratory management staff, and laboratory technical staff:

2.2.1 Vice President and General Manager

Assuring the laboratory achieves all QA Program objectives, the Vice President and General Manager monitors and directs quality activities of QA Department and lab personnel. The Vice President and General Manager acts in strict adherence to the procedures and requirements stated in the Quality Manual. He works closely with laboratory supervisors and staff to address data quality issues. The Vice President and General Manager reports directly to the President and Chief Executive Officer (CEO). The Vice President and General Manager and QA have oversight responsibilities for all lab operations as depicted in the organization chart. The Vice President and General Manager and QA Manager have the authority to terminate non-conforming work.

The Vice President and General Manager and the QA manager conduct annual assessments of the total QA program. Based on the assessments, a written status report of QA activities and progress is forwarded to management. Additional monthly reports include information regarding the effectiveness of the quality management systems and are reported to executive management staff. Included are:

- status of or changes to the QA program and Quality Manual
- measures of data quality
- significant QA problems, accomplishments and recommendations
- results of performance audits
- results of system audits
- status of QA requirements for contracts and QA Project Plans
- summary of QA training (internal and external QA/QC seminars and courses)
- overall effectiveness of the QA program

2.2.2 Manager of Quality Assurance (*QA Officer*)

The Manager of Quality Assurance reports to the Vice President and General Manager and is organizationally and functionally independent of direct job involvement and day-to-day laboratory operations. The QA Officer serves as the focal point for QA/QC and is responsible for the oversight and/or review of quality control data. She is primarily responsible for auditing the implementation of the quality system and carrying out the directives of the Vice President and General Manager.

2.2.3 Director of Laboratory Operations

The Director of Laboratory Operations reports directly to the President and Chief Executive Officer and is responsible for all aspects of laboratory operations. All laboratory section managers report directly to the Director of Laboratory Operations. She is responsible for ensuring that all laboratory technical staff are qualified and properly trained to perform their job functions. She is also responsible for the timely delivery of client data reports that meet all quality control and project requirements.

2.2.4 Laboratory Management

The laboratory section managers and supervisors report directly to the Director of Laboratory Operations and are responsible for sample receipt, sample preparation, sample analysis, reference standard preparation, instrument calibration, instrument maintenance, corrective action, data report preparation, and waste disposal.

2.2.5 Laboratory Technical Staff

Laboratory technical staff report directly to section managers and supervisors and are responsible for performing their various job functions utilizing current, approved laboratory standard operating procedures, EPA methods and EPA CLP statements of work. Laboratory technical staff are also responsible for the preparation and analysis of quality control samples and adherence to quality control and safety procedures.

2.2.6 Project Management and Customer Support Services

Project Management representatives are responsible for communicating client and project-specific requirements to the laboratory in order to ensure that data quality objectives are met. The Project Manager is the internal customer representative and the primary contact for the client. Details of the project requirements are reviewed and discussed prior to the receipt of samples. The Laboratory Information Management System (LIMS) allows the Project Manager (PM) to list detailed requirements for a given project. In addition, a Project Profile Sheet (PPS) can be completed to supply additional details or explain project specific requirements. Electronic PPS files are maintained in a network database available to all PCs. The LIMS is also available to all appropriate personnel.

2.5 Training of Technical Staff

CompuChem's training program is administered by the Human Resources (HR) department and laboratory supervisors and applies to all full-time, temporary and part-time employees. To be hired or promoted, an employee must meet all job description requirements. Checklists are used to document that requirements are met. All hiring and subsequent changes in personnel status are documented through the use of the Personnel Action Form (PAF).

Various types of training are provided for employees new to a position, and the training records are maintained in the individual's permanent training files. Initial and on-going performance is measured through indicators such as precision and accuracy in replicate spiked quality system matrices, performance evaluation or single blind proficiency test samples, and surrogate recoveries. If an employee fails to maintain acceptable performance standards, retraining must be documented before the employee may work independently. Training proficiency records are maintained for each employee.

Trainees are not allowed to process samples independently before they have demonstrated capability. See Appendix B of this manual for policy on performing Demonstration of Capability. During the training period, any work performed by a trainee is directly supervised by a senior qualified analyst, and any worksheets, forms, or other analytical data are reviewed and co-signed by the senior qualified analyst. The training period varies in length of time depending on the position and on the prior experience and knowledge level of the individual. On an as needed basis the QA staff provide training in certain quality aspects of the operation such as correct chain of custody documentation, proper error correction protocols, etc. Continuing training occurs annually with a signatory review of the Quality Manual by all staff.

In order to provide adequate staff to perform all of the laboratory's job functions, analysts are cross trained typically within their departments to perform other job functions. These cross trained analysts serve as backup in the absence of the primary analyst or as additional help if the work load is heavy in a particular area. Crossed trained analysts are required to demonstrate capability as described in Appendix B in all job functions in which they perform.

Each employee is required to read and understand the SOPs relative to their job responsibilities. They must agree to follow the most current version of the controlled SOP. Evidence of this agreement is maintained in each employee's training file or within the QA Department.

All job functions are fully described in formalized job descriptions. The employee job descriptions include minimum acceptable levels of formal education, training, prior experience, and special requirements for certifications or licenses. Some contracts or client agreements specify minimum qualifications for technical, administrative, computer, and management positions. Certain positions require auxiliary training, including viewing of training videotapes, on-site training classes, or off-site attendance of specialized training or certification courses.

Formal training at CompuChem also involves safety and chemical hygiene training. The Vice President and General Manager has the ultimate responsibility for chemical hygiene in the laboratory and provides continuing support of the program. The Safety Officer, Safety

18

Committee, and the Chemical Hygiene Officer (CHO) have the responsibility of coordinating and enforcing the laboratory safety program at CompuChem. Each employee in the laboratory is responsible for ensuring an effective chemical hygiene plan. The safety program involves the following key elements:

- safety training programs for all personnel
- the Chemical Hygiene Plan (CHP), approved by the Vice President and General Manager
- the Emergency Action Plan, approved by the Vice President and General Manager
- monthly inspections of the facilities for compliance with safety regulations
- verification that all safety equipment is operable and in good working condition (including inspection and recharging of all fire extinguishers, and monthly inspection of fume hoods and eye washes)
- initial testing of all new safety equipment
- annual fire/evacuation drills
- the safety committee, which is comprised of safety facilitators representing key sections of the operation
- right-to-know seminars held for all laboratory personnel to discuss chemical hazards, safety precautions, medical treatment, and spill procedures

The CHO and the safety committee have the responsibility of conducting internal safety inspections, covering all aspects of laboratory safety including fire, hazardous materials, personal dress, electrical safety, posted evacuation routes, and condition of all safety equipment. Corrective actions identified in the inspection or during safety drills are the responsibility of the each laboratory section manager.

Safety briefings for all employees are the responsibility of the department managers. Employees receive technical assistance from the CHO in complying with the CHP. Training includes safety for fire, electricity, compressed gases, chemical hazards, safety equipment, and hazardous sample and waste handling, depending on the responsibilities of the department or laboratory. New employees must be trained in all aspects of safety concerned with their job responsibilities and the laboratory in which they work. Human Resources, along with department managers and the CHO must maintain documentation of safety training. The documentation must include a completed training form, a list of the attendees, the training subject(s), the time spent in training, and the date.

A variety of local seminars, workshops, and lectures are also made available to employees. Workshop and seminar attendees usually relate their experiences in the form of trip reports or in-house presentations to appropriate staff members.

2.6 Laboratory Capabilities

CompuChem analyzes waste water, soil, and solid and liquid waste samples. Table 2.1 lists the parameters, analytes, and method references. Unless otherwise indicated in the SOP, the laboratory performs the published method as written.

Figure 2-1:

CompuChem, a Division of Liberty Analytical Corporation
Key Personnel Organizational Chart

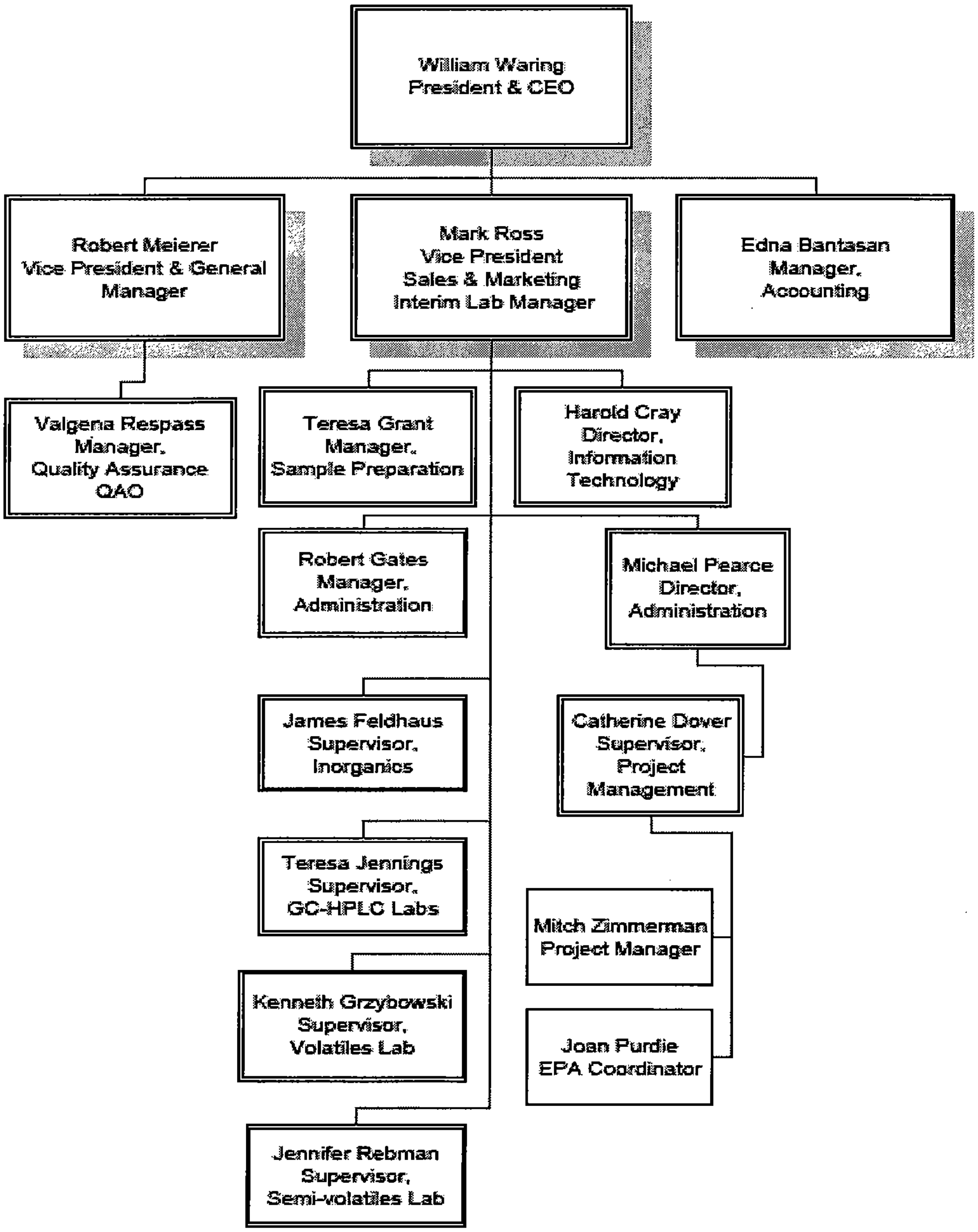


Figure 2-3: ***Job Descriptions of Key Positions listed on Organization Chart***

COMPUCHEM, a division of Liberty Analytical Corporation
DESCRIPTIVE TITLE: ***Vice President & General Manager*** **JOB NO.**:370008
DEPARTMENT: 3700 – Quality Assurance & Technology **F.L.S.A.** Exempt
IMMEDIATE SUPERVISOR: President & Chief Executive Officer **LOCATION**: Cary, NC

I. BASIC FUNCTION:

Develop and implement strategic processes and practices within the company. Manage and guide the overall organization. Provide guidance in analyzing and appraising the effectiveness of overall operations. Assure all EPA CLP contractual requirements and federal and state agency certification requirements are met by the company. Assure that the company consistently produces data of known and documented quality.

II. SCOPE OF THE POSITION:

A. Organizational Relationships

This position reports to and receives direction from the President and Chief Executive Officer (CEO). This position works closely with laboratory managers and the Marketing/Sales personnel concerning the nature and quality of work performed.

Outside of CompuChem, this position works closely with personnel from government agencies on analytical methodologies, customers and potential customers on the technical aspects of projects, and vendors on project information.

B. Major Functions Reporting to this Position

Director of Laboratory Operations

Quality Assurance Officer

C. Know How, Training and Experience

This position requires an advanced degree in analytical chemistry or equivalent, and a minimum of five (5) years experience in Quality Control/Quality Assurance functions. Extensive management experience and strong management capabilities are required. Experience in EPA and other agency requirements and regulations are required, as is an understanding of government agency interactions. Experience in GC, GC/MS and inorganic analyses are also required.

- Plan, develop and manage the Quality Assurance program assuring that all laboratory operations and standards meet the necessary requirements for continuing compliance with accreditation agencies.
- Monitor the effectiveness of the Quality Assurance program, assuring that appropriate QC standards are established and met, implementing changes or new programs as conditions require.
- Resolve quality control problems, explaining or directing the explanation of abnormal sample data, and recommending sample rework or corrective action when necessary.

Vice President & General Manager ***JOB No.: 370008 (continued)***

- Establish the conditions and programs necessary to meet certification and licensing standards on new products/analyses as they are developed.
- Work with laboratories to develop appropriate methodologies and standards for new products or special projects.
- Provide evaluation and approval for all method validation study programs and SOPs.
- Direct in-house systems and performance audits of laboratories and data audits
- Oversee and direct the efforts of the Quality Assurance staff activities to ensure that SOPs and the Quality Manual are current and documented.
- Conduct meeting of the Senior Managers.
- Assess findings in EPA CLP Contract Compliance Screening (CCS) Reports.
- Oversee responses to CCS Reports.
- Assess the feasibility of CLP modified analysis projects requested by the EPA
- Oversee and/of respond to EPA inquiries, data/tape audit reports, and on-site audit reports
- Review available RFP, RFQ and SOW documents for commercial clients and the EPA to understand the analytical and QC requirements

COMPUCHEM, a division of Liberty Analytical Corporation
DESCRIPTIVE TITLE: ***Director, Laboratory Operations*** **JOB NO.:** 500001
DEPARTMENT: 5000 Lab Support **F.L.S.A.** Exempt
IMMEDIATE SUPERVISOR: President & Chief Operating Officer **LOCATION:** Cary, NC

I. BASIC FUNCTION:

Direct the activities of the GC/MS, GC, Inorganics/Wet Chem & Extractions Laboratories which are comprised of various technical departments which function in a multi-shift production environment. The major responsibility of Laboratory Operations is to produce accurate and timely data packages based on the analyses of environmental samples. Additionally, to develop new methods and/or techniques which enhance CompuChem's product line and/or improves its process techniques and production throughput.

II. SCOPE OF THE POSITION:

A. Organizational Relationships

This position reports to and receives direction from President and COO. This position works closely with the Laboratory Managers as well as Managers from other CompuChem departments such as Sales & Marketing, Accounting, and Quality Assurance & Technology.

Outside of CompuChem, contact is with CompuChem's customers concerning laboratory practices, status of analyses, explanation of analytical results, etc. This position also has contact with equipment manufacturers, vendors, and consultants utilized by CompuChem.

B. Major Functions Reporting to this Position

Volatile and Semi-Volatile GC/MS Laboratories – Responsible for the preparation and analysis of environmental samples and for the generation of complete data packages.

Extractions Laboratory – Responsible for the preparation of sample extracts for analysis by other laboratories.

GC/HPLC Laboratories – Responsible for the preparation of sample environmental samples and for the generation of complete data packages.

Inorganics/Wet Chemistry Laboratory – Responsible for the preparation and analysis of inorganics samples, preparation of samples for metals, mercury, cyanide, phenols, fluoride, sulfate and chloride for the generation of complete data packages.

C. Know How, Training and Experience

The position requires a B.S. degree in Chemistry plus a minimum of five (5) years of experience in an analytical laboratory preferably performing organic environmental analyses. This position also requires a minimum of eight (8) years of managerial experience. The managerial experience should have been in a high growth, high technology production environment managing individuals with technical and/or scientific backgrounds. Knowledge of the environmental industry/analytical requirements is also required. A broad base knowledge of business plus excellent verbal and written communication skills is also required.

Director, Laboratory Operations ***JOB NO.: 500001 (continued)***

III. ACCOUNTABILITIES:

- Responsible for directing the Extractions, GC, HPLC, GC/MS, and Inorganics/Wet Chem Laboratories in the preparation, analysis, and generation of technical data packages of environmental samples within prescribed quality limits and specified timeframes in order to meet production requirements for shipments.
- Direct the development and implementation of new methods/processing improvements in order to allow CompuChem to expand its product line and/or to maximize instrument/processing capability and efficiency. The new methods/processing improvements may deal with analytical procedures, software enhancements or process flow improvements.
- Responsible for the preparation of the annual budget in order to accurately anticipate the cost associated with producing our products and to provide a framework for managing and controlling departmental resources and expenses.
- Develop annual goals and objectives within Laboratory Operations in order to provide a methodical systematic approach to planning and achieving business plan objectives.
- The position will have Profit & Loss (P&L) responsibility for the operation of the laboratory and will be charged with exercising control over various laboratory cost centers in order to accentuate efficiency and the use of purchased materials, reduce expenses to the extent possible, and maximize company profit.
- Responsibility for managing direct reports in the area of P&L responsibility and for assisting in the development of individual supervisors for accepting accountability for controlling costs in their respective lab areas.
- Responsible for ensuring that all pertinent information gleaned in executive staff meetings is disseminated to direct reports in order that communication may be provided on a real-time basis, openly and accurately.
- Participate in special assignments/projects as required.

IV. MAJOR CHALLENGES OF THIS POSITION:

- The most difficult and/or complex part of this position is to integrate a production orientation into a scientific environment, which is highly dynamic due to the growth of the business. In combination with the previous statement, the blending of multiple technologies, i.e., analytical chemistry, computers, production, and management expertise to increase the quality of the total organic data package (i.e., reduce reworks of all types) and simultaneously increase productivity is also extremely complex.
- The position will be directly responsible for meeting monthly production quotas, i.e. planned shipments of data that allow the company to meet monthly revenue and profit goals.

COMPUCHEM, a division of Liberty Analytical Corporation
DESCRIPTIVE TITLE: ***Manager, Purchasing, Admin., Facilities & Safety Officer*** **JOB NO.:** 600005
DEPARTMENT: 6000 Gen. Management **F.L.S.A.** Exempt
IMMEDIATE SUPERVISOR: *President & CEO* **LOCATION:** Cary, NC

I. *BASIC FUNCTION*

Responsible for the purchase of materials, supplies, etc. for all the departments.

Manage facility related activities, including building systems maintenance, telephone system installation and maintenance, and installation of CRT wiring; develop and implement facility renovation plans to provide proper work areas for both office, laboratories, manage hazardous waste collection and disposal program and company wide safety program; design, build and coordinate laboratory support equipment; coordinate cafeteria and vending machine service with contractor.

II. SCOPE OF THE POSITION

A. Organizational Relationships

This position reports to and receives direction from the President & COO. This position works closely with managers/supervisors and all other employees across the Company concerning purchasing, facility and safety issues. The position also serves as contact for CompuChem with vendors for facilities-related projects, telecommunications and Government Regulatory Agencies.

B. Major Functions Reporting to This Position

Building Maintenance

C. Know How, Training and Experience

This position requires a minimum of five (5) years experience in facilities and instrumentation management, including the design and construction of new and existing office and laboratory facilities as well as coordinating and scheduling work with outside contractors and the installation and service of laboratory instruments. Must have knowledge of plumbing system, electrical systems, HVAC systems, telecommunications systems and services, CRT systems, security and fire alarm systems and Halon systems equipment repair practices. The ability to read and develop blueprints is required. An understanding of safety practices and regulations is required. Knowledge of hazardous waste disposal requirements is also required.

III. ACCOUNTABILITIES

- Operate and maintain laboratory and office heating, ventilating, air conditioning systems and fume hoods. Also responsible for installation and renovation of new and existing systems to meet facility requirements.
- Operate and maintain laboratory and office electrical systems. Also responsible for installation and renovation of new and existing systems to meet facility requirements.
- Operate and maintain of plumbing and water systems and the installation and renovation of new and existing systems to meet facilities requirements.

Manager, Purchasing, Admin., Facilities & Safety Officer ***JOB NO.: 600005 (continued)***

- Operate and maintain telecommunications equipment. Audit monthly telecommunications invoices for accuracy and approve for payment. Maintain state-of-the-art telecommunications equipment and services.
- Maintain of laboratory appliances.
- Responsible for hiring, training and development of maintenance staff.
- Operate and maintain facility fire suppression systems and fire alarm equipment.
- Manage the facilities shop, assuring that parts and supplies are ordered in a cost-effective manner and making changes in suppliers and/or equipment as required.
- Responsible for the design and construction of new and existing space as required to meet facility needs.
- Work with the laboratory operations management on the adaptations and/or development of special equipment or projects as needed.
- Responsible for Operation and maintenance of building security systems and personnel.
- Operation and maintenance of building security systems and personnel.
- Design, fabricate and/or coordinate laboratory support apparatus and equipment.
- Coordinate operations of cafeteria and food vending services.
- Install laboratory gas supply systems.
- Interacting with the landlord to negotiate new leases and other requirements needed to provide adequate facilities.
- Responsible for accounts payable inquiries and remittances.
- Assist in accounts receivable inquiries.
- Responsible for the purchase of all materials & supplies.
- Provide recommendation for promotion and lateral transfers. Conduct performance appraisals, recommend and review merit increases.
- Develop and maintain CompuChem's Affirmative Action Program to provide an environment which is free of discrimination.
- Maintain an awareness of all Federal, State, & local rules and regulations that pertain to employment practices, i.e., wage & hour laws, EEO, and OSHA regulations.
- Responsible for communicating and ensuring that all employees understand and adhere to Company's Work Rules, and Policies and Procedures.
- Participate in special development projects as required.
- Insurance purchase and claims interface.

COMPUCHEM, a division of Liberty Analytical Corporation
DESCRIPTIVE TITLE: ***Manager of Quality Assurance*** **JOB NO.:** 370002
DEPARTMENT: 3700- Quality Assurance & Technology **F.L.S.A.** Exempt
IMMEDIATE SUPERVISOR: Vice President & General Manager **LOCATION:** Cary, NC

I. BASIC FUNCTION:

Manage and improve the laboratory's quality assurance program by conducting internal systems audits and coordinating corrective actions with laboratory management and staff.

II. SCOPE OF THE POSITION:

A. Organizational Relationships

This position reports to and receives direction from the Vice President and General Manager in matters relating to data quality.

Outside of CompuChem, contact is with State and Federal Regulatory agencies and clients.

B. Major Functions Reporting to this Position

None

C. Know How, Training and Experience

This position requires an undergraduate degree in Chemistry or related science or equivalent and a minimum of five (5) years laboratory experience, preferably in organic/analytical/clinical chemistry and five (5) years involvement in QA/QC.

III. ACCOUNTABILITIES:

- Develop and evaluate methods for evaluating the quality of data being generated to ensure method and contract compliance.
- Ensure that all employees have a current job description in their training file. The job descriptions must have complete signatures including employee, immediate supervisor and next managerial level.
- Represent the laboratory and the Quality Assurance Department, when required, during on-site audits and laboratory evaluations.
- Perform data and system audit functions and report findings to laboratory management.
- Oversee and participate in the requirements for State Certification programs and PE sample programs.
- Coordinate/perform subcontractor lab audits and provide recommendations for approval of such labs, if required.
- Maintain QA/QC databases, including control limits, MDL and reporting limits, and Corrective Action Reports (CARs).
- Review client QA Project Plans, contracts and statement-of-work, and provide other supplemental Marketing Department support as needed.
- Review and approve Standard Operating Procedures and Method Validation Study data.
- Perform special project functions at the direction of the Vice President and General Manager

COMPUCHEM, a division of Liberty Analytical Corporation
DESCRIPTIVE TITLE: ***Supervisor, Inorganics/Wet Chemistry Lab*** **JOB NO.:** 430001
DEPARTMENT: 4300 Inorganics **F.L.S.A.** Exempt
IMMEDIATE SUPERVISOR: Director, Lab Operations **LOCATION:** Cary, NC

I. BASIC FUNCTION:

Responsible for the analysis of various types of environmental samples and digestates utilizing various instrumental and wet-chemistry procedures for the generation of complete data packages ensuring that timely and accurate production is achieved. Responsible for analysis of environmental inorganic samples utilizing Inductively Coupled Plasma emission spectroscopy, ICP/MS, Cold Vapor/Hydride Atomic Absorption spectroscopy, Colorimetric Automated Analyzers and the generation and transfer of complete data in an accurate and timely manner.

II. SCOPE OF THE POSITION:

A. Organizational Relationships:

This position reports to and receives direction from the Director, Laboratory Operations. This position works closely with other managers for the purpose of coordinating production and special projects.

Outside of CompuChem, contact is with vendors, equipment manufacturers, and consultants utilized by CompuChem. This position also provides technical guidance to customers concerning analyses performed and/or participates in on-site audits.

B. Major Functions Reporting to this Position:

Inorganics/Wet Chemistry Laboratory - analysis of environmental samples and extracts with different matrices and the generation of complete and accurate data packages.

C. Know How, Training and Experience

This position requires an undergraduate degree in chemistry or equivalent. A minimum of three (3) years of experience in applied analytical techniques (including ICP) for Inorganic Environmental analysis is required. Must have three years of supervisory experience with a strong production orientation.

III. ACCOUNTABILITIES:

- Responsible for ensuring the analytical quality of all data generated by the Inorganics/Wet Chemistry Laboratory.
- Evaluate and develop methods for improving the quality and quantity of the data produced.
- Develop and monitor all training programs utilized in the Inorganics/Wet Chemistry Laboratory for effectiveness and compliance with existing analytical quality standards.
- Plan and schedule work assignments according to analysis requirements. Assign individual work schedules based on analysis requirements and capabilities of the department staff.
- Responsible for interviewing, selecting, orienting, and training new employees.
- Determine training needs of current employees and define a plan of action to address the training requirements.

Supervisor, Inorganics/Wet Chemistry Lab ***JOB NO.:*** ***430001 (continued)***

- Provide recommendations for promotions and lateral transfers. Conduct performance appraisals, recommend merit increases and review merit increases with employees.
- Responsible for communicating and ensuring that all departmental employees understand and adhere to all company policies and procedures.
- Responsible for safety attitudes and practices; and for the overall housekeeping of the Inorganics/Wet Chemistry Laboratory.
- Maintain an accurate inventory of laboratory supplies and equipment. Reorder supplies when required and maintain appropriate records of purchase. Keep expenses to a minimum.
- Responsible for maintaining up-to-date Standard Operating Procedures for the Inorganics/Wet Chemistry Laboratory.
- Assist other areas of the lab by providing personnel and cross-training whenever possible.
- Provide technical guidance and input as requested for new contract requirements, special, and/or new products.
- Ensure overtime is evenly distributed between staff and kept to a minimum.
- Maintain an awareness of all Federal, State, & local rules and regulations that pertain to employment practices, i.e., wage & hour laws, EEO and OSHA regulations
- Responsible for monitoring the absence and vacation utilization by departmental staff.
- Responsible for communicating & ensuring that all departmental employees understand & adhere to all Company's Work Rules; and Policies & Procedures.
- Participate in special assignments/projects as required.

COMPUCHEM, a division of Liberty Analytical Corporation
DESCRIPTIVE TITLE: ***Supervisor, Sample Preparation Lab*** **JOB NO.:** 360001
DEPARTMENT: 3600 Sample Preparation Lab **F.L.S.A.** Exempt
IMMEDIATE SUPERVISOR: Manager, Sample Preparation Lab **LOCATION:** Cary, NC

I. BASIC FUNCTION:

Preparation of various environmental matrices using liquid-liquid and liquid-solid chemical extraction techniques for analysis using SW-846 and CLP methodologies. Supervising and training of sample preparation technicians and ensuring that timely and accurate production is achieved. Handling and coordinating the disposal of hazardous waste generated by the facility.

II. SCOPE OF THE POSITION:

A. Organizational Relationships

This position reports to and receives direction from the Sample Preparation Lab Manager. This position works closely with the other supervisors and managers to coordinate sample processing throughout the laboratory.

B. Major Functions Reporting to this Position

Glassware Preparation – preparation and inventory of all glassware utilized by the various laboratory functions.

Organic Sample Preparation Technicians/analysts – preparation of samples for organic analyses.

C. Know How, Training and Experience

This position requires an undergraduate degree in chemistry or equivalent. A minimum of three (3) years in preparation of environmental samples, one (1) year supervisory experience and annual training in hazardous waste regulations are required

III. ACCOUNTABILITIES:

- Ensuring that the production of the organic sample preparation laboratory is conducted in a timely and accurate manner.
- Plan and schedule work assignments according to sample load.
- Assign individual work schedules based on sample load and capabilities of the department staff.
- Interview, select, and train new employees. Determine training needs of employees and define a plan of action to address the training requirements.
- Provide recommendation for promotions and lateral transfers. Conduct performance appraisals, recommend merit increases and review merit increases with employees.
- Practice overall good housekeeping of the sample and glassware preparation areas.
- Maintain an accurate inventory of laboratory supplies and equipment. Reorder supplies when required and maintain appropriate records of purchase.
- Maintain up-to-date Standard Operating Procedures for the preparation lab
- Monitoring absence and vacation utilization by departmental staff.
- Participate in special development projects as required.

Supervisor, Sample Preparation Lab ***JOB NO.: 360001(continued)***

- Collect, identify, label, package, store and coordinate the shipment of the facility's hazardous waste for disposal in compliance with all federal, state, and local regulations.
- Maintain records of all waste shipped
- Perform spill control and cleanup as described in the CompuChem Contingency Plan – Emergency Response Procedures, Section B Chemical Release.
- Perform and document compliance inspections of the waste storage areas

COMPUCHEM, a division of Liberty Analytical Corporation
DESCRIPTIVE TITLE: ***Supervisor Semi-VOA Lab*** **JOB NO.:** 412002
DEPARTMENT: 4120 - GC/MS Semi-VOA Laboratory **F.L.S.A.** Exempt
IMMEDIATE SUPERVISOR: Director, Lab Operations **LOCATION:** CARY,NC

I. BASIC FUNCTION:

Responsible for the in-depth review of all environmental GC/MS generated sample data ensuring that all data reviewed are turned-in in an accurate and timely manner. The Supervisor is also responsible for managing the multi-shift Semi-VOA Lab ensuring that timely and accurate production is achieved.

II. SCOPE OF THE POSITION:

A. Organizational Relationships

This position reports to and receives direction from the Sr. Manager, Organics Laboratory. This position works closely with other Managers & Supervisors of the Company for the purpose of coordinating production and special projects.

Outside of CompuChem , this position also provides technical guidance to customers concerning analyses performed and/or participates in on-side audits.

B. Major Functions Reporting to this Position

GC/MS Data Review & Case Review – In depth technical and clerical review of data packages generated by GC/MS Laboratories.

GC/MS Semi-Volatile Lab – analysis of environmental extracts with different matrices and the generation of complete and accurate data packages.

C. Know How, Training and Experience

This position requires an undergraduate degree in chemistry or equivalent. A minimum of three (3) of experience in applied gas chromatography/mass spectrometry is required as is the ability to interpret mass spectra. Must have demonstrated knowledge of basic analytical techniques and methods. Supervisory/managerial experience with a strong production orientation is also required. Excellent verbal, written communication skills, and a strong production orientation are required of this position.

III. ACCOUNTABILITIES:

- Responsible for ensuring that the production of the GC/MS Semi-VOA Lab in a timely and accurate manner. This includes coordinating the production effort with the Supervisors and other shifts/
- Responsible for developing methods for improving the quality and quantity of the data produced.
- Provide technical guidance and input of new contract requirements and/or new products.

Supervisor Semi-VOA Lab ***JOB NO.: 412002(continued)***

- Determine training needs of current employees and define a plan of action to address the training requirements.
- Responsible for ensuring the analytical quality of all data generated by the Environmental GC/MS Laboratory.
- Monitor and evaluate the statistical validity of the computerized databases identifying laboratory trends.
- Develop and monitor all training programs utilized in the GC/MS Laboratory for effectiveness and compliance with existing analytical quality standards.
- Develop and maintain database of all "go-backs" from the Final Technical Review Department. This includes monitoring the "go-backs" which are appropriate and also, those that are not. Provide the Final Technical Review Department with feedback concerning inappropriate "go-backs."
- Provide technical guidance and input as requested for new contract requirements, special projects, and/or new products.
- Respond to client directly when technical issues are involved.
- Responsible for interviewing, selecting, orienting, and training new employees.
- Responsible for the preparation of job descriptions for each position or job title within the department. Ensure that all employees have a current job description in their training file. The job descriptions must have complete signatures including employee, immediate supervisor and next managerial level.
- Provide recommendations for promotions and lateral transfer. Conduct performance appraisals and recommend merit increases.
- Responsible for safety attitudes and practices; and for the overall housekeeping of the Laboratories
- Responsible for ensuring that up-to-date Standard Operating Procedures are maintained.
- Maintain an accurate inventory of laboratory supplies and equipments. Reorder supplies when required and maintain appropriate records of purchase. Keep expenses to a minimum.
- Assist other areas of the lab by providing personnel and cross-training whenever possible.
- Ensure overtime is evenly distributed between staff and kept to a minimum.
- Responsible for monitoring the absence and vacation utilization by departmental staff.
- Maintain an awareness of all Federal, State, & local rules and regulations that pertain to employment practices, i.e., wage & hour laws, EEO and OSHA regulations.
- Responsible for communicating and ensuring that all departmental employees understand and adhere to all company work rules and policies & procedures.
- Participate in special assignment/projects as required.

COMPUCHEM, a division of Liberty Analytical Corporation
DESCRIPTIVE TITLE: ***Supervisor, Volatile Laboratory*** **JOB NO.:** 421002
DEPARTMENT: 4210 - GC/MS Laboratory **F.L.S.A.** Exempt
IMMEDIATE SUPERVISOR: Director, Lab Operations **LOCATION:** CARY, NC

IV. BASIC FUNCTION:

Responsible for the preparation and analysis of environmental volatile samples utilizing GC/MS and for the generation of complete data packages. The Supervisor is also responsible for managing the multi-shift Volatile Laboratory ensuring that timely and accurate production is achieved.

V. SCOPE OF THE POSITION:

A. Organizational Relationships

This position reports to and receives direction from the Director, Lab Operations. This position works closely with the other Managers & Supervisors of the Company for the purpose of coordinating production and special projects.

Outside of CompuChem, this position also provides technical guidance to customers concerning analyses performed and/or participates in on-side audits.

B. Major Functions Reporting to this Position

GC/MS Data Review & Case Review – In depth technical and clerical review of data packages generated by GC/MS Laboratories.

Volatile GC/MS Volatile Laboratory – analysis of environmental volatile samples utilizing GC/MS and the generation of complete data packages.

C. Know How, Training and Experience

This position requires an undergraduate degree in chemistry or equivalent. A minimum of three (3) years of experience in applied analytical gas chromatography/mass spectrometry is required as is the ability to interpret mass spectra. Must have a demonstrated knowledge of basic analytical techniques and methods. Supervisory/managerial experience with a strong production orientation is also required. Excellent verbal, written communication skills, and a strong production orientation are required of this position.

VI. ACCOUNTABILITIES:

- Responsible for ensuring that the production of the GC/MS Volatile Laboratory in a timely and accurate manner. This includes coordinating the production effort with the Supervisors and other shifts.
- Responsible for developing methods for improving the quality and quantity of the data produced.
- Provide technical guidance and input for new contract requirements and/or new products.

Supervisor, Volatile Laboratory ***JOB NO.: 421002(continued)***

- Responsible for planning and scheduling work assignments according to analysis requirements. Assign individual work schedules based on analysis requirements and capabilities of the department staff.
- Responsible for interviewing, selecting, orienting, and training new employees.
- Determine training needs of current employees and define a plan of action to address the training requirements.
- Monitor and evaluate the statistical validity of the computerized databases identifying laboratory trends.
- Develop and monitor all training programs utilized in the GC/MS Laboratory for effectiveness and compliance with existing analytical quality standards.
- Develop and maintain database of all "go-backs" from the Final Technical Review Department. This includes monitoring the "go-backs" which are appropriate and also, those that are not. Provide the Final Technical Review Department with feedback concerning inappropriate "go-backs."
- Provide technical guidance and input as requested for new contract requirements, specials, and/or new products.
- Respond to client directly when technical issues are involved.
- Responsible for communicating and ensuring that all departmental employees understand and adhere to all company policies and procedures.
- Responsible for interviewing, selecting, orienting, and training new employees.
- Provide recommendations for promotions and lateral transfer. Conduct performance appraisals and recommend merit increases.
- Responsible for the preparation of job descriptions for each position or job title within the department. Ensure that all employees have a current job description in their training file. The job descriptions must have complete signatures including employee, immediate supervisor and next managerial level.
- Responsible for ensuring that up-to-date Standard Operating Procedures are maintained.
- Responsible for safety attitudes and practices; and for the overall housekeeping of the Laboratories.
- Maintain an accurate inventory of laboratory supplies and equipments. Reorder supplies when required and maintain appropriate records of purchase. Keep expenses to a minimum.
- Assist other areas of the lab by providing personnel and cross-training whenever possible.
- Ensure overtime is evenly distributed between staff and kept to a minimum.
- Maintain an awareness of all Federal, State, & local rules and regulations that pertain to employment practices, i.e., wage & hour laws, EEO and OSHA regulations.
- Responsible for monitoring the absence and vacation utilization by departmental staff.
- Participate in special assignment/projects as required.

COMPUCHEM, a division of Liberty Analytical Corporation
DESCRIPTIVE TITLE: ***Supervisor, GC/HPLC Labs*** — **JOB NO.**: 410001
DEPARTMENT: 4100 - GC Laboratory — **F.L.S.A.** Exempt
IMMEDIATE SUPERVISOR: Director, Laboratory Operations — **LOCATION**: Cary, NC

I. BASIC FUNCTION:

Responsible for the analysis of various types of environmental samples and extracts utilizing GC and HPLC for the generation of complete data packages. The GC/HPLC Lab Supervisor is responsible for managing the GC/HPLC Laboratories ensuring that timely and accurate production is achieved.

II. SCOPE OF THE POSITION:

A. Organizational Relationships

This position reports to and receives direction from the Director of Laboratory Operations. This position works closely with the other Managers and Supervisors of the company for the purpose of coordinating production and special projects.

Outside CompuChem, contact is with CompuChem's customers concerning laboratory practices, status of analyses, explanation of analytical results, etc. This position also has contact with equipment manufacturers, vendors, and consultants utilized by CompuChem.

B. Major Functions Reporting to this Position

GC and HPLC analysts and data reviewers

C. Know How, Training and Experience

This position requires an undergraduate degree in chemistry or equivalent. Minimum of (3) three years of experience in applied analytical gas chromatography in pesticide and volatile GC analysis is required. Must have a demonstrated knowledge of basic analytical techniques and methods. Supervisory experience with a strong production orientation is also required.

III. ACCOUNTABILITIES:

- Responsible for ensuring that the production of the GC/HPLC Laboratory is conducted in a timely and accurate manner. This includes coordinating the production effort with other Departmental Supervisors.
- Ensure that quality control procedures and good laboratory practices are being followed.
- Evaluate and develop methods for improving the quality and quantity of the data produced.
- Provide technical guidance and input for new contract requirements and/or new products.
- Plan and schedule work assignments according to analysis requirements. Assign individual work schedules based on analysis requirements and capabilities of the department staff.
- Responsible for interviewing, selecting, orienting, and training new employees.
- Provide recommendations for promotions and lateral transfers. Conduct performance appraisals and recommend merit increases.

Supervisor, GC/HPLC Labs **JOB NO.: 410001 (continued)**

- Responsible for communicating and ensuring that all departmental employees understand and adhere to all company policies and procedures.
- Responsible for safety attitudes and practices; and for the overall housekeeping of the GC and HPLC Laboratory.
- Maintain an accurate inventory of laboratory supplies and equipment. Reorder supplies when required and maintain appropriate records of purchase.
- Responsible for maintaining up-to-date Standard Operating Procedures for the GC/HPLC Laboratory.
- Responsible for communicating and ensuring that all departmental employees understand and adhere to all company work rules and policies and procedures.
- Assist other areas of the lab by providing personnel and cross-training whenever possible.
- Maintain awareness of all Federal, State, and local rules and regulations that pertain to employment practices, i.e., wage and hour laws, EEO, and OSHA regulations.
- Responsible for monitoring the absence and vacation utilization by departmental staff.
- Participate in special assignments/projects as required.

COMPUCHEM, a division of Liberty Analytical Corporation
DESCRIPTIVE TITLE: ***Supervisor, Project Management/Shipping & Receiving*** **JOB NO.**: 500005
DEPARTMENT: 5000 Lab Support **F.L.S.A.** Exempt
IMMEDIATE SUPERVISOR: Director, Laboratory Operations **LOCATION**: Cary, NC

I. BASIC FUNCTION:

Supervise the daily activities in the Sample Receiving/Storage and Shipping Areas. Supervise and perform sample receipt, sample-login and order entry. Manage client projects and provide customer service.

II. SCOPE OF THE POSITION:

A. Organizational Relationships

This position reports to and receives direction from the Director of Laboratory Operations. The position will work closely with members of the Project Management personnel in order to facilitate timely log-in of customer sample receipts. The position will interface daily with all laboratory areas and personnel relative to the distribution of samples for analysis. The position will work closely with Subcontract Coordinator to insure that subcontracted work is documented on a real-time basis and to insure performance of vendor network.

Outside CompuChem, the position will communicate with shipping vendors to coordinate pick-ups, glassware shipment logistics, etc. This position will also communicate directly with clients as required to resolve issues related to sample receipt, log-in and/or order-entry.

B. Major Functions Reporting to this Position

Sample Custodian, Project Managers

C. Know How, Training and Experience

The position requires a Bachelor's Degree or a minimum of 5-7 years experience involving the processing and scheduling of receipts in a production environment. Prior supervisory experience is also required as is a working knowledge of LIMS. An understanding of extractions and/or analytical instrumentation processes would be useful.

III. ACCOUNTABILITIES:

- Supervise and train personnel in the areas of responsibility, establish daily workload priorities on a six day schedule and assist in and direct the completion of the activities. Responsible for scheduling personnel and their work time to address and meet workload requirements.
- Responsible for the completeness and correctness of all Chain of Custody documentation, including; ensuring proper COC procedures are followed for samples being received and internal COC guidelines are maintained.
- Responsible for identification of discrepancies between sample receipts and client COC documentation and for insuring that appropriate feedback is given clients in order to effect and facilitate timely corrections prior to entering client receipts into the LIMS. Responsible for ensuring those clients receive acknowledgment of sample receipt within 24 hours of order-entry.

Supervisor, Project Management/Shipping & Receiving JOB NO.: 500005 (continued)

- Responsible for interaction with subcontract coordinator as required in order to schedule shipments for all subcontracted parameters.
- Responsible for updating (as needed) and maintaining as current, all Standard Operating Procedures (SOPs) pertaining to the operation of the area. Responsible for having all personnel familiar with and adhering to them at all times.
- Responsible for preparation of glassware shipments via cooler or bulk distribution to clients as required by client. The position will ensure that clients receive appropriate bottleware, preservatives (if required), COCs, labels, etc. to ensure success of field sampling events.
- Responsible for maintaining the organization of walk-in and extract coolers daily and for ensuring that all sample request sheets received from each laboratory area are responded to completely, accurately, and in a timely manner with all signature requirements. Ensure sample security at all times by maintaining internal COC.
- Responsible for maintaining a safe, healthy, clean and presentable work environment at all times.
- Responsible for the hiring, training and development, and performance evaluations of employees in the department. Responsible for documenting sub-par work related performance with employees as may be necessary and for dealing with work related disciplinary problems on an as needed basis. Provide recommendation for promotions, lateral transfer, and merit increases.
- Responsible for maintaining temperature checks of thermometers for short and long-term storage areas and rotate sample stock to effect the SOP required purging process on a timely basis.
- Oversight of the purging process after samples have exceeded their retention times.
- Monitor inventory levels of warehouse stock items, glassware, coolers, components (COCs, labels, etc.) to ensure that appropriate levels are maintained on an ongoing basis.
- Maintain awareness of all Federal, State, and local rules and regulations that pertain to employment practices, i.e., wage and hour laws, EEO, and OSHA regulations.
- Responsible for communicating and ensuring that all departmental employees understand and adhere to all Company's Work Rules, and Policies and Procedures.
- Assist other areas of the lab by providing personnel and cross-training whenever possible.
- Manager or other company officers (e.g., Lab Manager, President) may assign responsibility for other duties as may be required from time to time.

- The position requires weekend work and overtime as may be required.

COMPUCHEM, a division of Liberty Analytical Corporation
DESCRIPTIVE TITLE: ***Project Manager*** **JOB NO.:** 750007
DEPARTMENT: 7500 - Project Management/Customer Service **F.L.S.A.:** Exempt
IMMEDIATE SUPERVISOR: Supervisor, Customer Service/Shipping/Rec **LOCATION:** Cary, NC

I. BASIC FUNCTION:

Provide technical and administrative management for client specific project.

II. SCOPE OF THE POSITION:

A. Organizational Relationships

Reports directly to Supervisor, Customer Service/Shipping and Receiving.

B. Major Functions Reporting to this Position

None

C. Know How, Training and Experience

- BA/BS in Chemistry or related discipline.
- Minimum of three years environmental knowledge required.
- Excellent verbal and written communication skills required.
- Knowledge of Word and Excel required.

III. ACCOUNTABILITIES:

- Ensure compliance with client Scope of Work (SOW).
- Answer any technical inquiries from client.
- Sign outgoing reports.
- Prepare and distribute internal project profile sheet (PPS) for each client.
- Gather information from client on project specific requirements.
- Communicate all issues and concerns with lab.
- Review project status and compliance.
- Prepare status reports and inquiry responses as required by client.
- Monitor financial compliance with client agreement.
- Ensure client is satisfied with lab.
- Assist in training of Senior Account Administrator.
- Perform other related duties as assigned.

COMPUCHEM, a Division of Liberty Analytical Corporation
DESCRIPTIVE TITLE: Director, Information Technology JOB NO.: 430007
DEPARTMENT: 4070 Computer Operations F.L.S.A. Exempt
IMMEDIATE SUPERVISOR: President & Chief Executive Officer LOCATION: CARY, NC

I. BASIC FUNCTION:

Manage the computer operations function in support of Company's production, administration, and system management.

II. SCOPE OF THE POSITION:

A. Organizational Relationships:

This position reports to and receives direction from the President, Chief Executive Officer. The position also interacts with any other user within the Company that relies on computerized production systems. This position works closely with the managers and supervisors throughout CompuChem and WearCheck USA.

Outside of CompuChem the position has contact with hardware vendors and consultants as well as hardware and software maintenance personnel.

B. Major Functions Reporting to this Position

Computer Operations - Provide technical expertise (hardware configurations, software revisions, user profiles, backup, and recovery) for system use and program development.

Computer Support Specialist

Electronic Deliverable System (EDS) Coordinator

C. Know How, Training and Experience

This position requires a minimum of B.S. degree in Computer Science or equivalent and 6 years of experience in computer operations management, a thorough understanding of integrated computer systems (preferably Hewlett-Packard) including computer maintenance. Also, effective human relation skills are also extremely important in managing and developing department personnel as well as interacting with the various users of the computer systems.

III. ACCOUNTABILITIES:

- Manage the Company's Computer Operations functions, assuring a fully functioning computer system adequate to support the Company's needs.
- Evaluate and select computer hardware and related products.
- Propose hardware configuration including migration/growth strategies.
- Participate in the selection of computer software and related products.
- Manage and control software installations, revisions, configuration and documentation.
- Manage system account structure setup.

- Ensure that system backup procedures are being followed and that a disaster plan exists.
- Oversee the installation, maintenance and monitoring of computer hardware including mainframes, printers, disk, modems, plotters, and personal computers, as well as the software and programs run on the hardware.
- Interview, select, and train new employees; provide recommendations for promotions and lateral transfers; conduct appraisals and recommend merit increases.
- Provide planned needs of all projects within the computer operations area.
- Maintain up-to-date Standard Operating Procedures for the department.
- Prepare job descriptions for each position or job title within the department. Ensure that all employees have a current job description in their training file. Ensure the written job descriptions have complete signatures including employee, immediate supervisor and next managerial level.
- Ensure that all departmental employees understand and adhere to all Company Policies and Procedures.
- Participate in special development projects are required.

Figure 2-4 Resumes of Key Laboratory Personnel and Technical Directors

Dover, Cathy
Supervisor, Project Management/Receiving

Responsibilities: Ms. Dover is responsible for representing the laboratory as the primary contact with commercial clients, account setup and maintenance, sample receipt into the Laboratory Information Management System (LIMS), tracking the status of projects within the production laboratory and providing technical evaluation and support. Ms. Dover must ensure that client requirements are met and that proper customer service and technical support are provided during the course of projects.

Education: Ms. Dover earned diploma from Charles E. Jordan High School in Durham County in June 1980. She continued her studies at North Carolina State University where she focused on the curriculum in the schools of Chemical Engineering, Chemistry and Science Education.

Experience: Ms. Dover joined CompuChem in August 1983 as a Senior Laboratory Assistant. She earned her first promotion in February 1985 to Quality Control and Report Integration Clerk.

In January 1986, Ms. Dover became Laboratory Production Coordinator, and in August1989 she worked in the position of Production Scheduler/Planner.

In January 1994, as Account Administration Representative, she worked closely with clients on a service level. In April 1997, Ms. Dover was promoted to Special Project Coordinator (CELDM) and dedicated her efforts providing customer service to one of our most significant clients.

In September 1998 Ms. Dover was promoted to the position of Supervisor of Sample Control. In that capacity Ms. Dover was responsible for sample management, including receipt of samples, sample custody, storage and control, and shipping collection materials to the field.

Seniority Date: August 15, 1983

Feldhaus, James C.
Supervisor, Inorganics

Responsibilities: Mr. Feldhaus is responsible for the daily operations of inorganics department. This includes sample preparation, sample analysis, verifying that quality control criteria are met, and the generation of client reports.

Education: Mr. Feldhaus received his Bachelor of Science degree in Chemistry from North Carolina State University in 2000.

Experience: Mr. Feldhaus joined CompuChem in May of 2005 as an Analyst III. In that position his responsibilities were the analyses of environmental matrices using ICP-AES and ICP-MS instrumentation and review of the data produced from those analyses.

Prior to joining CompuChem, Mr. Feldhaus was employed as a Chemist by Chemical and Environmental Technology, Inc in Cary, North Carolina from 2000 to 2005. His responsibilities included environmental sample collection, analysis of environmental matrices using GC, Cold Vapor, ICP-MS, and classical chemistry techniques.

Seniority Date: May 2, 2005

Gates, Robert (Rob) J.
Administrative Manager

Responsibilities:	Mr. Gates is Administrative Manager for CompuChem. This position manages all purchasing functions. Mr. Gates also manages all facility related activities, including building systems maintenance. Mr. Gates also serves as the Safety Officer.
Education:	Mr. Gates received a B.S. degree in Public Recreation from Georgia Southern University in 1975.
Experience:	Before joining CompuChem, Mr. Gates was the Health Physics Supervisor for Alara Engineer. Mr. Gates started this position in June 1992 where he tracked, scheduled, and audited health physics monitoring. From 1986 to 1992 Mr. Gates held the same position for Site Services at the Savannah River site.
Seniority Date:	July 8, 1996

Grant, Teresa M.
Manager, Sample Preparation

Responsibilities:

Ms. Grant is responsible for the daily planning and scheduling of sample preparation activities to meet production demands, the training of staff in standard operating and safety procedures.

Education:

Ms. Grant earned a B.S. degree in Biology with minors in Chemistry and Psychology from the University of Alabama in Birmingham in May 1980. She also earned a B.A. degree in Chemistry from Huntingdon College in June 1991.

Ms. Grant earned 38 credit hours in chemistry and 4 credit hours in microbiology toward her degree.

Experience:

Prior to resuming her current responsibilities, Ms. Grant was responsible for the operations of the GC, HPLC, GC/MS, Inorganic/Wet Chemistry, and Sample Preparation laboratories which function is a multi-shift production environment. Her primary responsibility is ensuring that the data produced from these laboratories is accurate, meets all quality control requirements and is provided to the client in a timely manner.

Before being promoted to Laboratory Director, Ms. Grant was Sample Preparation Laboratory Manager where her responsibilities included the daily planning and scheduling of sample preparation activities to meet production demands, the training of staff in standard operating and safety procedures, and oversight of the laboratory's data shipping and data archival activities. At CompuChem Ms. Grant has also held the positions of Hazardous Waste Coordinator, Manager of Sample Receiving and LIMS Administrator.

Prior to joining CompuChem, Ms. Grant was employed by CH2M Hill Quality Analytical Laboratory from December 1988 to August 1996 in the following capacities: Resource Chemist, Laboratory Health and Safety Officer, Organic Extraction Supervisor, Environmental Scientist I, and Technician.

From September 1980 to June 1981, Ms Grant was employed as the General Chemistry Lab Coordinator with Midwestern State University. Her responsibilities included supervision and teaching.

Grant, Teresa M.
Manager, Sample Preparation

Publications:

P.J. Schrynemeekers, Michael S. Clark, C.H. Kelly, Ward Dickens, and Teresa Priest, "The Analysis of Part Per Trillion Levels of Polynuclear Aromatic Compounds in Drinking Water Using GC/MS Selected Ion Monitoring", Pittsburgh Conference, Atlanta, GA, 1989.

P.J. Schrynemeekers, Mickael S. Clark, C.H. Kelly, Ward Dickens, and Teresa Priest, "GC/MS SIM for Drinking Water Analysis", Environmental Lab. April/May 1990.

Seniority Date: **April 14, 1997**

Grzybowski, Kenneth
Supervisor, Volatiles Lab

Responsibilities: Mr. Grzybowski is responsible for the analysis of environmental samples for volatile constituents utilizing GC and GC/MS instrumentation and the generation of complete and accurate data reports associated with these analyses. He also ensures that the data reported meets quality control and client requirements.

Education: Mr. Grzybowski earned a Bachelor of Science degree in Environmental Earth Science from Buffalo State College in Buffalo, New York.

Experience: Prior to rejoining CompuChem, Mr. Grzybowski was employed by Laboratory Corporation of America, Durham, North Carolina as a Senior Technician. His responsibilities included analysis of biological samples for drugs of abuse utilizing GC/MS instrumentation and the troubleshooting and maintenance of that instrumentation.

From April 2002 to September 2005, Mr. Grzybowski was employed by CompuChem as an Analyst II. His responsibilities included the analysis of environmental samples for volatile organic compounds using GCMS instrumentation. He ensured the instrument met all calibration and quality control requirements.

From December 1998 to April 2002, Mr. Grzybowski was employed at Severn Trent Laboratories in Amherst, New York were he held the positions of Volatile Organic Chemist and Laboratory Waste Disposal Manager.

Seniority Date: April 15, 2002

Jennings, Teresa A.
Supervisor, GC/HPLC

Responsibilities: Ms. Jennings is responsible for the analysis of environmental sample extracts utilizing GC and HPLC instrumentation, and for the review and reporting of the data associated with these analyses ensuring client requirements and quality criteria are met.

Education: Ms. Jennings received her B.S. degree in Textile Chemistry from North Carolina State University in May 2001.

Experience: Prior to joining CompuChem, Ms. Jennings was employed as a Laboratory Assistant at EnviroGuard and Sensors, Cary, North Carolina from March 2003 to June 2004. Her responsibilities included troubleshooting and routine maintenance of GC and HPLC instrumentation and customer service support.

From September 2001 to June 2002, Ms. Jennings was employed as Product and Process Improvement personnel for Milliken and Company, Alma, Georgia. Her responsibilities included overseeing and scheduling maintenance of the carpet and yarn machines as well as improving machine efficiency.

From July 2000 to September 2001, Ms. Jennings was employed as a Preventive Maintenance Dispatcher for Gregory Poole Equipment Company, Raleigh, NC.

Seniority Date: August 9, 2004

Meierer, Robert (Bob) E.
Vice President & General Manager

Responsibilities: Develop and implement strategic processes and practices within the company. Manage and guide the overall organization. Provide guidance in analyzing and appraising the effectiveness of overall operations. Assure all EPA CLP contractual requirements and federal and state agency certification requirements are met by the company. Assure that the company consistently produces data of known and documented quality.

Education: Mr. Meierer received an Associate degree in Industrial Chemistry from the Erie County Technical Institute in 1963, and an undergraduate B.A. degree in Chemistry from the State University of New York at Buffalo in 1971. He has taken advanced studies in Analytical Chemistry and Business Administration from the State University at Buffalo.

During his studies Mr. Meierer earned 76 credit hours in chemistry toward his degree. No credit hours in microbiology were required for his degree program.

Experience: As Vice President of Quality Assurance and Technology at CompuChem Mr. Meierer was responsible for assuring that the laboratory consistently produced high quality and reliable data, and that all necessary certification and licensing requirements were met by the laboratory. Additional responsibilities included the implementation of change, defined by new technology or operational improvement needs.

Prior to joining CompuChem, Mr. Meierer held positions as Laboratory Manager with Radian Corporation and as Department Head, Analytical Laboratory; Special Contamination Monitoring, The Carborundum Company from 1969-1980.

In his previous position with CompuChem Corporation as Vice President of Quality, Mr. Meierer was responsible for overseeing the QA efforts for both the environmental analytical and forensic drug testing aspects of the company.

Through the variety of laboratory positions Mr. Meierer has held, he has gained fifteen (15) years of experience in the interpretation of GC/MS volatile and semivolatile data. In addition, Mr. Meierer has six (6) years of experience in the preparation of extracts from environmental or hazardous waste samples.

Further, he has gained ten (10) years of experience in organochlorine pesticide residue and PCB analysis, including clean-up procedures (such as column chromatography) for a variety of environmental sample matrices.

Meierer, Robert (Bob) E.
Vice President & General Manager

Publications:

Meierer, R. E., "Non-Traditional Analyses on CLP Contracts." paper presented at the 19th Annual National Environmental Monitoring Conference, Crystal City Hilton, Arlington, VA, on July 23, 2003.

Meierer, R. E., "The Analytical Testing Laboratory: Its Role and Responsibility in Environmental Legislation." paper presented at the Environmental Science for Lawyers Seminar, NC Bar Center, Cary, NC, on February 10, 1995.

Meierer, R.E., "How to Maintain a High Level of Quality Assurance--and Still Make a Profit," paper presented at the Third Annual Conference of the International Association of Environmental Testing Laboratories, Virginia Beach, VA, on October 23, 1990.

Meierer, R.E., Whitehead, R.J. "Making an On-Site Evaluation of an Analytical Services Laboratory," Environmental Claims Journal, Vol. 1, 4 (Summer 1989)

L.R. Flynn, S.W. Bass, R.E. Meierer, "Headspace Screening/Capillary Column GC/MS Analysis for Volatile Organics: Validation Studies and Applications." paper presented at the Fifth Annual Waste Testing and Quality Assurance Symposium, Washington, DC, on July 24-28, 1989.

Meierer, R.E., Whitehead, R.J. "Quality Assurance: In Search of Excellence," Environmental Lab, November 1989.

Meierer, R.E., "Selecting and Evaluating An Analytical Service Laboratory: What the Client Should Do and What the Responsibilities of the Laboratory Are." paper presented at the Environmental-Analytical Teleconference on Quality, on November 10, 1988.

Meierer, R.E., Ragsdale, P.L. "Validation of Toxicity Characteristic Leaching Procedure (TCLP) and Application to Industrial Wastes," paper presented in Washington, DC at the USEPA Symposium on Solid Waste Testing and Quality Assurance, July 13, 1987.

Meierer, R.E., Myers R.L., Whitehead, R.J., "Quality Assurance Studies Based On Analytical Condition Codes," paper presented to the Fifth Annual EPA Contract Laboratory Program Conference, U.S. EPA, August 1, 1985.

Meierer, R.E., "GC/MS: Applications For The Determination of Organic Constituents In Hazardous Waste," paper presented at the Twelfth Annual Conference on Waste Technology, NSWMA, October 18, 1983.

Meierer, Robert (Bob) E.
Vice President & General Manager

Publications:

Meierer, R.E., Ragsdale P.L., and Mills, P.E., "Quality Assurance of Support Functions In A Large Hazardous Wastes Analytical Laboratory," paper presented before the division of Environmental Chemistry, American Chemical Society, March 29, 1982.

Meierer, R.E., "Laboratory Data Credibility and Reliability," paper presented in Milwaukee, Wisconsin on March 8, 1980, at the Federation of Environmental Technologists Conference.

Shaffer, P.T.B., Meierer, R.E., McGee, C.D., "Virus Recovery From Natural Water" JAWWA., 69 (10), 528-531 (1977).

Cook, G.A., Meierer, R.E., and Shields, B.M. "Combustibility Tests on Several Flame-Resistant Fabrics in Compressed Air, Oxygen Enriched Air, and Pure Oxygen." Textile Research, 37:591 (1967).

Seniority Date: October 2, 1980

Rebman, Jennifer B.
Supervisor, GC/MS Semivolatiles

Responsibilities: Ms. Rebman is responsible for the analysis environmental samples for semi-volatile constituents utilizing GC/MS instrumentation along with the generation of complete and accurate data reports associated with these analyses. She also ensures that the data meets quality control and client requirements.

Education: Ms. Rebman received her B.A. degree in Chemistry from the University of North Carolina at Chapel Hill, in 1991.

Experience: Prior to being promoted to supervisor, Ms. Rebman was a Senior Scientist responsible for the analysis of organic sample extracts utilizing GC/MS instrumentation and for the review of the data associated with these analyses insuring its compliance with quality control criteria and client requirements.

Prior to joinińg CompuChem, Ms. Rebman was employed by Chemical and Environmental Technologies, Inc., in Cary, North Carolina from 1991 to 2005. While there Ms. Rebman held various positions including Organic Chemist, GC/MS Chemist, Organic Preparation Supervisor, and Organic Department Supervisor. Her responsibilities included chemical extraction of environmental matrices for GC analyses. She analyzed sample extracts using GC instrumentation equipped with FID, PID, ECD, HALL and MS detectors. She insured that client reports met quality control and client requirements. She developed new preparation and analytical methods. She hired and trained new employees.

Seniority Date: July 13, 2005

Respass, Valgena
Quality Assurance Manager
QA Officer

Responsibilities: Ms. Respass is responsible for developing and maintaining the laboratory's quality system through the performance of internal systems and data audits and oversight of Proficiency Test sample analysis. She maintains the laboratory's certifications with state agencies and the National Environmental Laboratory Accreditation Program (NELAP).

Education: Ms. Respass earned a BS in Chemistry from Elizabeth City State University in Elizabeth City, North Carolina in 1985.

Ms. Respass earned 43 credit hours in chemistry toward her degree; no credit hours were required in microbiology.

Experience: Prior to joining CompuChem Ms. Respass was employed as a chemist at Triangle Laboratories, Inc. in Research Triangle Park, NC from March 1998 through March 1999 where she was responsible for overseeing data generated from the organic chemistry laboratory.

Ms. Respass was employed as a chemist at RCRA Environmental Inc. in Lionville, PA from June 1997 through February 1998 where she performed GCMS analyses and data review.

From October 1992 to June 1997 Ms. Respass was employed as a chemist at Roy F. Weston in Lionville, PA performing GC and GCMS analyses of samples for pesticide, PCB, and volatile target compounds.

From August 1985 to October 1992 CompuChem Laboratories, Inc. employed Ms. Respass where she performed GCMS analysis and data review. She also performed solvent extractions of samples for pesticides, PCBs, dioxins, herbicides, and semivolatiles.

Seniority Date: June 18, 1992

Zimmerman, Mitchell S.
Project Manager/Alternate Emergency Coordinator

Responsibilities: Mr. Zimmerman is responsible project oversight from order entry to data delivery. He ensures that the client requirements are met and that proper customer service and technical support are provided during the course of the project. He is responsible for updating the client on sample status, receipt issues, and any lab issues that may arise. As Alternate Emergency Coordinator, Mr. Zimmerman has the authority to implement the emergency response procedures in the lab's Contingency Plan.

Education: Mr. Zimmerman earned BS degree in Biology from Montana State University, Bozeman Montana, in May 1999. He received an AAS degree in Resource Management from Sterling College, Craftsbury Commons, Vermont, in June 1991.

Mr Zimmerman received a Masters Certificate in Disaster Relief Management and Community Preparedness from the University of North Carolina in 2006.

Experience: Mr. Zimmerman joined CompuChem in December of 1999 as Chemist I in the Volatile Organics lab. He was promoted to Analyst II in 2003. In these positions his duties included the GC/MS purge and trap analyses of various environmental matrices for volatile organic compounds. He was promoted to Data Reviewer I/Waste Handler in 2004. In this position his duties included and the review of the data produced by GC/MS analysis for volatile constituents to ensure compliance with quality control criteria and client requirements as well as the handling and removal of hazardous waste form laboratory areas.

Prior to joining CompuChem, Mr. Zimmerman served in the Peace Corps as Rural Community Developer in Paramaribo, Suriname from August 1996 to September 1998. While there, he successfully introduced a community development program in an area new to the Peace Corps.

Seniority Date: December 6, 1999

Table 2.1 - Analytical Methods Performed by CompuChem

Method ID	Type of Analysis	Analyte	Method References

Clean Water Act Methods

120.1	Conductivity	specific conductance	EPA, 1982
130.1	Colorimetric, flow Injection analyzer, Lachat	total hardness as CaCO3	EPA, 1971 Lachat, January 1993
4500-H^+B	Electrometric	pH	Standard Method, 20th Ed. 1998
2540C	Gravimetric	filterable residue, total dissolved solids (TDS)	Standard Methods 20th Ed. 1998
2540D	Gravimetric	non-filterable residue, total suspended solids(TSS)	Standard Methods 20th Ed. 1998
2540B	Gravimetric	total solids	Standard Methods 20th Ed. 1998
200.7	Inductively Coupled Plasma-Atomic Emmision Spectroscopy (ICP-AES)	Metals	40 CFR, Appendix C Rev. 4.4 , 1994
245.1 245.5	manual cold vapor AA(CVAA) automated Leeman analysis	Mercury	EPA, Rev 3.0, 1994 EPA, March 1983
300.0	Ion Chromatography	Bromide	EPA/6006R-93/100 EPA, Rev. 1.0, 1993
300.0	Ion Chromatography	Chloride	EPA/6006R-93/100 EPA, Rev. 1.0, 1993
300.0	Ion Chromatography Distillation	Fluoride	EPA/6006R-93/100 Std.Meth. 20th Ed.
			EPA, Rev. 1.0, 1993
300.0 353.2	Ion Chromatography Colorimetric, flow Injection analyzer, Lachat	nitrate N	EPA/6006R-93/100 EPA, Rev. 1.0, 1993
300.0 353.2	Ion Chromatography Colorimetric, flow injection analyzer, Lachat	nitrite N	EPA/6006R-93/100 EPA, Rev. 1.0, 1993 EPA, Rev. 2.0, 1993
300.0	Ion Chromatography	orthophosphate P	EPA/6006R-93/100 EPA, Rev. 1.0, 1993
300.0	Ion Chromatography	Sulfate	EPA/6006R-93/100 EPA, Rev. 1.0, 1993
310.2	Colorimetric, flow Injection analyzer, Lachat	Alkalinity	EPA, 1974 Lachat, January 1996
335.4 4500 Cn-F 10-204-00-1-A	Off-line manual distillation, colorimetric, flow injection analyzer, Lachat	Cyanide, total and free Cyanide, amenable	EPA, Rev. 1.0, 1993 Standards Methods 20th Ed. 1998 Lachat, February 1992

Table 2.1 - (cont.) Analytical Methods Performed by CompuChem

Clean Water Act Methods (cont.)

350.1	Colorimetric	Ammonia N	EPA, Rev.2, 1993
10-107-06-1-A	flow injection analyzer, Lachat		Lachat, November 1995
	distillation		
351.2 10-107-06-2-E	Colorimetric, flow injection analyzer, Lachat	Kjeldahl N, total	EPA, Rev. 2.1, 1993 Lachat, June1996
3500-Fe D/B	Phenanthroline method	Ferrous/ferric iron	Std.Meth. 19th/20th Ed.
365.4 10-115-01-1-D	colorimetric, flow injection analyzer, Lachat	total phosphorus P	EPA, 1974 Lachat, May 1995
4500-S^2-F	titrimetric	Sulfide	Standard Methods 20th Ed. 1998
1664A	gravimetric	Hexane-extractable material, HEM	EPA-821-R-98-002
1664A	gravimetric	Silica-gel treated (SGT)-HEM	EPA-821-R-98-002
3510B	DC-180 total organic carbon analyzer	TOC	Standard Methods 20th Ed. 1998
420.4 10-210-00-1-A	manual distillation, automated colorimetric, 4-AAP, Lachat	Phenols	EPA, Rev. 1.0, 1993 Lachat, April 1987
3030C	aqueous filtration/acid digestion	Metals	Std.Meth. 20th Ed.
10-124-13-1-A 3500-CrD/B	automated colorimetric, flow injection analyzer, Lachat	Hexavalent chromium (Cr+) (Aqueous)	Lachat, October 1993 Std.Meth. 19th/20th Ed.
608/608.2	solvent extraction, GC/ECD	Organochlorine pesticides & PCBs	40 CFR 136, Appendix A
610	solvent extraction, HPLC/UV/fluorescence	polynuclear aromatic hydrocarbons (PAH)	40 CFR 136, Appendix A
615	Solvent extraction GC/ECD	Herbicides	40 CFR 136, Appendix A
624	GC/MS P&T, megabore column	purgeable volatile Organics	40 CFR 136, Appendix A
625	Solvent extraction, GC/MS capillary column	BNA extractables	40 CFR 136, Appendix A
D3987-85	Leachate generation from soil	Wet chemistry Parameter	ASTM 1999
RSK-175	GC/FID, gas in water (headspace) analysis	Methane, ethane, ethene, propane	RSK-175

Table 2.1 - (cont.) Analytical Methods Performed by CompuChem

Method ID	Type of Analysis	Analytes	Method References

Resource Conservation & Recovery Act Methods

1010 ASTM-D93-00	Pensky-Martens closed cup	ignitability	EPA SW846, 3rd Ed., 9/86
1311	toxicity characteristic leaching procedure (TCLP)	semivolatiles, metals, herbicides, pesticides	EPA SW846, 3rd Ed., Up.I, 7/92
1311	TCLP w/ zero headspace extraction (ZHE)	volatile organics	EPA SW846, 3rd Ed., Up.I, 7/92
D3987-85	leachate generation from soil	Wet chemistry (S)	ASTM
1312	synthetic precipitation leaching procedure (SPLP)	semivolatiles, metals, herbicides, pesticides dissolved metals	EPA SW846, 3rd Ed., Up.II, 9/94 3rd Ed., Up.I, 7/92
3010A	aqueous acid block-digestion ICP	total metals (Aqueous)	EPA SW846, 3rd Ed., Up.I, 7/92
3050B	soil/sediment/sludge acid block-digestion	total metals (Solids)	EPA SW846, 3rd Ed., Up.III, 12/96
3510C	separatory funnel liquid/liquid extraction	organic extractables (Aqueous)	EPA SW846, 3rd Ed., Up.III, 12/96
3520C	continuous liquid/liquid extraction	organic extractables (Aqueous)	EPA SW846, 3rd Ed., Up.III, 12/96
3535	solid phase extraction (SPE)	Explosives (Aqueous)	EPA SW846 3rd Ed., Up.III, 12/96
3540C	soxhlet extraction	extractable organics (Solids)	EPA SW846, 3rd Ed., Up.III, 12/96
3541	Automated Soxhlet Extraction (SoxTherm)	Semivolatiles & PCBs (Solids)	EPA SW846, 3rd Ed., Up.III,12/96
3550B	sonication extraction	non-volatile & extractable organics (Solids)	EPA SW846, 3rd Ed., Up.III, 12/96
3580A	waste dilution, dilute & shoot	non-aqueous waste	EPA SW846, 3rd Ed., Up.I, 7/92
3620B	florisil column cleanup	Organochlorine pesticides & PCBs	EPA SW846, 3rd Ed., Up.III, 12/96
3640A	gel permeation cleanup (GPC)	extractable organics	EPA SW846, 3rd Ed., Up.II, 9/94
3660B	sulfur cleanup	organochlorine pesticides & PCBs	EPA SW846, 3rd Ed., Up.III, 12/96
3665A	sulfuric acid cleanup	PCBs	EPA SW846, 3rd Ed., Up.III, 12/96

Table 2.1- (cont.) Analytical Methods Performed by CompuChem

Method ID	Type of Analysis	Analytes	Method References

Resource Conservation & Recovery Act Methods (cont.)

3005A	Aqueous acid block digestion	Total recoverable or dissolved metals	EPA SW846, 3rd Ed., Up.I, 7/92
5030B	P&T	volatile organics	EPA SW846, 3rd Ed., Up.III, 12/96
5035	Closed system P&T for soil	volatile organics	EPA SW846, 3rd Ed., Up.III, 12/96
6010B	ICP	metals	EPA SW846, 3rd Ed., Up.III, 12/96
6020	ICP-MS	metals	EPA SW846, 3rd Ed.,Up.III, 12/96
7196A 3500CrB	automated colorimetric, flow injection analyzer, Lachat	Hexavalent chromium (Cr+) (Aqueous)	EPA SW846, 3rd Ed.,Up.III, 12/96 Std.Meth.20th Ed.
7470A, 7471A	CVAA automated Leeman	Mercury	EPA SW846, 3rd Ed., Up.II, 9/94
8015B	GC/FID	Gasoline range organics, including TN-DEC Diesel range organics, including JP4, JP8,TN EPH (Aqueous & Solids)	EPA SW846, 3rd Ed., Up.III, 12/96
8081A	solvent extraction, GC/ECD	Organochlorine Pesticides	EPA SW846, 3rd Ed., Up.III, 12/96
8082	solvent extraction, GC/ECD	PCBs	EPA SW846, 3rd Ed., Up.III, 12/96-
8151A	solvent extraction, GC/ECD	chlorinated herbicides	EPA SW846, 3rd Ed., Up.III, 12/96
8260B	GC/MS P&T Selected ion monitoring (SIM)	purgeable volatile Organics	EPA SW846, 3rd Ed., Up.III, 12/96
8270C	solvent extraction, GC/MS capillary column Selected ion monitoring (SIM)	semivolatile organic Extractables	EPA SW846, 3rd Ed., Up.III, 12/96
8310	solvent extraction, HPLC/UV/fluorescence	polynuclear aromatic hydrocarbons (PAHs)	EPA SW846, 3rd Ed., 9/86
8330	solvent extraction, HPLC,UV detector	Explosives	EPA SW846, 3rd Ed., Up.II, 9/94
8332	solvent extraction, HPLC,UV detector	Nitroglycerin/PETN	EPA SW846, 3rd Ed., Up. III, 12/96
9010B	manual midi-distillation (followed by 9012A, flow injection analysis,Lachat)	total and free cyanide	EPA SW846, 3rd Ed., Up. III, 12/96

Table 2.1 - (cont.) Analytical Methods Performed by CompuChem

Resource Conservation & Recovery Act Methods (cont.)

Method ID	Type of Analysis	Analytes	Method References
9012A	off-line midi-distillation, flow injection analyzer, Lachat	total and free cyanide	EPA SW846, 3rd Ed., Up.III, 12/96
Chapter (7.3.3) 9014	HCN formation and release, titration	reactive (total releasable) cyanide	EPA SW846, 3rd Ed., Up.III, 12/96
Chapter (7.3.4) 9034	H2S formation and release, titration	reactive (total releasable) sulfide	EPA SW846, 3rd Ed., 9/86
9040B	electrometric	aqueous pH	EPA SW846, 3rd Ed., 1/95
9045C	electrometric	soil & waste pH (corrosivity)	EPA SW846, 3rd Ed., Up.IIB, 1/95
9050A	conductivity	specific conductance	EPA SW846, 3rd Ed., Up.III, 12/96
9060, modified for soil/water Lloyd Kahn	DC-180 TOC analyzer	TOC (Aqueous & Solids) (Aqueous)	EPA SW846, 3rd Ed., 9/86
9066	manual off-line distillation, automated colorimetric, flow injection analyzer, Lachat	Phenol (Solids)	EPA SW846, 3rd Ed., 9/86, CE-81-1, 5/81
9070A (see Method 1664) 9071B	gravimetric soxhlet extraction, gravimetric Hexane-Extractable Material (HEM)	Oil and Grease (Aqueous) Oil and Grease (Solids)	EPA SW846, 3rd Ed.,Up.III, 12/96 EPA SW846, 3rd Ed., Up.III, 12/96 Rev.2, April 1998
9095A	filtration	paint filter liquids	EPA SW846, 3rd Ed., Up.III, 12/96

Table 2.1 - (cont.) Analytical Methods Performed by CompuChem

Superfund / Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), EPA Contract Laboratory Program (CLP)

Method ID	Type of Analysis	Analytes	Method References
EPA CLP	GC/MS P&T megabore column	purgeable volatile Organics	CLP SOW OLM04.3
EPA CLP	solvent extraction, GC/MS capillary column	semivolatile organic Extractables Pesticide confirmation	CLP SOW OLM04.3
EPA CLP	solvent extraction, GC/ECD capillary column TBA/sulfur cleanup	organochlorine pesticides & PCBs	CLP SOW OLM04.3
EPA CLP	ICP/AES	inorganic metals, total & dissolved	CLP SOW ILM04.1 ILM05.4
EPA CLP	ICP/MS	Inorganic metals, total & dissolved	CLP SOW ILM05.4
EPA CLP	CVAA	Mercury	CLP SOW ILM04.1 ILM05.4
EPA CLP	manual distillation, flow injection analyzer, Lachat	Cyanide total and amenable	CLP SOW ILM04.1 ILM05.4
EPA CLP	GC/MS P&T megabore column	Low concentration Purgeable volatile Organics (Aqueous)	CLP SOW OLC03.2
EPA CLP	Solvent extraction, GC/MS capillary column	Low concentration Semivolatile organics (Aqueous)	CLP SOW OLC03.2
EPA CLP	Solvent extraction, GC/ECD capillary column	Low concentration Organochlorine Pesticides & PCBs (Aqueous)	CLP SOW OLC03.2
EPA CLP	GC/MS P&T megabore column	trace & low-medium aqueous volatiles low solid volatiles	CLP SOW SOM01.2
EPA CLP	solvent extraction, GC/MS capillary column	semivolatile organic aqueous low solid	CLP SOW SOM01.2
EPA CLP	solvent extraction, GC/ECD capillary column	organochlorine pesticides	CLP SOW SOM01.2
EPA CLP	solvent extraction, GC/ECD capillary column	Aroclors	CLP SOW SOM01.2

Table 2.2: Method References

Method Key	Reference
ASTM	American Society for Testing and Materials, D3987-85 (1999), Standard Test Method for Shake Extraction of Solid Waste with Water; D93-00, Standard Test Method for Flash-Point by Pensky-Martens Closed Cup Tester
40 CFR 136	Code of Federal Regulations 40, Part 122, 136 (March 12, 2007) "Guidelines Establishing Test Procedures for Analysis of Pollutants Under the Clean Water Act."
40 CFR 136, Appendix A	Appendix A. (since October 26, 1984, with subsequent updates.) "Methods for Organic Chemical Analysis of Municipal and Industrial Wastewater."
40 CFR 135, Appendix C	Appendix C. (since October 26, 1984, with subsequent updates.) "Inductively Coupled Plasma – Atomic Emission Spectrometric Method for Trace Element Analysis of Water and Wastes, Method 200.7"
EPA CLP SOW	U.S. EPA. Contract Laboratory Program Statement of Work for Organic and Inorganic Analysis, Multi-Media, Multi-Concentration. Documents number OLM04.3, ILM04.1, and ILM05.4, SOM01.2.
EPA CLP SOW	U.S. EPA. Contract Laboratory Program Statement of Work for Organic Analysis, Low Concentration Water, OLC03.2
EPA MCAWW March 1983	U.S. EPA. (March 1983.) "Methods for Chemical Analysis of Water and Wastes". EPA-600/4-79-020.
Standard Methods, 19th,20th Ed	APHA, AWWA, WEF. (Standard Methods for the Examination of Water and Wastewater", 19th, 20th Editions 1995, 1998.
Lachat	Lachat Instruments. "Method Manual for the QuikChem Automated Ion Analyzer". Milwaukee, WI, (periodic updates by method).
SW-846 3rd Edition	U.S. EPA (September, 1986) "Test Methods for Evaluating Solid Waste Physical/Chemical Methods", SW846, Third Edition (9/86), Update I (7/92), Update II (9/94), Update III (12/96).
EPA/6006R-93/100	U.S. EPA "Methods for the Determination of Inorganic Substances in Environmental Samples", Method 300.0, Revision 2.1, August 1993
EPA-821-R-98-002	"Method 1664, Revision A: n-Hexane Extractable Material (HEM; Oil and Grease) and Silica Gel Treated n-Hexane Extractable Material (SGT-HEM; Non-polar Material) by Extraction and Gravimetry", EPA-821-R-98-002, February 1999
RSK-175	Dissolved Oxygen and Methane in Water by a GC Headspace Equilibration Technique", R.S. Kerr Environmental Research Laboratory, Ada, OK, RSK-175, March 15, 1989
EPA/4-81-054, page 115	U.S. EPA EMSL Cincinnati, Ohio, September 1978, "Methods for Benzidine, Chlorinated Organic Compounds, Pentachlorophenol and Pesticides in Water and Wastewater, page 115, "Method for Chlorophenoxy Acid Pesticides in Water and Wastewaters."
Lloyd Kahn Method	"Determination of Total Organic Carbon in Sediment," July 1

3.0 Quality Assurance Objectives

The overall QA objective for CompuChem is to develop and implement procedures for laboratory analysis, chain-of-custody, and reporting that will provide results that are of known and documented quality. Data Quality Indicators (DQIs) are used as qualitative and quantitative descriptors in interpreting the degree of acceptability or utility of data. The principal DQIs are precision, bias (accuracy), representativeness, comparability, completeness and detection limits. DQIs are used as quantitative goals for the quality of data generated in the analytical measurement process. This section summarizes how specific QA objectives are achieved. The specific application of these various activities are contained in the method SOPs.

3.1 Precision and Accuracy

Statistically derived control limits, determined from laboratory-acquired historical data, are reviewed annually and updated if needed. These limits are used for the evaluation of the laboratory control sample (LCS) in the control chart program and at the bench for some procedures. For other procedures, control limits are established in the method, Statement of Work (SOW), or laboratory Standard Operating Procedures (SOPs).

Statistical control limits for matrix spikes and matrix spike duplicates (MS/MSD) have been generated for SW-846 and wet chemistry methods. Default limits have been established internally when statistical limits are broad. For matrix spikes and for laboratory control samples the default limits are 20-150%, with allowances for marginal exceedances.

While the statistical limits presented are goals to be achieved, a specific client or project may dictate the use of other limits. In these cases the laboratory exercises flexibility in applying these in order to meet client-specific requirements.

For Clean Water Act 600 series, matrix spike recovery limits are taken from the tables of "QC Acceptance Criteria" in the "Range for Percent Recovery Measured" columns in the methods. For the Contract Laboratory Program (CLP), matrix spike recoveries are specified in the SOW.

An initial precision and accuracy demonstration is performed for each method. Four replicate control samples are spiked at concentrations near the calibration midpoint and processed through the entire analytical method. The mean percent recovery and percent relative standard deviation are calculated from the replicate results. Precision and accuracy studies are used to document analyst proficiency in performing methods. Data from these studies are maintained in the QA department and HR training files. The standard used in the preparation of the precision and accuracy determinations generally has a concentration within 20% to 80% of the linear calibration range.

The accuracy limits for surrogates are specified by the method or determined statistically for SW-846 and are applicable to laboratory QC samples as well as field samples.

3.1.1 Precision

Precision is a measure of the degree to which two or more measurements are in agreement. Precision is assessed through the calculation of relative percent differences (RPDs) and relative standard deviations (RSDs) for replicate samples. For inorganic analyses, laboratory precision is assessed through the analysis of a sample/sample duplicate pair, a matrix spike/matrix spike duplicate (MS/MSD) pair, and/or field duplicate pairs. For organic analyses, precision is assessed through the analysis of MS/MSD and field duplicate samples.

When acceptance criteria for precision are not met, depending on the type of problem and sample holding time, corrective action may involve reporting data with a laboratory qualifying notice. An example is the poor precision between matrix spike duplicates when one of the extracts is not concentrated accurately or when matrix interference is evident. When an analyte does not meet criteria for RPD in inorganic duplicates, a data qualifying flag accompanies the result in associated samples in accordance with the U.S. EPA CLP reporting convention.

Formulas used to calculate precision of test measurements and the associated acceptance ranges are as follows.

3.1.1.1 Percent relative standard deviation (%RSD)

$$\% \text{ RSD} = \frac{s}{x} \times 100$$

where: x = average of the data points,
s = is the standard deviation

3.1.1.3 Relative Percent Difference (RPD)

$$\text{RPD} = \frac{|A-B|}{1/2\,(A+B)} \times 100$$

where: A = conc. in sample A
B = conc. in Sample B

3.1.2 Accuracy

Accuracy is the degree of agreement between an observed value and an accepted reference or true value.

Accuracy is assessed by the analysis of quality control samples and through the adherence to all sample handling and holding times. Accuracy is demonstrated through the recovery of spiked compounds in the analysis of the MS/MSD and laboratory control samples (LCS), through surrogate recoveries in organic samples and QC, and through quality control check samples with known concentrations of target analytes.

3.1.2.1 Surrogate, Deuterated Monitoring Compounds and Spike Standard Recoveries

Evaluating the recoveries of spike, Deuterated Monitoring Compounds (DMC) and surrogate standards is a means to assess method accuracy in a specific sample matrix when subjected to specific method conditions. Samples are fortified before extraction, purging, and digestion or distillation.

The recovery of these standards is quantitatively measured during analysis. Records of the percent recovery for laboratory control samples are maintained in control chart databases. The statistical warning and control limits are updated annually, if needed. Surrogate, DMC, and spike compound recoveries must meet acceptance criteria before the analytical data are reported. In some instances the sample matrix may produce interferences that adversely affect recoveries of surrogates, DMC or spike compounds. Re-preparation and/or reanalysis of the sample must confirm the results. When a matrix spike test fails spike recovery criteria, the LCS must be evaluated. If the LCS test fails, the entire batch must be reprocessed. If the LCS passes, the sample matrix effect is confirmed. The data is qualified in the narrative or with a flag.

The formulas used to calculate accuracy of test measurements follow:

3.1.2.2 Accuracy = Percent Recovery (%R)

$$\%R = \frac{SSR - SR}{SA} \times 100$$

where: SSR = conc.of spiked sample
SR= conc.in unspiked sample
SA = expected conc.of spike

3.1.2.2 Control limits are calculated using the following formulas:

$LCL = x - 3sd$ where: LCL = lower control limit
$UCL = x + 3sd$ UCL = upper control limit
x = mean percent recovery
sd = standard deviation using n-1 degrees of freedom

3.2 Table of Concentration Levels for QC Samples

Type	*Purpose*	*Conc. Level*	*Method Reference*
MS/MSD	**Precision/Accuracy**	**Mid Level**	**CWA 600 series** **CLP organics** **SW-846 organics** **Wet Chemistry**
MS	**Accuracy**	**Mid Level**	**CWA 600 series** **Inorganics**
BS/LCS	**Accuracy**	**Mid Level**	**All analyses**
Duplicate	**Precision**	**Sample-dependent**	**Inorganics** **Wet Chemistry**

Mid level = Mean level between the minimum detection level and the upper end of the linear range

3.3 Representativeness

Representativeness expresses the degree to which the analytical results of one sample accurately and precisely represent results characteristic of a population, parameter variations at a sampling point, a process or an environmental condition within a defined spatial and/or temporal boundary. Representativeness is a qualitative characteristic, and is considered a goal to be achieved rather than a quantitative measurement. Representativeness is dependent upon both the sampling program design and proper laboratory protocol.

For many sample types, careful collection planning, sample compositing, and/or sample splitting can accomplish true representativeness. Soil samples and samples of complex or heterogeneous matrix usually present the greatest difficulties for samplers and analysts. The sampler should make every effort to homogenize the sample during collection. Laboratory chemists must, whenever practical, homogenize or thoroughly mix the sample before removing aliquots for analysis. CompuChem's sample preparation SOPs include specific procedures for homogenizing as-received samples. Volatile soil samples may not be composited or mixed due to the potential loss of analytes.

Representativeness is ensured by using the proper analytical procedures, appropriate methods, meeting sample holding times, and analyzing field duplicate samples.

The manner in which the data are correlated to the particular sampling episode and sample site are major considerations when evaluating representativeness. When the laboratory is aware of conditions adversely affecting data representativeness, a QA Notice or Laboratory Notice is included in data packages to qualify results or discussion is made in the Sample Delivery Group (SDG) narrative to provide guidance in interpreting data usability.

3.4 Completeness

Completeness is a measure of the amount of valid data obtained from a measurement system compared to the amount that was expected under normal conditions.

Laboratory completeness is a measure of the amount of valid measurements obtained from all the measurements taken in the project. CompuChem's objective for completeness is to provide unqualified data of the highest quality for 100% of samples.

Factors beyond the laboratory's control that adversely affect attainment of completeness objectives include:

- receipt of samples in broken containers
- receipt of samples whose chain of custody (COC) or integrity is compromised in some way
- receipt of samples with insufficient volume to perform initial analyses or repeat analyses should initial efforts not meet QC acceptance criteria
- receipt of improperly preserved samples
- receipt of samples held in the field for longer than expected so that holding times are jeopardized
- receipt of incomplete or inaccurate information resulting in the application of incorrect methods
- assessment of sample data by end-users using criteria other than those stated in applicable method references or applicable data validation guidelines (Data validation guidelines may reject data although method criteria are met.)

When requested, the completeness of an analysis can be documented by including in the test report sufficient information to allow the data user to assess the quality of the results. This information may include such items as chromatograms, mass spectra, a summary of QC sample results, and the tabulated analytical results.

Additional results, up to and including all data sufficient to recreate the entire analytical process, are optional deliverable items. These may include laboratory worksheets, calibration data, all QC sample data, and internal COC documents. The highest level document emulates that required under the U.S. EPA CLP and is intended as a legally defensible document in itself. The raw data are archived and stored electronically by scanning using Adobe Acrobat. Scanning allows for the accurate duplication of documents including signatures, affidavits, and all other information. The electronic data is then indexed for tracking on a computer that is backed up daily. The images of the data are stored on duplicate CDs. One CD is kept with the computer system for easy retrieval of data and the duplicate CD is kept in a secure location in a fireproof safe. The original hardcopy report is shipped to the client, but a hardcopy can be retained if requested or required.

Archived data are stored for a minimum of five years. Additional storage time may also be requested by the client for certain projects or required under certain programs such as the Ohio Voluntary Action Program (VAP). It is the responsibility of the laboratory project manager to oversee the extended retention of data reports. The auxiliary data field in the LIMS is able to record data retention time requirements for each client and to assist in tracking extended retention times. For the Ohio VAP, the laboratory must notify the agency by certified mail when the 10-year retention period has expired and retain the data until directed in writing by the agency whether they will or will not retain the data.

3.5 Comparability

Comparability is an expression of the confidence with which one data set can be compared with another. The analytical results can be compared to results of other laboratories because CompuChem's objectives for comparability are to:

- Demonstrate traceability of analytical/calibration standards to NIST, EPA, or other certified sources
- Use routine and approved analytical methodology
- Achieve sample holding time
- Adhere to instrument tuning and calibration procedures and frequency requirements
- Determine detection limits using Federal Register methodology consistently
- Apply appropriate levels of QC within the context of the QA program
- Report results in common units and use consistent rules in reporting data
- Participate in interlaboratory studies and independent proficiency testing programs to document laboratory performance

By using traceable standards and standard methods, the analytical results can be compared to other laboratories operating similarly. The internal QA program documents laboratory QC performance, and the inter-laboratory studies document performance compared to other laboratories.

3.5.1 QC Reference Standards Traceability

Calibration standards are traceable to the National Institute of Standards and Technology (NIST) or the EPA. EPA standards are purchased with certificates of purity and traceability.

Standards are received as neat materials and concentrated solutions with certificates of analysis (COA) for dilution into intermediate and working standard solutions.

Neat materials are logged into a receipt log and are assigned a sequential number. That number is placed on the COA and bottle label. Intermediate and working standards prepared from these materials are entered into a standard preparation logbook using the appropriate receipt log numbers to identify the components.

Concentrated standards are identified using the names and/or lot numbers which appear on the COA. Intermediate and working standards prepared from these solutions are entered into the standard preparation logbook using the name and/or lot number to identify the components.

In the standard preparation logbook intermediate and working standard solutions are given unique identification numbers (lot numbers). These lot numbers are used to reference these solutions on all subsequent data such as instrument logs and sample preparation sheets.

COA for all standards are retained for traceability to NIST sources. All standard containers (neat materials, concentrated solutions, intermediate and working standards) are labeled with a lot number, preparation/receipt date, expiration date, and analyst's initials.

3.5.2 Proficiency Tests

Interlaboratory studies in the form of proficiency tests are performed on at least a semiannual basis (NELAC) or quarterly (EPA).

3.6 Limits of Detection and Reporting Limits

Method Detection Limits (MDLs) are determined for all analytes as specified in the NELAC standards.

3.6.1 Method Detection Limits

A statistical method detection limit (MDL) study is performed yearly for all approved methods in use. The studies are performed following the design specified in the Federal Register, 40 CFR Part 136 (October 26, 1984).

The MDL is the minimum concentration of a substance that can be measured and reported with 99% confidence that the analyte concentration is greater than zero. The MDL is determined from the analysis of a sample in a lab pure matrix containing the analyte.

At least seven replicate samples are prepared containing the analyte(s) to be tested at a concentration that is 3 to 5 times the estimated MDL for each analyte. The samples are processed through the entire analytical method.

The MDL is calculated using the standard deviation of the replicate measurements and the Student's T value at the 99% confidence level (n-1 degrees of freedom.) The mean analyte value is also calculated. The Dixon outlier test or a similar one is used to eliminate any anomalous data point, but a minimum of seven replicate values are required for calculating the MDL.

Detailed MDL criteria are presented in the specific SOP.

3.6.1.1 MDL Calculation

- $MDL = t(n\text{-}1, 1\text{-}\alpha = .99)(\sigma n\text{-}1)$

  where: $t(n\text{-}1, 1\text{-}\alpha = .99)$ = the student's value for a 99% confidence level and a standard deviation with n-1 degrees of freedom

  $\sigma n\text{-}1$ = standard deviation of the replicate analysis

- Standard Deviation

$$\sigma n-1=\sqrt{\frac{\sum(x_i-x)2}{n-1}}$$

where: x_i = the data point
x = the mean
$\sigma n\text{-}1$ = standard deviation
n=number of samples

3.6.2 Instrument Detection Limits

To fulfill the requirements of the EPA Contract Laboratory Program (CLP) Statement of Work (SOW) ILM04.1, instrument detection limit (IDL) determinations are performed quarterly. This is accomplished by the analysis of seven replicate standards prepared in reagent water containing all target analytes at a concentration of 3 to 5 times the estimated IDL. These analyses must be performed over three non-consecutive days and the standard deviations of the replicates calculated. The IDL is calculated by multiplying the average of these standard deviations by three.

For SW-846 ICP analysis, the calculated IDL value must be less than or equal to MDL for the analyte.

3.6.3 Method Detection Limit Default Cut-off Values

For organic methods, when the concentration of a detected target analyte is between the MDL and the reporting limit, it is reported with a "J" flag to indicate the result is estimated.

For projects that do not require the results to be reported down to the MDL, a cut off value has been defined by the laboratory and may be used. The definition states that any analyte with an MDL <1/5 the RL will have a default cut-off value equal to 1/5 the RL. Any analyte with an MDL >1/5 the RL will have its actual MDL as the cut-off value. For the latter the MDL has to be less than the RL.

Clients would receive prior notification from the project manager for analytes falling into the latter scenario and may require an elevation in the reporting limit.

The use of the MDL cutoff option is not utilized for the EPA Contract Laboratory Program Statement of Work or clients requiring the actual MDL value.

3.6.4 Reporting Limits

For CLP methods, the reporting limit is the Contract Required Quantitation Limit (CRQL) or the Contract Required Detection Limit (CRDL) for ILM04.1. Results are reported down to the IDL for ILM04.1 or down to the MDL for **ILM05.4** and organic parameters. Results reported between CRDL and IDL or the CRQL and the MDL are flagged to indicate the quantitated results are estimated.

For non-CLP methods using a multipoint calibration, the reporting limit is equivalent to or higher than the lowest calibration standard concentration. For ICP metals, the laboratory determines a practical quantitation limit (PQL) for each analyte. The PQL is defined as four times the MDL rounded to a value four to eight times the MDL. However, the PQL may be adjusted, based on the judgment of the ICP analyst, for problematic or poor-performing elements. Experienced inorganic analysts team with senior Quality Assurance staff to establish a reporting limit for each element based on these PQLs. This level is either at or above the statistically determined PQL for most analytes, with few exceptions.

3.7 Method Validation Studies

Prior to analysis of any samples for approved methods not previously offered for sale by the laboratory, a method validation study must first be performed. A chemist familiar with the extraction/preparation procedures and the instrumental detection systems reviews the as-written method. The chemist looks for safety hazards, applicability of available instrument systems, new equipment requirements, any discrepancies in the written method, and the QA/QC requirements. A plan of testing approach is discussed with the laboratory director, technical directors, and executive management. Analysis of laboratory spiked matrices is performed to determine overall method recoverability. A draft SOP is written after the method validation study has been performed.

Documentation includes an MDL study, a precision and accuracy determination, and a draft SOP. This and any other pertinent information is then forwarded to the QA department for final approval. Any deviations from the published method must be noted in the SOP. Once approval by QA and SOP document control is completed, product codes can be developed and the new method can be offered to clients.

3.8 Data Quality Objectives

Data quality objectives (DQOs) are used in planning environmental data collection activities. They establish the level of data that is needed to support decisions regarding the site. They establish the level of uncertainty in results that a decision-maker is willing to accept. They can be used to define QA/QC programs specific to a project or data collection activity. DQOs have been established for programs under which the laboratory provides analytical services. Internal project support staff work closely with the client and regulatory agencies to ensure that DQOs will be met by the analytical results provided. The project management team at CompuChem convey project and client-specific requirements to the laboratory by using the Laboratory Information Management System (LIMS) and distributing a unique Project Profile Sheet (PPS) and meeting on a regular basis.

4.0 Sampling Procedures

CompuChem does not perform field sampling services. We do provide pre-preserved glassware with guidance on collection procedures, if requested, in compliance with program-specific and regulatory shipping requirements. Preservation and holding time requirements are listed in Tables 4.1 through 4.7. We offer shipping supplies that include a shipping container and requested glassware. Glassware supplied by CompuChem for sample collection is purchased pre-cleaned and certified from the vendor. Cleaning procedures are performed according to the U.S. EPA Office of Solid Waste Emergency Response (OSWER) directive published in the document *Specifications and Guidance for Obtaining Contaminant-Free Glassware* (current approved version). The vendor also provides results of analyses using low detection limit EPA methods to certify the glassware is free of contaminants. Certificates of analysis accompany the glassware, are kept on file in the Receiving department, and made available upon request.

4.1 Quality Control Procedures

4.1.1 Quality Control of Bottles

Pre-cleaned and certified glassware **lots including all of the bottles, jars, and vials sent to clients for the purpose of sample collection** are purchased and stored at CompuChem. **This glassware arrives at the laboratory with certificates of analysis documenting its level of contamination. The level of contamination should be less than the reporting limit (less that one half the reporting limit for DOD projects).** The vendor provides glassware with certificates of analysis for each lot. Preservative is added to sample collection bottles prior to shipment to the client with the exception of volatile vials. Volatiles are received from the vender containing preservative. Individually packaged EnCore™ sampling devices are provided for collection of 5 gram volatile soil samples for use with Method 5035 and certain methanol preserved TPH analyses.

4.1.2 Quality Control of the Pure Water System and Vendor Pre-Cleaned and Certified Bottles

A U.S. Filter pure water system is used to generate ASTM Type II reagent grade water. This laboratory pure water is used in sample and method blank preparations.

In addition, we supply water to our clients for use as a source of field QC samples (trip blanks, rinsate blanks, etc.) This water is stored in the volatile instrumentation laboratory in a series of 45 liter glass carboys. Water used for this purpose and for the volatile analytical procedures is generated by a Millipore system located in the volatile sample preparation room.

For many years, the water collected in each carboy has been analyzed for volatile, semivolatile, pesticide/PCB and inorganic (metal and cyanide) analytes. An assessment of the results from these tests has demonstrated that, with the exception of common laboratory solvents, the water had not contained target analytes above any blank acceptance criteria. For that reason, the analytical testing of the carboy water was discontinued, unless requested by a client.

Water used to prepare laboratory QC samples, such as method blanks and LCS, must meet method requirements for acceptability.

4.1.3 Volatile Storage Blank Tests

Storage blank tests associated with CLP analyses and certain commercial clients analyses are performed on a routine basis. The storage blank is now used to demonstrate that the refrigerated storage environments, for samples submitted for volatile organic analyses, are free from contamination. Cooler tests are not required for any refrigerators being used strictly for long-term storage of volatiles samples.

4.2 Shipping Coolers

4.2.1 Preparation

An Igloo-style sample collection container is provided as a service to customers who request that CompuChem supply bottles to the field. A Customer Service representative determines with the client the required number and types of bottles and fills out a cooler request form (Figure 4-1) that includes the following information:

- address of the client
- special instructions: use of chain-of-custody, etc.
- method of shipment
- account number
- latest shipping date
- test codes for samples

The cooler is sent with instructional and necessary information such as chain of custody record (Figure 5-1), sample collection and preservation guidelines (Figure 4-2), bottle labels, custody seals (Figure 4-3), etc. When soil samples are to be imported into the USA, the US Department of Agriculture requires that the sample containers be labeled with "Restricted Entry" labels (Figure 4-6). CompuChem encloses these labels and instructions when sent outside the continental U.S.

For regulatory work done in the States of Florida and New Jersey and for some other clients, formal COC starts when the pre-cleaned sample containers are dispatched to the field from the laboratory. The required COC record is sent with these containers. It must be signed and dated by the individual who packs the cleaned and certified sample containers into the cooler and relinquishes custody of them. This initiates the COC process.

Protocol for sample collection is left to the discretion of the field sampling crew. In general, the use of "blue" ice for sample preservation is discouraged and is adequate only if the samples have been pre-cooled with wet ice.

Please note that Tables 4.1 to 4.7 lists all Preservation, Holding Times, and Recommended Sample Volumes published in a variety of federal documents. CompuChem does not perform all these methods in-house but supplies this information for the benefit of our clients. See section 2 of the Quality Manual for details on analyses performed at CompuChem.

Table 4.1

Requirements for Containers, Preservation, Holding Times, and Recommended Sample Volumes Published in the Clean Water Act, 40 CFR 136, *Federal Register*

Parameter	Preservation	Holding[a] Time (days)	Containers[b]	Volume (mL)
Acidity	Cool, 4°C	14	P or G	200
Alkalinity	Cool, 4°C	14	P or G	100
Ammonia	Cool, 4°C, H_2SO_4 to pH<2	28	P or G	500
Biochemical Oxygen Demand	Cool, 4°C	48 hours	P or G	1000
Bromide	NR[c]	28	P or G	200
Chemical Oxygen Demand	Cool, 4°C, H_2SO_4 to pH<2	28	P or G	100
Chloride	NR	28	P or G	100
Chlorine, Total Residual	NR	0[d]	P or G	500
Chromium VI	Cool, 4°C	24 hours	P or G	500
Coliform, fecal and total	Cool, 4°C; 0.008% $Na_2S_2O_3$	6 hours	P or G	200
Color	Cool, 4°C	48 hours	P or G	500
Cyanide, total	Cool, 4°C; NaOH to pH>12 0.6 g ascorbic acid[f]	14[e]	P or G	1000
Cyanide, amenable to chlorination (free)	Cool, 4°C; NaOH to pH>12 0.6 g ascorbic acid[f]	14[e]	P or G	500
Fluoride	NR	28	P	500
Hardness	HNO_3 to pH<2 H_2SO_4 to pH <2	180	P or G	250
Hydrogen Ion (pH)	NR[c]	0[d]	P or G	40
Kjeldahl Nitrogen	Cool, 4°C; H_2SO_4 to pH <2	28	P or G	1000
Mercury	HNO_3 to pH<2	28	P or G	500
Metals (except Cr VI and Hg)	HNO_3 to pH<2	180	P or G	500
Nitrate (as N)	Cool, 4°C	48 hours	P or G	100
Nitrite (as N)	Cool, 4°C	48 hours	P or G	50
Nitrate-Nitrite (as N)	Cool, 4°C; H_2SO_4 to pH <2	28	P or G	500
Oil and Grease	Cool, 4°C; H_2SO_4 to pH <2	28	G	1000
Organic Carbon, Total (TOC)	Cool, 4°C HCl or H_2SO_4 to pH <2	28	P or G	100
Organic Nitrogen, Total	Cool, 4°C; H_2SO_4 to pH <2	28	P or G	500
Orthophosphate (as P)	Filter immediately, Cool, 4°C	48 hours	P or G	50
Phenols (Total)	Cool, 4°C; H_2SO_4 to pH <2	28	G	1000
Phosphorus (Elemental)	Cool, 4°C	48 hours	G	500
Phosphorus (Total)	Cool, 4°C H_2SO_4 to pH <2	28	P or G	200
TRPH	5 ml HCl; Cool, 4°C	**28 days**	G	1000

[a] From time of sample collection
[b] Polyethylene (P) or glass (G)
[c] None required
[d] 0 days indicates that the sample must be analyzed immediately.
[e] Reduced to 24 hours if sulfide is present, unless sulfide is removed before preservation.
[f] Added if residual chlorine is present

Table 4.1 (Continued)

Requirements for Containers, Preservation, Holding Times, and Recommended Sample Volumes Published in the Clean Water Act, 40 CFR 136, *Federal Register*

Parameter	Preservation	Holding Time[a] (days)	Containers[b]	Volume (mL)
Solids (Total and Filterable)	Cool, 4°C	7	P or G	100
Solids (Non-filterable)	Cool, 4°C	7	P or G	300
Solids (Settleable)	Cool, 4°C	7 days	P or G	1000
Silica	Cool, 4°C	28	P	100
Specific Conductance	Cool, 4°C	28	P or G	250
Sulfate	Cool, 4°C	28	P or G	250
Sulfide	Cool, 4°C Add zinc acetate and NaOH to pH>9.	7	P or G	
Sulfite	NR[c]	0[d]	P or G	250
Surfactants	Cool, 4°C	48 hours	P or G	250
Turbidity	Cool, 4°C	48 hours	P or G	250
Purgeable Halocarbons	Cool, 4°C 0.008% $Na_2S_2O_3$[e]	14	G	80
Purgeable Aromatic Hydrocarbons	Cool, 4°C 0.008% $Na_2S_2O_3$[e] HCl to pH<2	14	G	80
Phenols	Cool, 4°C 0.008% $Na_2S_2O_3$[e]	7/40[f]	P or G	2000
Benzidines	Cool, 4°C 0.008% $Na_2S_2O_3$[e]	7/7[g]	P or G	2000
Phthalate Esters	Cool, 4°C	7/40[f]	G	2000
Nitrosamines	Cool, 4°C, dark 0.008% $Na_2S_2O_3$[e]	7/40[f]	P or G	2000
PCBs	Cool, 4°C	7/40[f]	P or G	2000
Nitroaromatics and isophorone	Cool, 4°C, dark 0.008% $Na_2S_2O_3$[e]	7/40[f]	P or G	2000
Polynuclear Aromatic Hydrocarbons	Cool, 4°C, dark 0.008% $Na_2S_2O_3$[e]	7/40[f]	G	2000
Haloethers	Cool, 4°C 0.008% $Na_2S_2O_3$[e]	7/40[f]	P or G	2000
Chlorinated Hydrocarbons	Cool, 4°C	7/40[f]	P or G	2000
TCDD	Cool, 4°C 0.008% $Na_2S_2O_3$[e]	7/40[f]	P or G	2000
Pesticides	Cool, 4°C; pH 5-9	7/40[f]	P or G	2000

[a] From time of sample collection
[b] Polyethylene (P) or glass (G)
[c] None required
[d] 0 days indicates that the sample must be analyzed immediately.
[e] $Na_2S_2O_3$ added if residual chlorine is present; approx. equal to 1 ml of 10% thiosulfate / liter of sample.
[f] To complete extraction (or initiate extraction if continuous liquid-liquid extraction is performed)/ to complete analysis following extraction
[g] Extracts may be stored up to 7 days before analysis if stored under an inert (oxidant-free) atmosphere.

Table 4.2

Requirements for Containers, Preservation, Holding Times, and Recommended Sample Volumes Published in the U.S. EPA CLP SOW for Inorganics Analysis, ILM04.1/ILM05.4

Parameter	Preservation[a]	Holding Time[b] (days)	Containers[c]	Volume (mL)
Cyanide, total	Cool, 4°C NaOH to pH>12 0.6 g of ascorbic acid[d]	12	P or G	1000
Metals (except Hg)	HNO_3 to pH<2, 4°± 2°C	180	P or G	500[e]
Mercury	HNO_3 to pH<2, 4°± 2°C	26	P or G	500[e]

a Water sample only; preservation performed by sampler immediately upon sample collection. Soil/sediment samples are maintained at 4°C until analysis. Dissolved metals are filtered onsite by sampler before addition of preservative. Water samples received under the ILM04.1 SOW are stored at ambient temperature
b From validated time of sample receipt
c Polyethylene (P) or glass (G)
d Only used in the presence of residual chlorine
e Can be combined into a one-liter bottle.

Table 4.3

Requirements for Containers, Preservation, Holding Times, and Recommended Sample Volumes Published in the U.S. EPA CLP SOW for Organics Analysis OLM04.3, and OLC03.2 (aqueous only), and SOM01.1

Parameter	Preservation	Holding Time (days)[a]	Containers[b]	Volume (mL)
Aqueous Volatiles	Cool, 4°± 2°C[c] HCl to pH≤2	10[d]	G-TLSSL	80
Soil/Sediment Volatiles	4°± 2°C[c], sodium bisulfate < -7°C	10[d] 10	G-TLC, CET, EnCore™ samplers	4 oz 60 mL
Aqueous Semivolatiles	4°± 2°C[c]	5/40[e]	AG	2000
Soil/Sediment Semivolatiles	4°± 2°C[c]	10/40[e]	G	8 oz
Aqueous Pesticides/PCBs	4°± 2°C[c]	5/40[e]	AG	2000
Soil/Sediment Pesticides/PCBs	4°± 2°C[c]	10/40[e]	G	8 oz

a From validated time of sample receipt
b All containers are 1-liter amber glass (AG) bottles with Teflon-lined cap except aqueous volatiles (G-TLSSL = 40-ml glass bottle with Teflon-lined septum sealed lid), and soil/sediment volatiles (G-TLC = 4-oz glass jar with Teflon-lined cap or CET = closed-end tubes such as brass sleeves). Soil samples may also be collected under OLM04.3 and SOM01.1 for low level analysis in Encore™ samplers or as 5 gm sample in sodium bisulfate or medium level analysis in pre-weighed vials containing 10ml methanol. When this occurs, the sample vial, with 10 ml methanol and all labeling, is weighed to the nearest 0.1g prior to the addition of sample. Approximately 5g of sample is added to the vial. The sample vial with sample is weighed to the nearest 0.1g. The initial weight, final weight and sample weight are recorded and provided to the laboratory.
c Preserve samples at time of collection; samples should be stored in the dark until extraction/analysis.
d Until analysis
e To complete extraction/to complete analysis following extraction

Table 4.4

Requirements for Containers, Preservation, Holding Times, and Recommended Sample Volumes for Aqueous and Solid Matrices[a] Published in SW-846 Test Methods for Evaluating Solid Waste, Third Edition, Update 3, December 1996.

Parameter	Methods	References	Container	Preservation	Maximum Holding Times[b]
Volatile Organics in water	Purge and trap GC and GC/MS	8015A modified/ 8015B, 8260B	Glass, 40-ml vial with zero headspace	4°C, HCl to pH <2, 0.008% $Na_2S_2O_3$	14 days (A) (see below for soil)
Semivolatile Organics	GC, HPLC, and GC/MS	8081A,8082, 8151A, 8310, 8270C, 8330, 8332	Glass, amber (A) (1 liter sample); 8-oz wide mouth with PTFE-lined cap (S) (50-g min. ea. test)	Cool to 4°C, 0.008% $Na_2S_2O_3$	7 days to extract (A); 14 days to extract (S); 40 days to analyze (A/S)
Total Metals – except Mercury and Chromium VI	ICP	6010B	Glass or plastic 500ml (A), 8-oz wide mouth (S) (200-g sample)	HNO_3 to pH<2 (A); filter dissolved on-site first; filter suspended-no acid	6 months (A/S)
Chromium VI	Colorimetric, automated	7196A	Glass or plastic, 500ml (A), 8-oz wide mouth (S) (200-g sample)	Cool to, 4°C	24 hours (A); one mo. to extraction, 4 days after (S).
Mercury	Manual cold vapor AA	7470 7471A	Glass or plastic, 500ml (A), 8-oz wide mouth (200-g sample)	pH<2 HNO_3 (A); Cool to 4°C (S)	28 days (A/S)
Cyanide	Colorimetric automated	9012A	Glass or plastic	Cool to 4°C; pH >12 NaOH (A)	14days (A)
Phenols	Colorimetric, automated	420.2	Glass or plastic	Cool to 4°C; pH <4 H_2SO_4 (A)	28 days (A)
Specific conductance	conductivity	9050A	Glass or plastic	Cool to 4°C (A)	28 days (A)
Sulfide	distillation, titration	9034	Glass or plastic	Cool to 4°C; Zinc acetate (A/S)	7 days (A/S)
Oil & grease	Gravimetric	9070 9071A	Glass	Cool to 4°C (A/S); 5 ml diluted HCl(A)	28 days (A) 14 days (S)
TOC	Combustion analyzer	9060	Glass or plastic	Cool to 4°C; pH<2 HCl or H_2SO_4; Store in dark (A)	28 days
TOX	DX 208 analyzer	9020B	Glass, PTFE-lined cap	Cool to 4°C; pH<2 H_2SO_4	28 days

[a] Table originally excerpted, in part, from Table II, 49 FR 28, October 26, 1984, and revised.
b Holding time begins at time of sample collection.
[c] $Na_2S_2O_3$ added if residual chlorine is present; approx. equal to 1 ml of 10% thiosulfate / liter of sample.
(A) aqueous, (S) solid

Table 4.5

Sample Handling, Preservation and Holding Time Table for SW-846 Method 5035, Volatile Organics in Soil

Conc. Level	Sampling Device	Collection Procedure	Container Type	Container Preparation	Preservation	Maximum Holding Time[a]
≤ 200 ug/kg	Coring Device	5035-Section 6.2.1	Glass vial w/ PTFE-silicon septum	5035-6.1.1	4°C, $NaHSO_4$	14 days
	Coring Device	5035-Section 6.2.1	Glass vial w/ PTFE-silicon septum	5035-6.1.1[b]	4°C	48 hours
	Coring Device	5035-Section 6.2.1	Glass vial w/ PTFE-silicon septum	5035-6.1.1	4°C/-10°C[d]	48 hours/ 14 days[e]
	Encore™ or equivalent	5035-Section 6.2.1	Encore™ or equivalent	5035-6.1.1[b,f,g]	4°C	48 hours
	Encore™ or equivalent	5035-Section 6.2.1	Encore™ or equivalent	5035-6.1.1[f,g]	$NaHSO_4$, 4°C	48 hours, 14 days
	Encore™ or equivalent	5035-Section 6.2.1	Encore™ or equivalent	5035-6.1.1 [b,f,g]	4°C/-10°C [c,d]	48 hours/ 14 days
> 200 ug/kg[h]	Encore™ or equivalent	5035-Section 6.2.2.3[f]	Encore™ or equivalent	5035-6.1.1 [f,g]	4°C	48 hours 14 days
	Coring Device	5035-Section 6.2.2.3[I]	Glass vial w/ PTFE-silicon septum	5035-6.1.1 [I]	Methanol/PEG 4°C	14 days
·	Conventional Devices	FLDEP SOP –Section 4.3	Glass vial w/ PTFE-silicon septum	5035-6.1.1	4°C	14 days
Dry weight	Conventional Devices		Glass w/ teflon liner		4°C	

a Maximum time allowed from time/date of collection to sample analysis.
b Eliminate 6.1.1.2; use only organic-free water.
c Contents of sampling device must be transported to the laboratory at 4°C and stored at –10°C; this option upon client request.
d In order to ensure that vials do not break during freezing, they should be stored on their side or at a slanted angle.
e Maximum allowed time at 4°C is 48 hours; maximum allowed time to sample analysis is 14 days from collection.
f Conducted in the laboratory.
g Entire contents of sampling device is extruded into the sample analysis vial containing the appropriate solvent.
h Procedures are limited only to those situations or programs in which the maximum contamination level does not exceed 200ug/kg.
I Methanolic preservation in the field is not recommended.

Table 4.6

Requirements for Holding Times for Hazardous Characteristics Indicators Published in SW-846 Test Methods for Evaluating Solid Waste, Third Edition, Update 3, December 1996.

Parameter	Methods	References	Container	Preservation	Maximum Holding Times
Reactivity-Total releasable cyanide	Reflux distillation, colorimetry	Chapter 7, 7.3.3, 9012A	Glass, with zero headspace	4°C in dark, pH>12 NaOH	ASAP
Reactivity-Total releasable Sulfide	Acid distillation, titration	Chapter 7, 7.3.4, 9034	Glass, with zero headspace	4°C in dark, pH>12 NaOH; zinc acetate	ASAP
Ignitability	Flash point	1010	Glass or plastic	NA	ASAP
Corrosivity	Electrometric	9040B	Glass or plastic	NA	ASAP
Paint filter liquids	filtration	9095A	Glass or plastic	NA	ASAP

Table 4.7

Requirements for Containers, Preservation, Holding Times, and Recommended Sample Volumes for Toxicity Characteristics Leaching Procedure, TCLP, Method 1311, and Synthetic Precipitation Leaching Procedure, SPLP, Method 1312, Published in SW-846 Test Methods for Evaluating Solid Waste, Third Edition, Update 3, December 1996.

Sample Maximum Holding Times				
Parameter	**From: Field collection To: TCLP Extraction**	**From: TCLP Extraction To: Preparative Extraction**	**From: Preparative extraction To: Determinative Analysis**	**Total elapsed time in days**
Volatiles	14	NA	14	28
Semivolatiles	14	7	40	61
Mercury	28	NA	28	56
Metals, no Hg	180	NA	180	360

Exceeding the holding time is not acceptable in establishing that a waste does not exceed the regulatory level. Exceeding the holding time will not invalidate characterization if the waste exceeds the regulatory level.

Holding time associated with the ASTM leachate generation method (D3987-85) is 14 days from collection to leachate generation, i.e. filtration, then the method holding time to preparation and/or analysis.

Figure 4-1

GLASSWARE/COOLER ORDER FORM

DATE:______________	DATE NEEDED BY CLIENT:__________ (circle one) AM PM
REQUESTED BY:______________	**SHIP VIA:_____ (circle one) NDA NDAS 2nd DAY AM 2nd DAY AIR 3 DAY GROUND
CLIENT:______________	PROJECT ID:______________
ADDRESS:______________	COOLER #s______________
______________	
______________	
______________	
PHONE #:______________	

BOTTLES PER ANALYSIS

Number of Samples*	Parameters Needed	Container	Bottle Lot Numbers	Pres	Preservative Lot Number	Total Bottles

* includes QC

Circle items needed: Coc's Labels Seals ____TB's / carboy#____ ____Liters DIH2O / carboy#____

Additional items:____

Prepared by/date:______________________

** NDA = NEXT DAY AIR (by 10:30AM); NDAS = NEXT DAY AIR SAVER (by 3:00PM); 2nd DAY AM = 2nd DAY AIR AM (by 10:30AM); 2nd DAY AIR = 2nd DAY AIR (by 3:00PM); 3 DAY = 3 DAY SELECT (by 3rd DAY PM); GROUND = GROUND 3-5 DAYS (SLOW BOAT)

Figure 4-2

Sample Collection and Preservation Guidelines

Preservatives must be added in the field at the time of sample collection unless glassware are already pre-preserved. Preservatives should be recorded on the Chain-of-Custody form in the "Remarks" column on a per sample basis. For certain methods and parameters, the laboratory verifies upon receipt that the sample pH falls within an acceptable range. Improperly preserved samples or samples with pH values outside of the specified range are noted in the sample receiving documentation. The client is contacted and given the option of resampling, directing the laboratory to preserve the sample in-house, or processing the sample as it was received. To document the action taken, a Quality Assurance Notice is included in the data report for any occurrence.

When obtaining aqueous samples for the determination of volatile organics, the collector should ensure the absence of headspace by filling the 40-ml bottle to the top. This procedure should produce a positive meniscus across the surface of the vial. The Teflon-lined septum should be placed gently over the sample surface, with the Teflon side down, and the top screwed firmly on over the septum. A proper seal should be verified by inverting the sealed bottle and gently tapping on the sides with your finger, ensuring that no air bubbles appear.

The collector should designate which samples are to be used for Quality Control. For these designated samples, the recommended sample weight or volume should be doubled. If sufficient sample is not available to the laboratory, QC requirements may not be achievable. Excess sample will unnecessarily increase shipping costs.

Guidance on the EPA SW8-46 Method 5035 for the Closed System Purge and Trap and Extraction for Volatile Organics in Soil and Waste Samples.

CompuChem has the capabilities and supplies to provide any of the Method 5035 options. Because of some disadvantages, we favor the use of disposable EnCore™ samplers, with zero headspace design, for the collection of soil samples for volatile analysis. The EnCore™ sampler is available in 5g and 25g sizes. Some regulatory agencies may mandate using the 5g size. Three 5g EnCore™ samplers, with a 2 ounce jar for percent moisture, would be required per sampling site to include:

- a 5g aliquot for the sample analysis
- a 5g aliquot as a back-up for the sample analysis
- a 5g aliquot for a methanol extraction used for screening and/or a high concentration analysis
- a 2 oz. aliquot for a % moisture determination

In most cases, the methanol aliquot (containing surrogates) will be used for screening purposes. Based on those results, other tests will be performed. Once aliquots of the soil sample, taken from the EnCore™ sampler, are added to vials containing preservative, the remainder of the 14 day holding time is available.

During the initial transfer of sample aliquots to the vials containing the sodium bisulfate preservative solution, the presence of carbonates will be identified due to the observed effervescence. If this occurs, a 5g aliquot of sample will be transferred to a vial containing only water. The sample will be immediately sealed and analyzed as soon as possible but no later than 48 hours from preparation. Alternatively, the analysis will be conducted on the methanol-preserved aliquot. For effervescence, with the client's approval, another option is to freeze the contents of the EnCore.™ Freezing the contents of

Encore™ samplers in closed system purge and trap vials with or without the addition of water is also allowed by some EPA Regions and other regulatory agencies. The laboratory project manager conveys this type of information directly to the laboratory upon sample receipt. Advantages of use of the EnCore™ include:

- No need to take or use a balance in the field
- No exposure of field personnel to corrosive sodium bisulfate or flammable/toxic methanol
- No additional shipping paperwork or cooler labeling
- No need to use the costly closed system purge and trap vials in the field
- No chance of volatile sample container breakage during shipment
- Significant decrease in man-hour requirements to complete the field sampling efforts

Figure 4-3

Cooler Label

CompuChem
a division of Liberty Analytical Corporation

501 Madison Avenue
Cary, North Carolina 27513

Phone #(919) 379-4100

Please return cooler to the above address.

Custody Seal

CompuChem
a division of Liberty Analytical Corporation

CUSTODY SEAL

Person Collecting Sample______________________________ Sample No.________________
(signature)

Date Collected____________________________________ Time Collected________________

Figure 4-4

Instructions for Bottles, Refrigerant, and Sample Collection Records

CompuChem
a division of Liberty Analytical Corporation

Bottles:

- Do not open any bottles until you actually put your sample in them—this prevents contamination.
- Do not substitute your own bottles or interchange any lids or labels on our bottles.
- Repack all bottles we provided, especially the plastic bottles in the center. Otherwise, bottle breakage may occur.
- Do not rinse our bottles prior to sample collection. Rinsing will contaminate them and remove preservative. Some states may require that non-preserved containers be rinsed with sample water before collection.

Blue Ice Substitute

- A wet ice slurry is ideal for sample collection and the use of blue ice is discouraged and not allowed by some state certifying bodies. Florida requires samples be cooled on wet ice to 4° C before packing.
- If you must use blue ice, freeze in a standard freezer for at least 12 hours and no more than 18 hours prior to sampling. *Do not freeze the blue ice using dry ice. This freezes your sample and breaks bottles.*
- Do not freeze the sample itself.
- Please repack the blue ice (with red caps upward). Otherwise, your sample results will not be accurate or bottle breakage may occur during shipment.

Sample Records

- Three types of labels will be supplied. Included will be: a return label, Custody seals, and a sufficient number of sample identification labels. On the sample identification labels, please indicate the analysis code you have ordered and your sample identification. If the sample ID is more than nine characters it will be truncated, due to computer software limitations, and explained in the SDG narrative. Affix these labels to the appropriate sample containers.
- A Chain-of-Custody record and client information sheet are also provided. The analysis code ordered as well as the volume requirements will be stated on the client information sheet.
- Provide as much identifying information about your company and your sample identity as possible. CompuChem processes thousands of samples a year—often from several plants within several divisions of the same company, all at the same time!

If you have any other questions, please call your customer service representative at 1-800-833-5097.

Figure 4-5

Permit to Receive Soil

Soil Permit

Permit Number: S-40886 Revised

UNITED STATES DEPARTMENT OF AGRICULTURE

Animal and Plant Health Inspection Service

Plant Protection and Quarantine

Issued To: Compuchem, A Division of Liberty Analytical
(Robert E. Meierer)
501 Madison Avenue
Cary, North Carolina 27513

TELEPHONE: (919) 379-4000

Under the authority of the Federal Plant Pest Act of May 23, 1957, permission is hereby granted to the facility/individual named above subject to the following conditions:

1. Valid for shipments of soil not heat treated at the port of entry, only if a Compliance Agreement (PPQ Form 519) has been completed and signed. Compliance Agreements and Soil Permits are non-transferable. If you hold a Soil Permit and you leave your present employer or Company, you must notify your local USDA office promptly. A copy of this permit must accompany all shipments.
2. To be shipped in sturdy, leakproof, containers.
3. To be released without treatment at the port of entry to permittee or authorized user.
4. To be used only for analysis and only in the facility of the permittee at Compuchem, located in Cary, North Carolina.
5. No use of soil for growing purposes is authorized, including the isolation or culture of organisms imported in soil.
6. All unconsumed soil, containers, and effluent is to be autoclaved, incinerated, or heat treated by the permittee at the conclusion of the project as approved and prescribed by PPQ.
7. This permit authorizes shipments from all foreign sources, including Guam, Hawaii, Puerto Rico, and the U.S. Virgin Islands through any U.S. port of entry.

MARCH 31, 2009
Expiration Date

Lia Stewart
Approving Official LIA STEWART

WARNING: Any alteration, forgery, or unauthorized use of this Federal form is subject to civil penalties of up to $250,000 (7 U.S.C. s 7734(b)) or punishable by a fine of not more than $10,000, or imprisonment of not more than 5 years, or both (18 U.S.C. s 1001).

PPQ FORM 525B (8/94)

PART 1 - PERMITTEE

Figure 4-6

Soil Sample Cooler Restricted Entry Label

CompuChem
a division of Liberty Analytical Corporation

In order to remain in compliance with current United States Department of Agriculture regulations regarding the importation of soil samples of foreign origin into the Unites States for subsequent analysis, it is necessary to affix the attached USDA labels to every soil sample that is expected to enter the U.S.A. Each label should be placed in a highly visible position on the exterior surface of every cooler being sent. Failure to comply with this regulation can result in transportation delays and denials.

U.S. DEPARTMENT OF AGRICULTURE
ANIMAL AND PLANT HEALTH INSPECTION SERVICE
PLANT PROTECTION AND QUARANTINE
4700 RIVER RD., UNIT 136
RIVERDALE, MD 20737-1236

SOIL SAMPLES
RESTRICTED ENTRY

The material contained in this package is imported under authority of the Federal Plant Pest Act of May 23, 1957.

For release without treatment if addressee is currently listed as approved by Plant Protection and Quarantine.

PPQ FORM 550
(MAR 95)

☆U.S.GPO: 1995—621-030

5.0 Sample Handling

This section summarizes policies and practices for sample handling. Further details are contained in SOPs. If any discrepancy is noted at sample receipt or if there is any question about the sample's suitability for testing, the Project Manager or Customer Service Representative contacts the client for instructions on how to proceed. The condition of the samples is recorded on the Chain of Custody (COC) record, on the sample log-in form, and in the final report.

5.1 Sample Acceptance Policy

CompuChem's sample acceptance policy outlines the circumstances under which samples will be accepted by the laboratory. Data that do not meet the policy are noted in the laboratory report defining the nature and substance of the variation. Samples received by the laboratory for analysis require the following:

- Proper, full, and complete documentation, including:
  - unique sample identification,
  - location, date and time of collection,
  - collector's name,
  - preservation type,
  - matrix
  - analytical method
  - special remarks concerning the sample

- Sample identified using durable label completed in indelible ink
- Proper preservation
- Intact, undamaged sample container
- Adequate sample volume
- Appropriate receipt temperature
- Receipt within holding time

It is the laboratory's policy to accept all samples including those that do not meet the requirements listed above. However, in cases where these requirements are not met, the project manager contacts the SMO (who contacts the EPA Region) or the client via telephone or e-mail indicating any receiving issues. The laboratory will proceed with analysis or reject the sample as advised by the client or EPA Region.

5.2 Sample Tracking

CompuChem uniquely identifies each sample to be tested, to ensure that there can be no confusion regarding identity. The sample identification system includes identification for all samples, sub-samples and subsequent extracts and/or digestates. A unique identification (ID) code is automatically assigned by the LIMS. A label is printed and affixed to the sample container.

Internal COC records accompany raw samples from the cooler to the laboratories and back, extracts and digestates to the instrument labs from preparation, and are part of the data deliverables depending on the report style requested by the client.

5.2.1 Bench Log-In Procedure

The following steps are completed by the Receiving Clerk and Sample Custodian for all samples when received by CompuChem. If for any reason a sample requires special handling, the Project Manager is consulted for instructions for processing and documentation. Completed COC forms are part of the data deliverables.

Each employee is required to wear protective clothing (lab coat, safety glasses, and gloves) at all times when working in the hood with samples. Upon receipt, the condition of the sample, including any abnormalities or departures from standard condition is observed and recorded. Each container is opened carefully under the fume hood and inspected for damage and integrity. For those clients using padlocks, sealing tape, or custody seals, these items are inspected to make sure that they are intact and this observation is recorded on the COC form (Figure 5-1). If the custody seals, tapes, or padlocks are broken, a project manager contacts the client for instructions as to how to proceed.

The condition of the refrigerant (whether any ice remains or whether the cooling packs, if present, are solid) is checked. The temperature of a representative sample, taken from the middle of the cooler, or of the temperature blank, when present, is obtained by means of an infrared (IR) gun. The temperature is taken while the sample is still inside the cooler. The temperature is recorded on the log-in sheet and on the COC. All samples requiring thermal preservation are considered acceptable if the arrival temperature is either within +/- 2 degrees C of the required temperature (4 degrees C) or the method-specified range. The acceptable range for the State of North Carolina DENR is 2°-4.4°C. Samples that are hand delivered to the laboratory immediately after collection may not meet criteria. In these cases, the samples will be considered acceptable if there is evidence that the chilling process has begun, such as arrival on ice. A Quality Assurance notice is completed and clients contacted for samples that exceed temperature requirements.

Samples are checked for breakage and removed from the shipping container. The sample identification information on the sample bottles is compared to the sample information on the traffic report, packing slip, and Chain-of-Custody form included in the container. If discrepancies exist, the problem is noted on the COC form; the receiving clerk notifies the Project Manager.

Each 40 mL vial for volatile analysis is checked for air bubbles and headspace. Findings are noted on the Chain-of-Custody and on the log-in-sheet. A bubble up to the size of a pea is permitted.

Incoming EPA samples are checked against SMO scheduled receipts. Samples are logged in on the log-in-sheet using either an organic or inorganic EPA Receiving Log sheet (Figures 5-2 and 5-3) for EPA samples and the following items are noted:

- Case number/SDG
- CompuChem ID number (CC#)
- client name or order number
- temperature
- field ID (Sample ID)
- receiving date (RD)
- sampling date (SD)
- test codes
- matrix
- volume received
- pH of inorganic samples
- residual chlorine and sulfide check for cyanides and phenols
- residual chlorine check for all organic parameters, TKN, and ammonia, when required

Additional preservation checks include a residual chlorine check performed for cyanide and phenol samples and samples requiring Method 625 analysis. A sulfide check is performed for cyanide and phenol samples. The pH is verified for inorganic samples and samples requiring analysis by Method 608 using test strips and a small aliquot of sample dripped onto the strip with a disposable pipette. If a sample has not been properly preserved, the client is notified and a standard QA notice (Figures 5-4 through 5-9) is completed and placed in the sample file. The results are documented on the log-in sheet and on the COC.

On each complete EPA COC, Traffic Report, and commercial client COC a statement as to the condition of samples upon receipt is documented. "Good Condition" indicates that the sample cooler was received with the custody seal intact and the sample or samples were received intact with all associated documentation. If there are any discrepancies in the documentation or other problems, the exceptions are noted on the appropriate documents, initialed and dated.

The statement `Received in Good Condition' does not include sample temperature since EPA samples may be received at temperatures above the recommended 4°C. The temperature is noted on the sample log-in sheet and COC. Each log-in sheet and COC is reviewed by the Receiving department supervisor or designee, who ensures that all information is properly documented. Each is signed as having been reviewed, initialed, and dated.

All COC and log-in sheets are forwarded to the Project Manager for the completion of the LIMS log-in procedures. Samples that must be preserved by refrigeration do not remain un-refrigerated for more than two hours. If the completion of order entry is delayed, the samples are wheeled into the cooler until labels are generated and the process can be completed.

5.2.2 Computer Log-in Procedure

For EPA and commercial samples, the Project Manager or designee enters the account data into the client setup section of the LIMS to generate the client's profile. This profile contains a listing of all requested analysis codes and project specific information.

The sample information is entered into the sample receipt portion of the LIMS in order to generate a CompuChem number (CCN) for each sample. A CCN is a unique laboratory identifier that consists of the work order number and a numerical suffix. EPA case and SDG numbers are associated with a specific work order number. The CCN is added to the log-in sheet and the original COC form next to the client ID if possible. QC samples associated with an SDG are also assigned a unique laboratory identifier.

Sample labels print in numerical sequence based on the number of bottles received for each sample ID. The labels contain the CCN, client ID, receipt date, container ID, container type, preservation, and any special lab instructions. Samples are labeled by wrapping each sample bottle with its unique computer-generated label (Figure 5-10), leaving the field label exposed if possible.

The labeled samples are transferred to the appropriate cooler. Samples to be analyzed for extractable organics and soil inorganics are stored in cold storage units separate from samples to be analyzed for purgeable organics. For ILM05.3, aqueous inorganic samples need to be refrigerated. Standards are always stored in separate refrigerated storage units in the analytical laboratories. Aqueous inorganic samples, except for hexavalent chromium and ILM05.3 aqueous inorganics, are stored separately at room temperature.

File envelopes are used to assemble field and QC sample information for report preparation. EPA envelopes contain all information for the case including: the yellow copy of the Organic Traffic Report (OTR), a copy of the COC, an original air bill, a copy of the log-in sheet, a copy of the EPA scheduling log, sample custody tags (if received), telephone logs, and "pull sheets" (internal chain of custody forms.) The envelope is stamped with the information in Figure 5-11. The white copy of the OTR is returned with the cover sheet to the EPA SMO. Commercial sample file folders contain the customer sample order information sheet and a copy of the COC record.

CompuChem sometimes receives raw samples from the EPA that should not have been sent to this location. These samples require a transfer. When this occurs, a new COC form is filled out using the information on the sample tags. Custody is relinquished to the courier by signing and dating the "Relinquished by" section of the COC form. A copy of the COC is kept and the original COC and paperwork are sent with samples. Notations are made on Traffic Reports that samples are being sent to another laboratory.

A work-order number is assigned to a group of samples according to client and matrix not to exceed 20 samples received together or over a period of 7 days. (A 14 day receipt may be used, per client request.)

In the event that client samples are received by the laboratory unexpectedly, a Project Manager or salesperson contacts the client documented on the sample chain-of–custody by phone. During that call the Project Manager or salesperson verifies the information documented on the COC such as the project name, parameters to be tested, test methods to be used, client contact person, date the data report is due, and the data reporting requirements. The Project Manager documents the client information and project requirements in the LIMS and proceeds with sample login.

For samples hand-delivered after business hours, the actual date of sample receipt is recorded on the COC. The date and time of sample receipt and sample condition are recorded on the OTR. "Hand-Delivered" is recorded on the COC and OTRs.

5.3 Storage Conditions

The sample custodians and the supervisor of the Receiving department are responsible for the security of the sample storage units. Sample preparation and off-shift personnel also have access to the sample storage units. A roster is posted on each sample cold storage unit in the receiving department identifying personnel authorized to access samples. Samples are requested from the receiving department by lab staff by completing an internal COC form (Figure 5-12).

Under the NELAC standards, samples requiring thermal preservation are stored under refrigeration at ± 2 °C of the specified preservation temperature. For samples with a specified storage temperature of 4°C, storage at a temperature above the freezing point of water to 6°C is considered acceptable. Samples are segregated and stored in a manner that prevents cross contamination.

5.4 Chain of Custody

5.4.1 Sample Custody

Chain of custody records are used to document the collection of field samples and the transfer of the samples to the laboratory. The COC forms remain with the samples during transport or shipment. If shipping containers and/or individual sample containers are submitted with sample custody seals, and any seals are not intact, it is noted on the original COC. Internal COC records are used to document the storage, possession, transfer and disposal of samples, sub-samples, sample extracts and digestates with the laboratory. The COC documents the identity of all individuals who physically handle samples and the time periods associated with the sample handling. Initials of individuals may be used since a cross-reference is maintained by QA that includes the initials and full names of all individuals signing COCs (except for work performed for the State of Florida, and other work when specified, where full signatures are required.) Any corrections to COC information must be made with black indelible ink by using a single horizontal line to strike through the incorrect entry, and dating and initialing the correct entry written adjacent to it. Access to all samples is controlled. The laboratory area is maintained securely and is restricted to authorized personnel only. The sample custodian relinquishes possession to the lab staff.

Depending on client and regulatory requirements, COC may originate at the time pre-cleaned sample containers are sent from the lab to the field, or when the sample containers are filled in the field and loaded into the coolers. New Jersey and Florida are two states that require COC initiation in the laboratory with the loading of pre-cleaned empty containers into the cooler and <u>before</u> shipment to the field. A representative of the Receiving department is responsible for initiating a glassware release COC in such cases.

An internal COC form is generated to accompany the physical transfer of the sample (including its extract or digestate) through the lab. Internal COCs, sample preparation and analytical worksheets, and instrument run logs are used to document the individuals handling the samples at all times. When the analysis is complete, the sample is returned to the sample custodian for log-term storage and disposal.

5.5 Sample Retention and Disposal

Unused raw samples are retained in a controlled temperature environment for 60 days after data submission to the client, or approximately 90 days after sample receipt. Extracts are stored refrigerated for one year after data submission. ILM05.3 requires a one year retention of metals digestates. Sample receipt and report dates are documented in the LIMS.

The sample custodian is responsible for purging raw samples from cold storage at the prescribed time. All samples, digestates, leachates, and extracts and other sample preparation products are disposed of in accordance with Federal and State laws and regulations. Sample identifications are recorded in designated Sample Disposal Logbooks at the time of purging (Figure 5-13.) Once segregated by the custodian, samples are processed for disposal by the hazardous waste technician. Client names are removed from bottles at the time of purging. If a sample is part of litigation, disposal of the physical sample occurs only with the concurrence of the client.

Figure 5-1

CompuChem
a division of Liberty Analytical Corp.
501 Madison Avenue
Cary, NC 27513
1-800-833-5097

CHAIN-OF-CUSTODY RECORD

No. 064578

Project Name :	Client Address :	Point-of-Contact :
Carrier :		Telephone No. :
Airbill No. :		Sampling complete? Y or N (see Note 1)
Sampler Name :	Sampler Signature :	Project-specific (PS) or Batch (B) QC ? _____

BOX #1	BOX #2	BOX #3	Box #4	Box #5
1. Surface Water 2. Ground Water 3. Leachate 4. Rinsate 5. Soil / Sediment / Sludge 6. Trip Blank 7. Oil 8. Waste 9. Other________	A. HCl + Ice B. HNO3 + Ice C. NaOH + Ice D. H2SO4 + Ice E. Unpreserved F. Ice Only G. Other__________ H. NaHSO4 + Ice I. ZnAc+NaOH + Ice	F. Filtered U. Unfiltered	H. High M. Medium L. Low	C. CLP 3/90 S. SW-846 W. CWA 600-series O. Other___________ T. TCLP

Sample ID (9 characters maximum)	Date:Year____	Time	Box #1 Matrix	Box #2 Preservative	Box #3 Filtered / Unfiltered	Box #4 Expected Conc.	Box #5 Method	No. of Bottles	Use for Lab QC (MS or DUP)	VOA	SVOC	Pesticide	PCB	Herbicide	Metals / Mercury	Cyanide	TOC / TOX	O&G / TPH					Remarks / Comments (see Notes 2 & 3)
	/	:																					
	/	:																					
	/	:																					
	/	:																					
	/	:																					
	/	:																					
	/	:																					
	/	:																					
	/	:																					
	/	:																					

Clients Special Instructions: Temperature_____°C

Lab: Received in Good Condition? Y or N Describe Problems, if any:

#1 Relinquished By: (Sig)	Date:	#2 Relinquished By: (Sig)	Date:	#3 Relinquished By: (Sig)	Date:
Company Name:	Time:	Company Name:	Time:	Company Name:	Time:
#1 Received By: (Sig)	Date:	#2 Received By: (Sig)	Date:	#3 Received By: (Sig)	Date:
Company Name:	Time:	Company Name:	Time:	Company Name:	Time:

Note (1): If "N" lab will hold samples to await remainder of project-maximizing batch size and minimizing QC ratio; if "Y" lab will begin processing batches now.
Note (2): Samples stored 60 days after date report mailed at no extra charge. Note (3): All lab copies of data destroyed after three years.

Figure 5-2

Page ____ of ____

CompuChem, a Division of Liberty Analytical Corp.- EPA ORGANIC RECEIVING LOG

Client / Account EPA	Rec'd Date	Comments:
Case No:	Courier	
Temp Blk in cooler? Yes / No	Airbill No.	
Temperature:		
Tags? Yes / No		
Custody Seals? Yes / No Intact? Yes / No		

COOLER REC'D BY:	REVIEWED BY:
Samples Logged in by:	SDG #:
Number of TR's?	Work Order No.:
Return Airbill in cooler? Yes / No	

No.	Sample No.	Client ID	QC	Matrix	Sample Date	Sample Time	T. VOC	VOC	VOC SIM	SVOC	SIM	PEST	AR	Amount/Containers
1														
2														
3														
4														
5														
6														
7														
8														
9														
10														
11														
12														
13														
14														
15														
16														
17														
18														
19														
20														

OrgRec.log.doc-02/24/06

Figure 5-3

Page ____of

CompuChem, a Division of Liberty Analytical Corp.- EPA INORGANIC RECEIVING LOG

Client / Account EPA	Rec'd Date	Comments:
Case No:	Courier	
Temp. Blk in cooler? Yes / No	Airbill No.	
Temperature:		
Tags? Yes / No		
Custody Seals? Yes / No Intact? Yes / No		

COOLER REC'D BY:	REVIEWED BY:
SAMPLE LOGIN:	SDG #:
Number of TR's?	Work Order No:
Return Airbill in Cooler? Yes / No	
Cyanide Samples checked for sulfide & chlorine? YES / NA	

No.	Sample No.	Client ID	QC	Matrix	Sample Date	Sample Time	Total Metals	Cyanide	Dissolved Metals	pH	Amount/Containers
1											
2											
3											
4											
5											
6											
7											
8											
9											
10											
11											
12											
13											
14											
15											
16											
17											
18											
19											
20											

InorgRaclog.doc-03/01/06

Figure 5-4

CompuChem
a division of Liberty Analytical Corporation

QUALITY ASSURANCE NOTICE

CompuChem ID # ______________
Client ID # ______________
Case # ______________
Type of Analysis ______________
Receipt Date ______________

A chlorine and sulfide check was performed on the above cyanide sample

The results are checked below.

Chlorine was detected ____
Sulfide was detected ____

A CompuChem customer service representative contacted the client. The client instructed the Receiving department to:

Analyze - qualify with notice ______

Dispose - client will resample ______

Supervisor Signature/ID ____________________/________

Date ___________

QAN-R-1
971022

Qanr1 – 10/22/97:llc

Figure 5-5

CompuChem
a division of Liberty Analytical Corporation

QUALITY ASSURANCE NOTICE

CompuChem ID # ____________
Client ID # ________________
Case # ____________________
Type of Analysis ____________
Receipt Date _______________

The pH reading for the sample above was _______: the required pH level is _______.

A CompuChem Project Manager contacted the client who instructed the laboratory to:

Preserve in-house _______

Note: For samples preserved in house, certain clients require that the maximum amount of preservative added to a sample in an SDG also be added to the associated field or equipment blank. If neither blank is present, the appropriate laboratory must be notified so the proper amount of preservation can be added to the method blank.

Analyze - qualify with notice ______

Dispose - client will resample ______

Subcontract lab to preserve ______

Project Manager______________________ Date ______________________

Preservation Type______________________ Preservative Lot Number__________

Preserved By__________________________ Date______________________

QAN-R-2
020529

QAN-R-2:052902:llc

Figure 5-6

CompuChem
a division of Liberty Analytical Corporation

QUALITY ASSURANCE NOTICE

Client ____________________
Case # ____________________
Type of Analysis ______________
Receipt Date _________________

For some organic and/or inorganic determinations temperature preservation at 4 degrees Celsius is required for environmental samples during shipment to the laboratory and prior to analysis. A temperature tolerance range is generally allowed. Temperature of a representative sample from the shipping container is taken and recorded by the receiving clerk at the time of sample receipt. This temperature is representative of all samples contained in the cooler. The EPA CLP program requires the laboratory make notification when the temperature exceeds 10 degrees Celsius. The State of North Carolina allows a range of 2-4.4° Celsius. Notification to other clients is either client or project dependent.

Samples that are hand delivered to the laboratory immediately after collection may not meet this criteria. In these cases, the samples shall be considered acceptable if there is evidence that the chilling process has begun, such as arrival on ice.

The temperature of this sample at the time of receipt was determined to be ______.

A CompuChem customer service representative contacted the client. The client instructed the Receiving department to:

Hand Delivery/Received on ice ______

Analyze - qualify with notice ______

Dispose - client will resample ______

Supervisor Signature/ID ____________________/_______ Date __________

QAN-R-3
020205

qanr3 – 2/5/02:dce

Figure 5-7

CompuChem
a division of Liberty Analytical Corporation

Quality Assurance Notice

CompuChem ID#________________
Client ID#____________________
Case #_______________________
SDG# _______________________
Receipt Date__________________
Method______________________

A chlorine check was performed on the above phenol sample and was determined to be present. A member of CompuChem's Customer Service Department contacted the client. The Receiving Department was instructed as follows:

Analyze – Qualify with notice and address in narrative: _________
Dispose – Client will resample: _________

Supervisor Signature/ID __________________________/_________

Date ________________

QAN-R-4
010702

Qanr4 – 07/2/01:dcc

Figure 5-8

CompuChem
a division of Liberty Analytical Corporation

Quality Assurance Notice

Case # ____________________ SDG# ____________________
Receipt Date ____________________ Matrix ____________________

In the USEPA Contract Laboratory Program (CLP) "Statement of Work for Organic Analysis, Multi-Media, Multi-Concentration (Document Number OLM04.3, OLC03.2 and SOM01.1),"directions are provided dealing with a temperature blank, termed the USEPA Cooler Temperature Indicator.

If a cooler temperature indicator bottle is not present in the cooler, the laboratory is required to contact the Sample Management Office (SMO), inform them of that fact and use an alternative means of determining the cooler temperature.

The following is a list of options employed by CompuChem to determine the cooler temperature. For the Case/ SDG presented above, the option(s) used have been indicated by a check mark.

Note: Any of the options performed are done so immediately after the cooler has been opened and the determination made that the cooler temperature indicator bottle is absent.

Water Samples
___An aliquot from a sample bottle designated for extractable organics is poured into a disposable container, a thermometer is inserted into the disposable container, and the temperature is taken and recorded after a 3-minute equilibration period. The contents of the disposable container are then properly discarded.

___A calibrated IR temperature gun is focused onto a sample container, contained in the cooler, and after a minimum of 5 seconds, a temperature reading is taken and recorded.

Soil Samples
___A calibrated IR gun is used, as indicated for water samples.
___A temperature strip is affixed to the outside of a sample container and, after one minute, the temperature is read and recorded.

As required by the organic SOW, the alternative technique used to determine the cooler temperature must be documented in the SDG Narrative.

Signature____________________
Date____________________

QAN-R-5
011324

Qanr5 – 11/15/05:vr

Figure 5-9

CompuChem
a division of Liberty Analytical Corporation

Quality Assurance Notice

Case # ______________________________SDG# ______________________________
Receipt Date _________________________Matrix ______________________________

In the USEPA Contract Laboratory Program (CLP) "Statement of Work for Inorganics Analysis, Multi-Media, Multi-Concentration (Document Number ILM04.1 and ILM05.3),"directions are provided dealing with a temperature blank, termed the USEPA Cooler Temperature Indicator.

If a cooler temperature indicator bottle is not present in the cooler, the laboratory is required to contact the Sample Management Office (SMO), inform them of that fact and use an alternative means of determining the cooler temperature.

The following is a list of options employed by CompuChem to determine the cooler temperature. For the Case/ SDG presented above, the option(s) used have been indicated by a check mark.

Note: Any of the options performed are done so immediately after the cooler has been opened and the determination made that the cooler temperature indicator bottle is absent.

Water Samples
___An aliquot from a sample bottle is poured into a disposable container, a thermometer is inserted into the disposable container, and the temperature is taken and recorded after a 3-minute equilibration period. The contents of the disposable container are then properly discarded.

___A calibrated IR temperature gun is focused onto a sample container, contained in the cooler, and after a minimum of 5 seconds, a temperature reading is taken and recorded.

Soil Samples
___A calibrated IR gun is used, as indicated for water samples.
___A temperature strip is affixed to the outside of a sample container and, after one minute, the temperature is read and recorded.

As required by the inorganic SOW, the alternative technique used to determine the cooler temperature must be documented in the SDG Narrative.

Signature______________________________
Date__________________________________

QAN-R-6
011023

Qanr6 – 11/15/05:vr

Figure 5-10

Bottle Label

175015
Rec'd: 12/09/03
Container ID: 175015-6
Client ID: FB120503
Container Type: 500ML_PL
Preservative: COOL 4C
PPS 954**VOC=NECTEX.SUB

175015

Figure 5-11

Gray Folder Label

EPA CASE #s

EPA SAMPLE #s

C/C SAMPLE #s

DATE RECEIVED

AIRBILL INCLUDED: (   )

SAMPLES DELIVERED BY CUSTOMER: (   )

CHAIN OF CUSTODY: (   )

TAGS RECEIVED: (   )

COOLER RECEIVED SEALED: (   )

SAMPLES RECEIVED BELOW 4 C: (   )

Figure 5-12

CompuChem a Division of Liberty Analytical
INTERNAL CHAIN OF CUSTODY

Laboratory: ______________________ Requested By: ____________________

Water _____ Soil _____ P.E. _____ Date: _________ Shift: 1 2 Sat (circle one)

EPA ________ Commercial ________ Time: __________

	SAMPLE NUMBER	RECEIPT DATE	PRES.	PARAMETER	RECEIVING USE ONLY BOTTLE NUMBER
1					of
2					of
3					of
4					of
5					of
6					of
7					of
8					of
9					of
10					of
11					of
12					of
13					of
14					of
15					of
16					of
17					of
18					of
19					of
20					of

Relinquished By: Date: Received By: Date: Reason:

Relinquished By: Date: Received By: Date: Reason:

Relinquished By: Date: Received By: Date: Reason:

Comments: ____

lc1 - 6/25/01:doc

Figure 5-13

CompuChem, a Division of Liberty Analytical

SAMPLENUM	CONTAINERTYPE	BOTTLES	MATNUM	RECEIVEDATE
A0243-14	8oz jar	1	SO	7/21/01 0:00
A0243-15	8oz jar	1	SO	7/21/01 0:00
A0243-16	8oz jar	1	SO	7/21/01 0:00
A0243-17	8oz jar	1	SO	7/21/01 0:00
A0243-18	8oz jar	1	SO	7/21/01 0:00
A0243-19	8oz jar	1	SO	7/21/01 0:00
A0243-20	8oz jar	1	SO	7/21/01 0:00
A0251-3	amber liter	1	WA	7/21/01 0:00
A0251-4	amber liter	1	WA	7/21/01 0:00
A0265-1	8oz jar	1	SO	7/21/01 0:00
A0265-2	8oz jar	1	SO	7/21/01 0:00
A0265-3	8oz jar	1	SO	7/21/01 0:00
A0265-4	8oz jar	1	SO	7/21/01 0:00
A0265-5	8oz jar	1	SO	7/21/01 0:00
A0265-6	8oz jar	1	SO	7/21/01 0:00
A0265-7	8oz jar	1	SO	7/21/01 0:00
A0265-8	8oz jar	1	SO	7/21/01 0:00
A0265-9	8oz jar	1	SO	7/21/01 0:00
B09P8-1	amber liter	1	WA	7/21/01 0:00
B09P8-2	amber liter	1	WA	7/21/01 0:00
B09P8-3	amber liter	1	WA	7/21/01 0:00
C0098-10	40ml vial	1	WA	7/21/01 0:00
C0098-11	40ml vial	1	WA	7/21/01 0:00
C0098-12	40ml vial	1	WA	7/21/01 0:00
C0098-13	40ml vial	1	WA	7/21/01 0:00
C0098-14	40ml vial	1	WA	7/21/01 0:00
C0098-15	40ml vial	1	WA	7/21/01 0:00
C0098-16	40ml vial	1	WA	7/21/01 0:00
C0098-17	40ml vial	1	WA	7/21/01 0:00
C0098-4	40ml vial	1	WA	7/21/01 0:00
C0098-5	40ml vial	1	WA	7/21/01 0:00
C0098-6	40ml vial	1	WA	7/21/01 0:00
C0098-7	40ml vial	1	WA	7/21/01 0:00
C0098-8	40ml vial	1	WA	7/21/01 0:00
C0098-9	40ml vial	1	WA	7/21/01 0:00
MC0GK7-1	8oz jar	1	WA	7/21/01 0:00
MC0GK7-1	plastic liter	1	WA	7/21/01 0:00
MF0DY2-3	8oz jar	1	WA	7/21/01 0:00
MF0DY2-3	plastic liter	1	WA	7/21/01 0:00
MF0DZ5-14	4oz jar		SO	7/21/01 0:00
MF0DZ5-14	8oz jar	1	SO	7/21/01 0:00
MF0DZ5-14	plastic liter	1	SO	7/21/01 0:00
MF0DZ5-15	4oz jar		SO	7/21/01 0:00
MF0DZ5-15	8oz jar	1	SO	7/21/01 0:00
MF0DZ5-15	plastic liter	1	SO	7/21/01 0:00
MF0DZ5-16	4oz jar		SO	7/21/01 0:00
MF0DZ5-16	8oz jar	1	SO	7/21/01 0:00
MF0DZ5-16	plastic liter	1	SO	7/21/01 0:00

Relinquished by coolers 1, 2A, 2B, 3, 4, 5 and ambient storage

Received by ________ **Date** 10/1/2 **for disposal**

6.0 Reference Standard Preparation and Instrument Calibration

6.1 Standard Preparation and Storage

Reference standard solutions including those used for both sample preparation and instrument calibration are prepared by individuals within the various laboratory sections.

Standards are purchased as neat materials and concentrated solutions and are diluted to intermediate and working standards. The frequency of standard preparation varies with method requirements, stability and rate of consumption.

With the exception of organic CLP standards, standard preparations are verified with the analysis of initial calibration verification standards prepared using a different source or standard lot than that used to prepare the initial calibration.

Standard storage conditions vary depending on the method requirements and vender recommendations. Most of the standards used for organic analyses are stored at 2 to 4 °C to meet the state of North Carolina regulatory requirements. All standards used for volatile organic analyses are stored at –10 to –20°C. Standards used for inorganic analyses are stored at room temperature.

6.2 Analytical Support Equipment

Analytical support equipment includes balances, ovens, refrigerators, freezers, water baths, thermometers, and volumetric dispensing devices (such as Eppendorf®, or dilutor/dispensing devices, if quantitative results are dependent on their accuracy). All support equipment is maintained in proper working order. The records of all activities, including service calls, are retained.

Prior to use on each working day balances and ovens are checked with NIST traceable references in the expected range of use and documented. Acceptance criteria are documented in the applicable logbook.

The temperatures of cold storage units containing samples (including sample extracts and digestates) are monitored daily. Cold storage units containing reference standards are monitored on the lab's normal days of operation. Monitoring is documented in the applicable logbook.

Balances are calibrated semiannually by a qualified outside service organization over the entire range of use. Balance calibrations are verified each day of use with certified Class-S (NBS circular 547 or ASTM E617 Class 1 and 2) weights.

All thermometers are calibrated annually against a NIST-certified thermometer. The NIST-certified thermometer is calibrated annually at both the ice point and boiling point. The infrared (IR) gun is used to measure sample temperatures upon receipt and is calibrated quarterly.

Automatic pipettes are calibrated monthly by weighing three aliquots of water dispensed into a container and calculating the accuracy of the pipettes.

If calibration criteria are not met, the equipment is removed from service until repaired or replaced.

6.3 Instrument Calibration

Instruments used in the analysis of samples must be calibrated at regular intervals as specified by the analytical test method and manufacturer's recommendations. The calibration procedures, frequency, acceptance criteria, corrective actions and reference standards are specified in the applicable analytical SOPs.

For mass spectral analysis, tuning is required prior to calibration. Instrument calibration procedures for organic analysis consist of an initial calibration, initial calibration verification, and continuing calibration verification.

Instrument calibration procedures for inorganic analysis consist of (a minimum of) an initial calibration, initial calibration verification, initial calibration verification blank, continuing calibration verification, and continuing calibration verification blank. Continuing calibration verification is performed at a minimum of every ten sample analyses.

Initial calibration verification standard solutions are prepared using reference materials from a source other than that used to prepare the initial calibration.

Information relative to instrument calibration is documented in instrument run logs. This information includes instrument identification, data file names, standard lot numbers, analysis dates, analysis times, analyst identification, and calibration status. (Analysis times are not included in all instrument run logs.)

7.0 Test Methods and Standard Operating Procedures

CompuChem maintains Standard Operating Procedures (SOPs) that accurately reflect laboratory activities such as assessing data integrity, corrective actions, handling customer complaints, and all test methods. Procedures for test methods describing how the analyses are performed are specified in analytical SOPs and include sample preparation, cleanup and analysis. These are based on referenced methods published primarily by the EPA. Internally developed methods will be validated according to the EPA Performance-Based Measurement System, although none have been developed at this time. Method validation is discussed in Section 3.0. Controlled copies of SOPs are accessible to all personnel in each laboratory area as well as electronically on the company's intranet site. Each SOP indicates the effective date, revision number, and signatures of the person who initiates the revision and those who approve the revision.

SOPs are useful in training staff, in ensuring consistency among staff in performing procedures, and in saving time and effort. Any deviation from an established procedure is documented. The SOP collection is outlined in Table 7.1. A listing of methods performed at CompuChem and the corresponding SOPs is located in Section 2.0 of this manual.

7.1 SOPs for Test Methods

CompuChem's analytical procedures are divided into two categories, sample preparation procedures (SPPs) and instrument procedures (IPs). The Quality Assurance department controls SOP revision and distribution ensuring that only the most current approved procedures are documented and distributed for laboratory use. Documentation of procedures is critical to the assurance of data quality. These SOPs contain or reference to the following information:

- identification of the test method
- applicable matrix or matrices
- detection limit
- scope and application, including components to be analyzed
- summary of the method
- definitions
- interferences
- safety
- equipment and supplies
- reagents and standards
- sample preservation and storage
- quality control
- calibration and standardization
- procedure
- calculations
- method performance
- pollution prevention
- data assessment and acceptance criteria for quality control measures
- corrective actions for out-of-control data
- contingencies for handling out-of-control or unacceptable data
- waste management
- references
- tables, diagrams, and flowcharts,

7.2 Distribution Control of Standard Operating Procedures

SOPs are distributed by location and each lab area receives its own set of SOPs applicable to the procedures performed in the area. The complete set of original SOPs is maintained in the Quality Assurance department. A master copy of the complete set resides on the intranet and is available to all personnel in a read-only electronic format.

7.3 Document Control of Standard Operating Procedures

The Quality Assurance department is responsible for formalizing (editing, assigning document control information), distributing, and tracking all SOPs.

7.3.1 Creating and Revising SOPs

When laboratory staff draft a new SOP or a revision to an existing SOP, the individual must sign a SOP Documentation Form (Figure 7-1) and obtain approval and the signature of the supervisor or a qualified second party. This form, along with a copy of the SOP, is submitted to the QA department. After the SOP has been word processed by QA and has had document control information added, it is then distributed to the area in which it is used. All appropriate lab personnel read the SOP and sign the SOP Confirmation Form (Figure 7-2). The date that the SOP is distributed for use becomes the effective date of the SOP. The original, master, and controlled copies are generated and distributed to the appropriate locations. The SOP Confirmation Form is archived by QA.

7.3.2 Archiving SOPs

When a procedure becomes obsolete, the request is made to remove it from the SOP collection. The SOP is removed from the active SOP table of contents to the Archival SOP table. The SOP is then removed from each collection. Archived SOPs are maintained indefinitely on hardcopy record.

7.3.3 SOPs as Training Tool

New analysts are required to read SOPs pertinent to their job functions as part of their training. A SOP Signature Form is completed and signed by the employee and his/her immediate supervisor/manager to document that the employee has read the SOPs pertinent to his/her job function. Supervisors document various training aspects using checklists and most include a list of the required SOPs.

7.4 Document Control of the Quality Manual

The Quality Manual is revised and edited solely by the QA department. Revision numbers are provided with each update, and each section may be updated independently of others. There are controlled copies of the Quality Manual available to all laboratory staff. Quality Manuals that are sent off-site are for informational purposes only and are not controlled documents unless requested by the client. In that event, the issue is assigned a tracking number and a copy of the Quality Manual is sent to the recipient with each revision. On an annual basis, the Quality Manual is distributed laboratory-wide for all staff to read. Signature sheets are maintained to document this review.

7.5 Document Control of Laboratory Logbooks and Sample Preparation Worksheets

The QA department has primary responsibility for document and distribution control of over 100 logbooks used in the laboratory. To ensure document uniformity and compliance with NELAC standards, the U.S. EPA, good laboratory practices, and other certifying agency protocol, specific document control procedures are used for all laboratory logbooks and run logs.

Document control header information appears along the top of each logbook page and identifies the laboratory or administrative area, the logbook, and the issue number. Each logbook issue is consecutively paginated and permanently bound.

A logbook is developed cooperatively by the area manager and the QA department. The requestor submits a completed Logbook Request Form to the QA department. They confer to design a prototype logbook page that meets the needs of the laboratory and contains the key elements required by the QA department. These elements are:

- The identity of the task
- The name CompuChem, a Division of Liberty Analytical Corporation
- A "Reviewed by" signature field
- A date of review field
- Any applicable measurement acceptance ranges with instructions for reporting out-of-range readings
- A corrective action statement
- Model specifications for equipment
- Standard lot number fields

An alphanumeric identifier is assigned to each logbook. The laboratory notifies QA when the logbook is ready for archival. Before turning over the logbook issue to QA, the manager of the area in which the logbook is used or a designee must review the contents of the logbook and sign the Logbook Authorization form, which is the last bound page.

The laboratory staff must complete the logbooks with the proper quality details. Any changes made must not obliterate or overwrite the original entry. Personnel make a single strike through the entry and initial and date the correct entry that is made adjacent to the original. Correction tapes and fluids are not allowed when completing laboratory logbooks or other records.

When completed, the laboratory returns the logbook to QA for archival. The issue is then logged into the Logbook Archival Log and assigned to a unique box number. The logbook is then placed into the appropriate box for archival.

The QA department also maintains laboratory sample preparation worksheets which include the same elements as logbooks. Logbook pages are included as attachments in SOPs. These are not bound nor paginated for ease in photocopying for data reports. When completed the sample preparation staff return the worksheets to QA for archival.

The worksheets are then paginated and logged into the Worksheet Archival Log. The worksheets are assigned to a unique box number. The worksheets are then placed into the appropriate box for archival.

7.6 Records Retention and Purging

Archived laboratory records are stored on site for a period of five years, or longer per client request. (Data retention is 10 years for the Ohio Voluntary Action Program.)

7.7 Method Modifications

7.7.1 Total Organic Carbon in Soil -- Method 9060

The water method is adapted for soil matrices. Soil samples are analyzed using a boat sampler attachment in which the samples are introduced into an 800°C combustion zone, where all carbonaceous matter is oxidized to carbon dioxide. The carbon dioxide level is then determined using the non-dispersive infrared analyzer.

7.7.2 Aqueous Metals Digestion – Method 3010A

The block digestion technique utilizing an aqueous 50 ml sample aliquot, adjusted to a final volume of 50 ml, is used in the preparation procedure.

7.7.3 pH – Method 150.1

The method states that samples "should be analyzed as soon as possible preferably in the field at the time of sampling." Since the sample pH is measured in the laboratory, the method holding time cannot be met.

7.7.4 Oil and Grease—Method 9071A

The solvent evaporation step has been eliminated for analyses by the partition-infrared method.

7.7.5 Total Petroleum Hydrocarbons—Method 9071A

The solvent evaporation step has been eliminated for analysis by the partition-infrared method. Silica gel adsorbent is added to remove interferences.

Figure 7-1

CompuChem
Liberty Analytical Corp.

501 Madison Avenue
Cary, NC 27513

NELAP accredited

SOP DOCUMENTATION FORM

This form must accompany all new and revised Standard Operating Procedures (SOPs) when you turn them in to Quality Assurance for review. Please fill out the entire block below (except effective date).

This is a new procedure ______ revised procedure ______ outdated procedure (archive) ______

- Procedure Code:__________________ SOP Section #: ______________ Revision #:_____

SOP Title: Effective date: (QA fills in)

____ ________________

____

____

- Procedure prepared by: Date:

____ ________________

- Procedure approved by: (If the manager prepared the SOP, a qualified second party should sign) Date:

____ ________________

- Reason for change:____

____

- This procedure meets the requirements of the following approved method references:

____

____

____

Procedure approved by a QA Representative (unless QA Representative signed above):

____ Date:______________

On an annual basis: Lab managers are required to review lab practices and revise the SOP if necessary. If no revision is necessary, indicate by your signature that the SOP has been reviewed.

Annual Review—Signature: ____________________________ Date: ____________

Annual Review—Signature: ____________________________ Date: ____________

Annual Review—Signature: ____________________________ Date: ____________

Annual Review—Signature: ____________________________ Date: ____________

Sopdocform2-1/19/07: vr

Figure 7-2

SOP Confirmation Form

A new or revised version of the SOP documented below has been placed in your SOP collection. Take the time to read the procedure. For revised SOPs, new text is in **bold print**. After reading the new or revised procedure, sign and date this form in the spaces provided below. After all personnel that perform the procedure have signed this form, please return it to the Quality Assurance Department.

______________________________ ______________
Manager/Supervisor Signature Date

SOP Title: ____

____

Section # ______________

Rev. # ______ Area/Lab __________________________

Effective Date __________________
(QA fills in)

Department Signatures

I acknowledge review of the SOP documented above and agree to adhere to the procedures outlined in that document.

Printed Name	Signature	Date

Page 1 of 1

[illegible] – 11/2006.[illegible]

Table 7.1

SOP OUTLINE

ANALYTICAL STANDARD OPERATING PROCEDURES

1.0 Purgeable Organics
- 1.1 VOA GC
- 1.2 VOA GCMS CLP
- 1.3 VOA GCMS Non-CLP
- 1.4 VOA GCMS Miscellaneous

2.0 Extractable Organics
- 2.1 GC CLP
- 2.2 GC Non-CLP
- 2.3 HPLC
- 2.4 SV GCMS CLP
- 2.5 SV GCMS Non-CLP
- 2.6 Clean-up Procedures
- 2.7 Leachate Generation Procedures
- 2.8 Miscellaneous Preparation Procedures

3.0 Inorganics
- 3.1 Metals CLP
- 3.2 Metals Non-CLP
- 3.3 Mercury
- 3.4 Cyanide
- 3.5 Wet Chemistry
- 3.6 Organic Characterization

NON-ANALYTICAL STANDARD OPERATING PROCEDURES

4.0 Sample Control
5.0 Customer Services
6.0 Sample Scheduling
8.0 Organic Sample Preparation Laboratory
9.0 Inorganic Sample Preparation Laboratory
10.0 Glassware Preparation Room

Table 7.1 (continued)

OUTLINE OF NON-ANALYTICAL STANDARD OPERATING PROCEDURES

11.0 Instrument Laboratories
- 11.1 Purgeable Organics
- 11.2 Extractable Organics
  - 11.2.1 GC
  - 11.2.2 SV GC/MS
- 11.3 Inorganics
  - 11.3.1 Metals
  - 11.3.2 Wet Chemistry & Organic Characterization

12.0 Hazardous Waste Management & Safety

13.0 Quality Control

14.0 Data Review
- 14.1 Purgeables
  - 14.1.1 VOA GC and GC/MS

14.2 Extractable Organics
  - 14.2.1 GC
  - 14.2.2 SV GCMS
- 14.3 Inorganics
  - 14.3.1 Metals
  - 14.3.2 Wet Chemistry & Organic Characterization
- 14.4 Data Release, Storage &Archival

15.0 Computer Operations

16.0 Human Resources

17.0 Quality Assurance

8.0 Data Quality Indicators

The data acquired from quality control (QC) procedures are used to estimate the quality of the analytical data, determine the need for corrective action in response to identified deficiencies, and to assess the effectiveness of the corrective actions implemented. Each analytical SOP includes a QC section that documents the specific QC requirements for that procedure.

8.1 Quality Control Samples

8.1.1 Blanks

8.1.1.1 Method Blanks

Method blanks are prepared and analyzed at a rate of one per sample batch not to exceed 20 field samples, of the same matrix and test method. Method blanks are used to access the batch for possible contamination during sample processing. Samples associated with a blank that does not meet quality control acceptance criteria are re-prepared and analyzed.

8.1.1.2 Storage Blanks

Storage blanks are generated each day CLP SDGs are received for volatile analysis. These blanks are stored with each SDG and are analyzed after all samples in the SDG have been analyzed. The results of the storage blank indicate whether contamination occurred during sample storage. While storage blanks are required for CLP SDGs, they may also be associated with non-EPA client samples stored in the sample cold storage unit.

8.1.1.3 Trip Blanks

For volatile analyses, a blank is placed in each cooler that is delivered to the client for sample collection. The blank remains with the samples during transport to the lab for analysis. The results of the trip blank indicate whether contamination occurred during sample transport.

8.1.2 Laboratory Control Samples

A Laboratory Control Sample (LCS) is prepared and analyzed with each sample batch not to exceed 20 field samples. An LCS is not required for those analytes for which spiking solutions are not available such as pH. The LCS is used to assess whether the total analytical system is in control. The results of the LCS determine batch acceptance. Samples associated with an out of control LCS are re-prepared and analyzed.

8.1.3 Matrix Spikes

Matrix spikes are prepared and analyzed at the frequency required by the client, QAPP, or EPA region. **The compounds spiked should be specified in the**

client QAPP or EPA CLP SOW. Matrix spikes are used to assess the effect the sample matrix has on the precision and accuracy of the test method. The results of the matrix spikes are expressed in percent recovery and relative percent difference between duplicate matrix spikes. The results of the matrix spikes do not determine the acceptance of the sample batch.

8.1.4 Sample Duplicates

Sample duplicates are prepared and analyzed at the frequency required by the client, QAPP, or EPA region. The sample duplicate is used to assess the precision of the test method. The results of the sample duplicate do not determine acceptance of the batch. Matrix spike duplicates may be used as sample duplicates.

8.2 Surrogates and DMCs

Surrogates and DMCs are added to all samples, standards, and blanks for all organic analyses. The surrogate recoveries are used to assess preparation/extraction efficiency. Surrogate percent recovery acceptance criteria used by the laboratory are presented in the test method or are derived statistically by the laboratory. Surrogate failures may indicate poor extraction efficiency or matrix interferences. Field and QC samples that do not meet surrogate acceptance criteria are reanalyzed or re-prepared and analyzed.

8.3 Internal Standards

Internal standard solutions are added to all calibration standards and field and QC samples for mass spectral analyses. Internal standards are used to quantitate results. The laboratory's acceptance criteria for internal standard responses are those specified in the applicable analytical method.

8.4 Spiking Solutions

The compositions of spiking solutions used vary according to method and client requirements. Typically the solutions will contain all compounds of interest in a project and that are commercially available. For some clients (EPA Region) a representative subset of compounds may be used. Spike percent recovery criteria are presented in the test method or are derived statistically by the laboratory.

8.5 Calibration Verification

Initial instrument calibration verification is performed using a reference standard solution acquired from a second manufacturer or lot than the solution used for the initial calibration. Initial calibration verification is required for inorganic methods and organic non-CLP methods. The initial calibration verification (ICV) standard is analyzed after the initial calibration and generally before any samples are analyzed.

When an initial calibration is not performed on the day of sample analysis, the initial calibration is verified by the analysis of the continuing calibration verification (CCV) standard. If the solution used for the CCV standard is from a second manufacturer or lot, analysis of an ICV is not required.

8.6 Selectivity

Selectivity is evaluated by using the checks established within the analytical methods.

GC/MS and ICP-MS instrumentation is tuned to meet method requirements and these acceptance criteria are documented in SOPs.

Retention time window are established for GC analyses and second column confirmation is performed. Acceptance criteria for retention time windows are documented in SOPs.

Inter-element interference checks are analyzed for ICP and ICP-MS methods. Acceptance criteria are documented in SOP.

8.7 Quality Control Sample Management

The analytical and quality control requirements for each sample are documented in the LIMS. The LIMS uses a system of test codes to schedule the appropriate analytical procedures and the QC samples required for each work-order or sample delivery group (SDG). The test codes have the analytical methods associated with them and are assigned to each sample upon receipt. Product codes may be defined to allow for specific requirements of a client or Quality Assurance Project Plan (QAPP). Unique project requirements may also be documented in a project profile sheet.

8.7.1 Batching

8.7.1.1 Preparation Batch

A preparation batch is a group of no more than 20 field samples prepared (extracted or digested) together with a method blank. A Laboratory Control Sample (LCS) is also required for non-CLP samples.

8.7.1.2 Analytical Batch

An analytical batch is a group of no more to 20 samples, sample extracts, or sample digestates (including QC samples) that are analyzed together on the same instrument. For analyses that have no preparation step (volatiles), the method blank, LCS, matrix spike and matrix spike duplicate are included in the 20 samples.

9.0 Data Reduction, Review and Reporting

Computer software used for data reduction is validated before use. A test set of data, with manually calculated or previously validated results, is used to validate the new or revised software routine. Procedures for software validation are documented in SOPs. All data used in producing the final report are retained either as a hard copy or electronic file to insure that all results can be reproduced. These data include all instrument tune files, calibration files, sample files, QC sample files, standard preparation records, and sample preparation records. The following is a summary of the data review process. The analyst review responsibilities may vary slightly between the individual laboratory groups.

9.1 Data Review for Organic Analyses

Data collected by GC, GC/MS, and HPLC instrumentation software are transferred to Hewlett Packard UNIX servers for processing and review. The data is accessed by analysts and data reviewers through their personal intranet log-on.

All data are subjected to a three-tier review before being reported to the client.

The analyst documents all analyses on the instrument run log. The analyst insures that all tune, calibration, method blank, QC sample and field sample data met acceptance criteria. The analyst prints hard copies of the tune and calibration data generated by the instrument. The analyst signs (initials) and dates any manual integration he or she performed.

The data reviewer insures that all weights, volumes, and percent moistures are transcribed accurately into the raw data for calculation purposes. The data reviewer insures that the proper preparation and analysis methods have been used and that all the compounds of interest have been included in the analysis. The data reviewer insures that all tune, calibration, method blank, QC sample and field sample data met acceptance criteria. The data reviewer assesses the spectra of target and tentatively identified compounds. The data reviewer prints hard copies for all method blanks, QC samples and field samples included in the work-order/SDG. The data reviewer signs (initials) and dates the hard copy reports as well as any manual integration he or she performed.

Manual integrations are performed according to the procedures outlined in SOP 13.18 "Manual Chromatographic Peak Integration Procedures".

A senior level staff member or a supervisor performs the final review. The final reviewer insures that all weights, volumes, and percent moistures are transcribed accurately into the raw data for calculation purposes. The final reviewer prints hard copies of all report forms and generates any electronic data deliverable (EDD). The final reviewer summarizes the data in the work-order/SDG narrative documenting any anomalies in sample collection, receipt and analysis.

To meet the requirements of the Ohio VAP, the final reviewer must review all data files containing manual integrations.

9.2 Data Review for Inorganic Analyses

Metals data collected on the ICP and ICP-MS instrumentation software are transferred to the Metals Analytical Review and Reporting System (MARRS) for review and reporting. Wet Chemistry data collected on the Lachat instruments are transferred to LIMS for review and reporting. Wet Chemistry data not collected on the Lachat are manually entered into Excel spreadsheets by the analyst. The information entered into these spreadsheets is transferred to LIMS for reporting.

Data for inorganic parameters is subjected to a two-tier review before being reported to the client.

The analyst documents all analyses on the instrument run log. The analyst insures that all weights, volumes, and percent solids are transcribed accurately into the raw data for calculation purposes. The analyst insures that all calibration, method blank, QC sample and field sample acceptance criteria are met. The analyst insures that all raw data transcribed into spreadsheet is accurate.

A senior level staff member or a supervisor performs the final review. The final reviewer insures that all weights, volumes, and percent solids are transcribed accurately into the raw data for calculation purposes. The final reviewer insures that all calibration, method blank, QC sample and field sample acceptance criteria are met. The final reviewer prints all reporting forms and generates the EDD. The final reviewer summarizes the data in the work-order/SDG narrative documenting any anomalies in sample collection, receipt and analysis.

9.3 Data Reporting

It is CompuChem's policy to report data that meet all quality control criteria, to the extent possible. If deficiencies are identified at any point in the review process, corrective action is taken. Documentation of any corrective action or data qualification is done by the final reviewer in the narrative.

Each fraction is reviewed separately and the individual reports that make up the final report are produced. The final report is scanned, paginated, saved in a portable document format (pdf), printed and the pdf archived. The printed final report is sent to the client.

The final report format and detail are tailored to the specific client needs.

Figure 9-1 shows how data flows through the laboratory from sample receipt to final report.

9.4 Confidentiality

Results of sample analyses and associated raw data are reported to the customer who requested the analyses. Confidentiality is preserved to the extent possible when clients require transmission of test results via telephone, fax, and electronic mail.

A version of the following statement accompanies out-going fax and electronic mail correspondence:

> "This e-mail and any information contained or attached to this e-mail are privileged, confidential and proprietary information intended only/solely for the individual or entity to which it is addressed. It is a PRIVATE e-mail message and the sender does not waive any related rights and obligations. Kindly notify the sender immediately by e-mail if you have received this e-mail in error. You are notified that disclosing, copying, distributing or taking any action in reliance on contents of the information is strictly prohibited."

Access to data reports and other laboratory records is available to external auditors (representatives of accrediting bodies and agencies) during on-site assessment. Data reports and other laboratory records are provided upon request to auditors off-site to support the laboratory's certifications.

9.5 Data Security

The Computer Operations department assures the security of the computer systems by assigning log-on accounts and individual passwords for individuals to access data. The user is restricted to certain menu options through the log-on account, and only authorized staff has access to editing capabilities. A software product controls menus and uses local attributes consisting of specific options available to authorized users. These attributes are created and maintained by the computer operations staff. Access levels vary and depend on the user job functions. Log-on passwords are required to be changed every six months. Workstations are set up to lock after 10 minutes of inactivity.

The data servers located in the Computer Operations department are linked to an Uninterruptible Power Supply (UPS). All data saved on the data servers and personal computers are backed up at varying frequencies. The HP UNIX servers are backed up incrementally on a nightly basis and fully once each week. Personal computers are backed up on weekends. Archiving procedures are performed in compliance with Computer Operations SOPs. The archive storage media are stored in a restricted area within the facility, secured by locked doors, with limited access. Access is allowed only by means of an electronic security access key. The storage area is air-conditioned and kept free of debris. An additional copy of the archive storage media is maintained off-site.

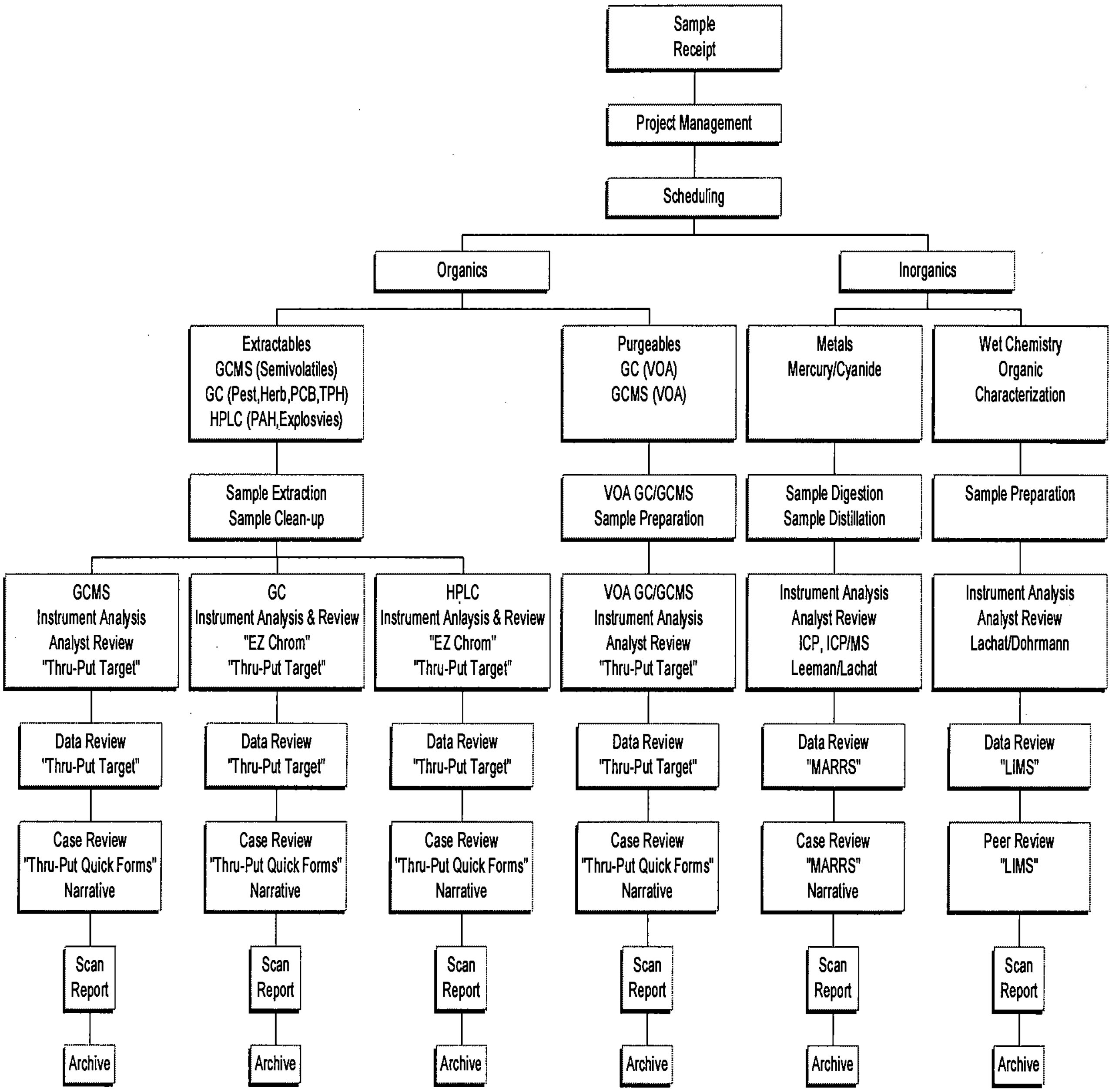
9.6 Hard Copy Data Retention

The laboratory scans the hard copy data, paginates it, and sends it to the client. Only the scanned copy is retained on database at the laboratory, unless the client requires otherwise. If the client requires that a hard copy of the final report and associated data be retained by the laboratory, the data are boxed and placed in a secure room within the facility. The laboratory retains the data for 5 years or as specified by the client.

9.7 Electronic Data Retention

Archived data are stored for a minimum of five years, except for EPA who requires one year. Additional storage time may also be requested by the client for certain projects or required under certain programs such as the Ohio Voluntary Action Program (VAP) which requires a data retention time of at least 10 years. It is the responsibility of the laboratory project manager to oversee the extended retention of project files. The auxiliary data field in the LIMS is able to record data retention time requirements for each client and to assist in tracking extended retention times. For the Ohio VAP, the laboratory must notify the agency by certified mail when the 10-year retention period has expired and retain the data until directed in writing by the agency whether they will or will not retain the data.

Figure 9-1 Sample Data Flow Chart



10.0 Performance and System Audits and Frequency

10.1 Quality Assurance Audit Unit

The QA department staff consists of senior scientists with Bachelor of Science or Bachelor of Arts degrees in chemistry, ten or more years of environmental analytical laboratory experience, and at least five years of experience using laboratory QA/QC techniques.

The QA Manager, and Vice President **and General Manager** conduct internal system audits. The auditor applies specific audit methods, evaluates audit findings, and reports these findings to laboratory management.

10.2 Systems Audits

A systems audit is an on-site inspection or self-assessment of the laboratory's control systems. System audits are performed both by internal and external auditors. Clients and federal and state certifying agencies perform external system audits. A system audit is performed to qualitatively assess the laboratory's control systems and is intended to provide evidence of the laboratory's competence.

The objectives of a systems audit include ensuring that:

- management is committed to creating a work environment dedicated to quality and that a structured management system is in place to support an effective QA program,
- the QA program is documented and implemented to assess work to ensure technical, administrative, and quality objectives **are met**,
- personnel are adequately trained and qualified to do their jobs,
- procured items and services meet established requirements and perform adequately,
- procedures are established and maintained for the preparation, **review, revision, and** issuance of **laboratory documents**, including **SOPs, logbooks, and data reports**
- **records are retained** for evidentiary purposes,
- computer hardware **is maintained to support data processing and reporting software**
- **computer software is developed, documented, validated and** any changes are controlled **and documented**
- work performed complies with established **documented procedures** as well as safety policies, and
- procedures are established for detecting and preventing quality problems and for ensuring quality improvement.

10.2.1 Internal Systems Audits

Internal systems audits are used to verify that laboratory operations continue to comply with the requirements of the quality system. Systems audits include a review of laboratory documentation on sample receiving, sample log-in, sample storage, chain-of-custody procedures, sample preparation, **sample** analysis, instrument operating records, etc. While performance audits are a quantitative appraisal, system audits are more qualitative in nature, intended to provide evidence of the laboratory's competence.

Upon completion of an internal system audit, the auditor discusses his or her findings with the responsible manager or supervisor. The auditor summarizes his or her findings in an audit report that is distributed to laboratory management. A Corrective Action Report (CAR) is issued for each finding. The responsible manager corrects the deficiency, documents the correction in the CAR, and returns the completed CAR to the auditor. Completed CARs are retained in the QA department. Implementation of the documented corrective actions is verified by subsequent follow-up audits. If an audit finding were to cast doubt on the correctness or validity of the laboratory's results, an immediate corrective action would be initiated and any client whose work may have been affected would be notified.

A full **internal** systems audit **is** performed annually. The following components comprise a complete system audit. **Below is a summary of the** audit activities performed by QA staff. **Figures 10-1 through 10-5 are example checklists used to document these activities.**

10.2.1.1 **Documentation and Record Keeping -- Review** logbooks **that document refrigerator temperature, instrument analysis, balance calibration, and standard preparation. Verify that records are complete, that documented observations are current, that any errors are corrected properly,** and **that** complete**d pages and logbooks were peer reviewed as evidenced by a** review **signature.**

10.2.1.2 **Sample storage/Chain of Custody – Review temperature logs for refrigerators that store samples and sample extracts** Verify that samples are stored and controlled properly **and**, that COC procedures are followed through documented transfers.

10.2.1.3 **SOP compliance – Observe a procedure being performed by an analyst to** verify that **the** procedure **being performed** follows **the** written SOP. Also verify that **the** written SOP **is** compliant with the referenced methods.

10.2.1.4 **Reagent (solvent and chemical) storage and control – Observe and verify the proper storage conditions of reagents and solvents. Verify that proper control documentation is written on the container label such as the receipt date and expiration date.**

10 2.1.5 **Standard storage and control -- Observe and verify the proper storage conditions of reference standards. Verify that**

proper control documentation is written on the container label such as the standard lot number and expiration date. Review standard logbooks to verify that standard preparations are properly documented and traceable to primary standards. Also verifies that standards are traceable to NIST sources.

10.2.2 QC test sample analyses – Review of data associated with the analysis of new solvent lots.

10.2.3 Data audits – QA staff routinely audit all data associated with the analyses of proficiency test samples. EPA CLP data are reviewed routinely by the Vice President and General Manager as a result of EPA CCS reports. During these audits, QA staff verify **the data for** accuracy, completeness, **and test method** and **program compliance**. Software data reduction routines are verified during data audits by performing manual calculations **or by reviewing the calculation verification provided with the data report**. Hardcopy to diskette results may be compared in the course of a data audit **but are typically verified by automated software routines.**

10.2.4 ThruPut systems Audit Trail —The audit trail in ThruPut systems is checked **annually** to verify changes to the processed files are **correct,** documented, allowed, and performed by authorized individuals.

10.2.5 Corrective Action Report (CAR) follow-up -- Verifies that corrective actions have taken place, are still in effect, and that recurrence is controlled.

10.2.6 Facilities maintenance -- Verifies that facilities and equipment are adequate and properly maintained and that laboratory areas are free from interference or contaminants.

10.2.7 Subcontract laboratory audits -- In lieu of on-site audits, a paper audit may be performed involving a review of the quality assurance plan, SOPs, data reports, and PE study results. On-site audits can be performed upon client request, but no routine audit is performed by our lab.

10.2.8 Employee training file audit-- Verifies that training records are current and that personnel meet the requirements stated in the current USEPA CLP SOW as well as those specified by individual states.

10.2.9 External Systems Audits

CompuChem's systems are also inspected extensively by external agencies, contractors, and third parties. The laboratory's primary NELAC accrediting authority conducts an assessment of the laboratory every two years. Most of the state certification programs specify that on-site inspections are to be conducted annually. As a laboratory in the USEPA CLP, CompuChem is audited annually by representatives of the EPA. Many clients conduct inspections or hire third party QA auditors to inspect the laboratory before start-up and during the course of larger, more critical, or sensitive projects.

CompuChem prefers a two-week notification before a scheduled audit to ensure that management and QA staff are available. However, an external audit may be conducted (announced or unannounced) at any time during normal business hours. To protect client confidentiality, some documents (particularly those identifying clients, sites, or projects) will not be made available for inspection except to those directly involved in such projects or authorized state or federal officials or authorized third parties.

Any deficiencies or non-conformances observed by the auditors are included in an audit report. Corrective action reports are initiated as needed in response to the audit findings. Once the corrective action responses are completed, a formal response is compiled by a QA staff member and submitted to the external agency by the required due date. Copies of the response are circulated to laboratory management. Follow-ups are performed to ensure implementation of stated corrective actions.

10.3 Performance Evaluation Samples

Laboratory performance is evaluated using proficiency test (performance evaluation) samples.

CompuChem analyzes water pollution (WP) and solid matrix (SM) proficiency test (PT) samples semiannually in support of its NELAC accreditation. The laboratory analyzes WP samples semiannually in support of its accreditation with the Ohio Voluntary Action Program. The laboratory analyzes single blind performance evaluation (PE) samples quarterly in support of its participation **in** the **EPA's** contract laboratory program.

As part of its data audit function, the QA department audits all PT sample data before results are submitted. PT and PE sample results are summarized in memoranda that are distributed to laboratory management.

10.4 Management Review

The results of the annual internal systems audit performed by the QA staff are reported to the laboratory management. Corrective action reports are distributed to the managers documenting any deficiencies. Corrective actions for these deficiencies are documented on the reports and returned to the QA department.

The QA Manager reports on activities done in support and development of the laboratory's quality system in writing on a monthly basis to the **Vice President and General Manager**.

The **Vice President and General Manager also writes a report on activities done in support of the laboratory's quality system and** discusses quality system **issues with senior management during** staff meetings.

Figure 10-1

SYSTEM AUDIT CHECKLIST

Sample Storage/Chain of Custody

Auditor__________________Date__________________Department______________________

1. Are refrigerators well organized?	Yes	No
2. Is ID Label on door?		
3. Is there a corrective action SOP posted on the door? (OLC03.2 and SOM01.1)	Yes	No
4. Is temperature range posted?	Yes	No
5. Is corrective action stated in logbook?	Yes	No
6. Are temperatures within range?	Yes	No
7. Are standards and samples separated?	Yes	No
8. Are logbook errors corrected properly?	Yes	No
9. Has the supervisor reviewed and signed off?	Yes	No
10. Are logbooks completed to the point of inspection?	Yes	No
11. Are samples under proper chain of custody?	Yes	No
12. Is chain of custody record completed?	Yes	No
13. Are samples left out of refrigeration more than 2 hrs since receipt?	Yes	No

Comments:

1. ______________________________
2. ______________________________
3. ______________________________
4. ______________________________
5. ______________________________
6. ______________________________
7. ______________________________
8. ______________________________
9. ______________________________
10. ______________________________
11. ______________________________
12. ______________________________

Figure 10-2

DOCUMENTATION AND RECORD KEEPING AUDIT FORM

Auditor____________________ Date________________________ Laboratory________________________

Logbook Title	Logbook ID No.	Documentation complete?	Cross-outs/ Overwrites Initialed & Dated Yes/No	Page z'd-out? Yes/No	Supervisor sign-off? Yes/No	Comments

Figure 10-3

SYSTEM AUDIT CHECKLIST

SOP Compliance

Auditor__________________Date__________________Department_________________________

SOP Title:____

Instrument Procedure No._______________ or Sample Preparation Procedure No. _________________

1. Is the procedure performed according to the SOP?	Yes	No
2. Is the SOP compliant with referenced methods?	Yes	No
3. Does the SOP require revision?	Yes	No
4. Is corrective action necessary?	Yes	No
5. Is there documentation of training for this chemist and procedure?	Yes	No

Comments

1. ____
2. ____
3. ____
4. ____
5. ____

Corrective Action Follow-up

1. ____
2. ____
3. ____
4. ____
5. ____

Figure 10-4

SYSTEM AUDIT CHECKLIST

Standard Storage and Control

Auditor__________________Date__________________Department______________________

1. Is the standards refrigerator/freezer well organized?	Yes	No
2. Is ID Label on door?	Yes	No
3. Is there a corrective action SOP posted on the door? (OLC03.2 and SOM01.1)	Yes	No
4. Is temperature range posted?	Yes	No
5. Is corrective action stated in logbook?	Yes	No
6. Are temperatures within range?	Yes	No
7. Are standards and samples separated?	Yes	No
8. Are logbook errors corrected properly?	Yes	No
9. Has the supervisor reviewed and signed off?	Yes	No
10. Are logbooks completed to the point of inspection?	Yes	No
11. Are shelves or racks clearly labeled and are active standards segregated from expired/unapproved/special standards?	Yes	No
12. Are standards left out of refrigeration more than 2 hrs?	Yes	No

List below standard lot numbers currently in use for traceability to the standards preparation logbooks.

Standard ID ________________ Lot Number ________________ Expiration date ________________
Standard ID ________________ Lot Number ________________ Expiration date ________________
Standard ID ________________ Lot Number ________________ Expiration date ________________
Standard ID ________________ Lot Number ________________ Expiration date ________________
Standard ID ________________ Lot Number ________________ Expiration date ________________

List below any standard Ids and lot numbers of expired standards, is any, stored with current standards.

Standard ID ________________ Lot Number ________________ Expiration date ________________
Standard ID ________________ Lot Number ________________ Expiration date ________________
Standard ID ________________ Lot Number ________________ Expiration date ________________
Standard ID ________________ Lot Number ________________ Expiration date ________________
Standard ID ________________ Lot Number ________________ Expiration date ________________

Comments

1. ____
2. ____

Figure 10-5

SYSTEM AUDIT CHECKLIST

Reagent (Solvent and Chemical) Storage and Control

Auditor__________________Date__________________Department_____________________

1. Are chemicals stored properly (ether in flammables cabinet, etc.)?	Yes	No
2. Are bottles labeled with date received, opened, and initials?	Yes	No
3. Are expiration dates determined (i.e. 3 yr. from receipt or manufacturer recommendation)?	Yes	No
4. Are any beyond the expiration period?	Yes	No
5. Are materials logged into the materials receipt log (inorganics)?	Yes	No
6. Are materials traceable to the receipt log (inorganics)?	Yes	No
7. Are all bottles labeled with the identity of the contents?	Yes	No
8. Are reagents being made at the required frequency?	Yes	No
9. Is proper safety equipment worn when handling reagents?	Yes	No
10. Is the area clean of debris or spills?	Yes	No

List below reagent lot numbers currently found to be in use.

Reagent ID _______________ Lot Number _______________ Expiration date _______________
Reagent ID _______________ Lot Number _______________ Expiration date _______________
Reagent ID _______________ Lot Number _______________ Expiration date _______________
Reagent ID _______________ Lot Number _______________ Expiration date _______________
Reagent ID _______________ Lot Number _______________ Expiration date _______________

List below any expired reagents, or those stored or labeled improperly.

Reagent ID ____
Reagent ID ____
Reagent ID ____
Reagent ID ____
Reagent ID ____

Comments

1. ____
2. ____
3. ____

11.0 Facilities, Equipment, Security, Safety and Waste Management

11.1 Facilities, Security, and Safety

CompuChem is located in Cary, North Carolina on an eleven-acre site. The laboratory facility has over 30,000 square feet of office and laboratory space (Figure 11.1). An adjacent 1000 square foot concrete block storage building is used for waste containment. This building is vented and has a four-inch concrete berm designed to contain at least a 10% capacity spill.

Laboratory areas are separated as outlined below. A comprehensive instrument and support equipment list is found in Tables 11.1 to 11.7.

11.1.1 Sample Receiving Area

Located in the sample receiving area is a large walk-in refrigerator and several reach-in refrigerators for sample storage, an ambient storage unit for sample storage, and fume hooded bench space is used to unpack and inventory samples received for analysis.

11.1.2 Sample Preparation Laboratory

The sample preparation laboratory houses both organic and inorganic sample preparation areas. Fume hoods separate the two areas. A Liebert air handling system conditions the air by heating, cooling, filtering, humidifying and de-humidifying as needed. The room is maintained under a negative pressure to isolate any solvent vapors from the analytical laboratories.

11.1.3 Semivolatile Analytical Laboratory

The semivolatile analytical laboratory houses the GC and GC/MS instrumentation used to analyze sample extracts for semivolatile, pesticide, herbicide, polychlorinated biphenyl, and diesel range organic compounds. A Liebert air handling system conditions the air by heating, cooling, filtering, humidifying and de-humidifying as needed.

11.1.4 High Performance Liquid Chromatography Laboratory (HPLC)

The HPLC laboratory houses the HPLC instrumentation used to analyze sample extracts for polycyclic aromatic hydrocarbons and explosives. A Comfort Maker air conditioning unit cools the space.

11.1.5 Volatile Analytical Laboratory

The volatile analytical laboratory houses the GC and GC/MS instrumentation used to analyze samples for volatile organics and gasoline range organics. A Liebert air handling system conditions the air by heating, cooling, filtering, humidifying and de-humidifying as needed. In an effort to eliminate cross-contamination, the Liebert is equipped with carbon filters and the laboratory is under positive air pressure.

11.1.6 Organic Standards Laboratory

Located in the organic standards laboratory are reach-in refrigerators and freezers used for standard storage. A Mettler analytical balance is used to weigh neat materials. A NIST-traceable thermometer is used for laboratory thermometer and IR gun calibrations.

11.1.7 Inorganic Analytical Laboratories

The inorganic analytical laboratories house ICP, ICP-MS, cold vapor, ion chromatograph and spectrophotometric instrumentation used to analyze sample digestates for trace metals, cyanide, minerals, nutrients, and anions. A Lennox air handling system conditions the air in the ICP lab by heating, cooling, filtering, humidifying and de-humidifying as needed.

11.1.8 Preventive and Routine Maintenance of Analytical Instrumentation and Support Equipment

The laboratory has an analytical instrument specialist on-site. He performs **preventive and/or** major maintenance (e.g. **replacement of turbo pump oil or** replacement of circuit boards) on the laboratory's analytical instrumentation except the ICPs and ICP-MS. The ICP and ICP-MS instruments have outside service contracts. Routine instrument maintenance (e.g. replacement of injector liners and septa) is preformed by the analyst. **Procedures for routine instrument maintenance are detailed in the SOPs for the particular analytical method and in the manufacturers instrument mauals.**

Analytical support equipment such as balances, ovens, and refrigerators are monitored by the analysts using NIST-traceable reference **materials.** Qualified outside servicepersons calibrate each balance on-site semiannually. **The NIST-traceable reference thermometer and weights are calibrated annually by the North Carolina Department of Agriculture and Consumer Services Standards Division.**

Any analytical instrument that cannot be successfully calibrated before the next work shift must be identified as out of service. The failed calibration is documented in the instrument run log. If the instrument cannot be returned to service after maintenance by the analyst, instrument specialist, or outside service person, a sign indicating the instrument is out of service is affixed to the instrument.

If analytical support equipment cannot be calibrated or is not operating within the required temperature range, a sign indicating it is out of service is affixed to it until it is repaired or replaced.

11.1.9 Documentation

The QA department issues bound and paginated log books to the laboratory areas. These log books include run logs, maintenance logs, temperature logs, standard preparation logs, and balance calibration logs. The analysts make entries in to these logs and return the completed logs to the QA department for archival.

11.2 Facilities Maintenance and Security

The facility is maintained under the direction of the Manager, Purchasing, Administration, and Facilities. Preventive maintenance, repair and/or replacement of facility environmental systems such as heating and cooling units are accomplished by maintenance personnel and outside contractors under his supervision. Plans for facility renovations and improvements developed by laboratory management and staff are coordinated and implemented under his supervision.

The facility is secured by locked doors accessed by electronic and manual keys. An electronic security system monitors access. A chain link fence surrounds the entire acreage. The fence is equipped with two gates secured by pad locks during non-business hours. Only authorized personnel have unsupervised access to the facility.

11.3 Safety

Laboratory personnel wear protective eyewear, lab coats, and gloves while handling samples. Emergency showers are located in the sample preparation laboratory. Eye wash stations and fire extinguishers are located throughout the facility. The safety committee performs monthly safety inspections and reports observations to management. A list of safety equipment is presented in table 11.8.

11.4 Contingency

Carolina Power and Light (CP&L) supplies electrical service to CompuChem. The laboratory also maintains an uninterruptible power supply (UPS), that powers computers, instruments, and hoods for approximately two hours in case of a temporary power outage. The laboratory has at its disposal a refrigerated tractor trailer for maintaining samples at the required storage temperature. Dry ice would be used to maintain freezer temperatures.

Qualified subcontracting laboratories are available to perform analyses on short notice in emergencies. In such a case, CompuChem notifies clients and gains approval before allowing a subcontractor laboratory to perform analyses.

11.5 Reagent Storage Control, Documentation and Labeling

The receipt date, open date, expiration date, and the initials of the person recording the information are placed on reagent bottle labels after receipt by the laboratory. If the vendor does not supply an expiration date, a period of three years from date of receipt is used. Table 11-9 summarizes the reagents present at the laboratory and under what conditions they are stored. Before a solvent lot is purchased, it is analyzed and approved by the laboratory. Once the lot is approved, the **vendor** supplies the laboratory with reagents until that lot is depleted.

In methods where the purity of reagents is not specified, analytical grade is used. Reagents of lesser purity than those specified by the method are not used. Reagent container labels are checked to verify that the purity meets the requirements of the particular method. Reagent lot numbers are documented on preparation sheets and instrument run logs.

11.6 Hazardous Waste

Waste handling and disposal procedures are carried out in compliance with CompuChem's waste disposal SOP. This SOP includes procedures for training of personnel, identification, segregation, storage, and details of disposal procedures. Disposal of samples, sample digestates, and sample extracts is detailed in sample control SOPs. Waste disposal is performed in compliance with all applicable local, state, and federal regulations. A licensed hazardous waste contractor handles all recycling and arrangements for final disposal. (See Table 11-10.)

CompuChem is subject to yearly RCRA inspections by the State of North Carolina Hazardous Waste Section. CompuChem is a large quantity waste generator (in excess of 1000 kg per month) and must comply with all applicable parts of the following regulations:

- Resource Conservation and Recovery Act (RCRA)(40 CFR 261-271)
- Occupational Safety and Health Administration (OSHA)(29 CFR 1910.120 and 1910.1200)
- Hazardous Material Transportation Act (HMTA)(49 CFR 171-180: HM-181 and HM126F)
- Clean Water Act (CWA)(40 CFR 403.5)
- Superfund Amendments Reauthorization Act (SARA)(40 CFR 355, 370)
- NC Hazardous Waste Rules(15A NCAC 13A)

CompuChem pursues waste minimization efforts and makes every effort to recycle the materials and chemicals that are well suited for this purpose. After analysis and following a 90 day holding period, all residual solid and aqueous samples are disposed of as hazardous waste. Wastes are segregated into various waste streams which fall under RCRA codes F001, F002, F003, F005, D001, and D018. Table 11.10 represents general waste disposal procedures.

Any additional wastes not listed above are evaluated by the hazardous waste technician, safety officer, and/or contracted disposal company to determine the appropriate means of disposal.

Each satellite accumulation container must have a hazardous waste label. Shipment containers must be labeled according to HM-181 and must include the generator's name and address, EPA ID number, manifest document number, accumulation start date, and EPA waste number. All hazardous waste shipments are accompanied by a North Carolina Hazardous Waste Manifest. One copy of the manifest is kept on file at CompuChem at the time of shipment by the hazardous waste technician. Additional copies accompany the waste to the hazardous waste contractor. After disposing of the waste, the contractor returns a signed copy of the manifest to CompuChem verifying disposal. These final copies of the manifests are kept on file by the hazardous waste technician. Logbooks are maintained for daily inspections of the outside 90-day waste storage building and manifest tracking and are located inside the waste storage area. To prevent any improper disposal, the licensed hazardous waste contractors perform additional testing on the contents of the shipment containers before disposal.

Figure 11-1 Laboratory Floor Plan

CompuChem
a division of Liberty Analytical Corporation

Fire and Emergency Evacuation Routes

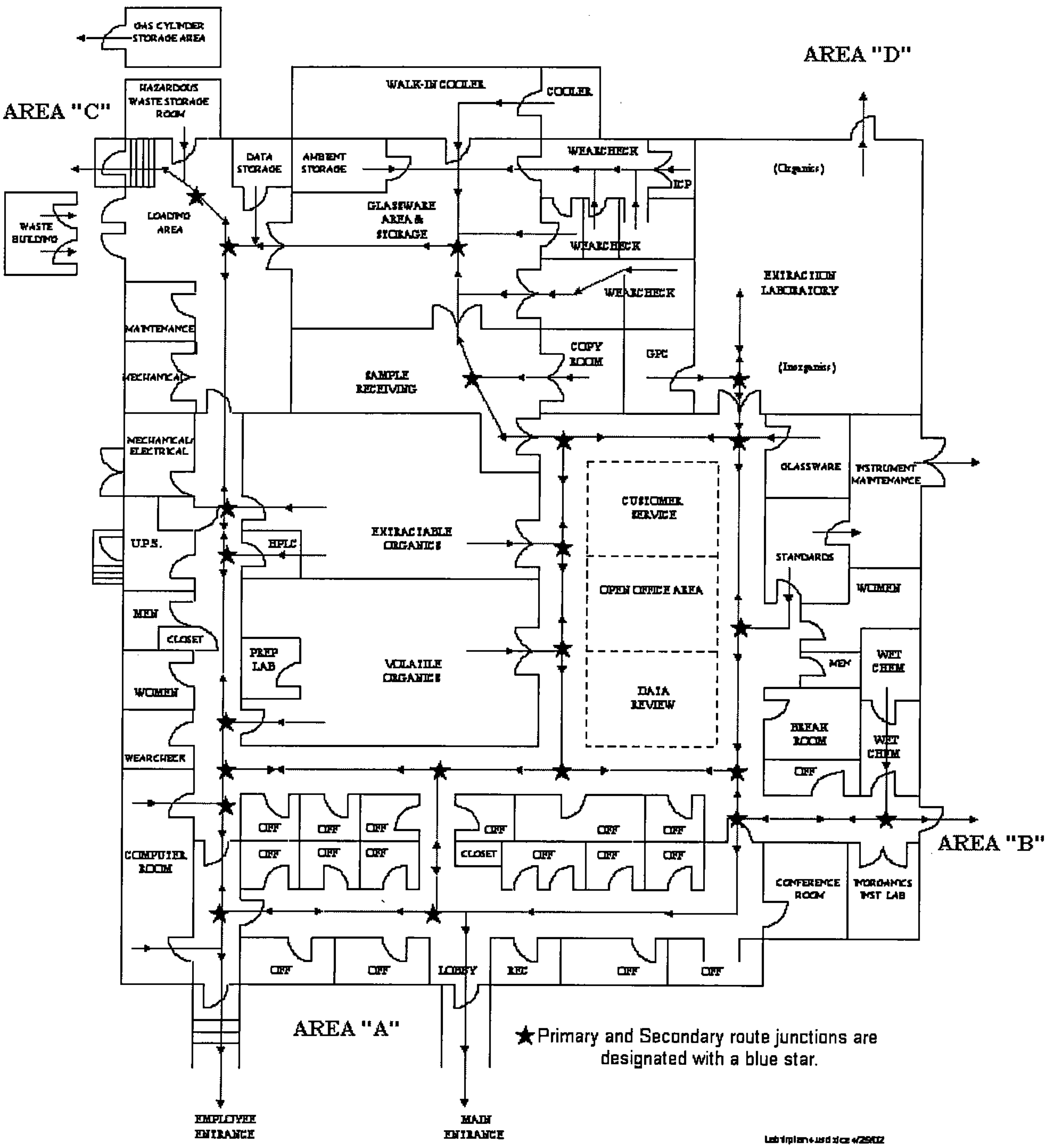


Table 11.1 GC Laboratory Equipment

Model No.	Serial No./Channel No.	Type	Installation Date
GC			
Varian 3400	#54	NPD	
Varian 3400	6949 #37/42	Dual ECD	1989
Varian 3400	3623 #39/41	Dual ECD	1987
Varian 3400	17403 #44	FID	
Varian 3400	3356 #59	FID	
Trace GC 20011612	#86/87	Dual ECD	2000
Trace GC	TR101370/#80/81	Dual ECD	2000
Trace GC	TR101369/#82/83	Dual ECD	2000
Trace GC	TR101375/#84/85	Dual ECD	2000
Hewlett Packard P5890	Series II GC LR47359C #67	FID	2002
Hewlett Packard 5890	Series II GC #32/33	Dual ECD	
Agilent Technologies 6890N	CN10552045 #90/91	Dual ECD	2006
Agilent Technologies 6890N	CN10522046 #92/93	Dual ECD	2006
Autosampler			
CTC A2000S	1304/89(#37/42)	Autosampler	1991
CTC A2000S	13013(#39/41)	Autosampler	1991
CTC A2000S	1301/89(#44)	Autosampler	1991
CTC A2000S	12371(#54)	Autosampler	1989
CTC A2000S	1792/90(#59)	Autosampler	
CTC A2000S	1915/90(#86/87)	Autosampler	1991
CTC A2000S	12369(#80/81)	Autosampler	2000
CTC A2000S	1804/90(#82/83)	Autosampler	1990
CTC A2000S	12387(#84/85)	Autosampler	2000
CTC HS500	30135(#67)	Autosampler	2002
CTC A2000S	12371 (#32/33)	Autosampler	
Agilent Technologies 7683B	CN54637426 #90/91	Autosampler	2006
Agilent Technologies 7683B	CN62940489 #92/93	Autosampler	2006
Refrigerators			
Refrigerator #2	GC Lab Refrigerator #2	8 ft^3	
Refrigerator #7	GC Lab Refrigerator #7	8 ft^3	
Refrigerator #8	GC Lab Refrigerator #8	22,7 ft^3	
Refrigerator #3	GC Lab Refrigerator #3	8 ft^3	
Refrigerator #4	GC Lab Refrigerator #4	22 ft^3	
Refrigerator #9	GC Lab Refrigerator #9	22 ft^3	

Table 11.2 HPLC Laboratory Equipment

Model No.	Serial No./Channel No.	Type	Installation Date
Agilent 1100 Series HPLC Micro Vacuum Degasser Quaternary Pump ALS Sampling System Thermo Column Compartment Multiple Wavelength Detector	a11001 JP40714429 DE40926792 DE33224733 DE405384472 JP43826437	HPLC	2004
Agilent 1100 Series HPLC Micro Vacuum Degasser Quaternary Pump ALS Sampling System Thermo Column Compartment Multiple Wavelength Detector	a11002 JP40721307 DE43631227 DE43627396 DE43644464 JP43826438	HPLC	2005
Refrigerators			
Baxter Explosion-Proof		Precision 814, 8 ft^3	
Marvel #1		8 ft^3	

Table 11.3 SV GC/MS Laboratory Equipment

Model No.	Serial No./ID No.	Type	Installation Date
Hewlett Packard HP5972 GCMS 5890 Series II GC HP 7673 autosampler	#60 3244A32866	SV	1994
Hewlett Packard HP5972 GCMS 5890 Series II GC HP 7673 autosampler	#64 3415A38536	SV	1996
Hewlett Packard HP5972 GCMS 5890 Series II GC HP 7673 autosampler	#66 3442A40444	SV	1996
Hewlett Packard HP5972 GCMS 5890 Series II GC HP 6890 autosampler	#70 3529A43269	SV	1998
Hewlett Packard HP5972 MSD 5890 Series II GC 6890 Series injector	#62 3404A37674	SV	2005
Refrigerators			
Refrigerator #1	GC/MS SVOA Lab Ref. #1	8 ft^3	
Refrigerator #3	GC/MS SVOA Lab Ref. #3	22 ft^3	

Table 11.4 VOA GC/MS Laboratory Equipment

Model No.	Serial No./ID No.	Type	Installation Date
Finnigan INCOS 500 GCMS Tekmar 3000 concentrator Archon autosampler	#55 IN001125 95107004	VOA	1991
Hewlett Packard HP6890 MSD 6890 Series GC Tekmar 3000 P&T concentrator Varian Archon autosampler	#71 US00004710 95097006 610701	VOA	2000
Hewlett Packard HP5972 MSD 5890 Series II GC Varian Archon autosampler, closed system P&T Tekmar LCS 3000	#59	VOA	2000
Hewlett Packard HP5973 MSD Varian Archon autosampler Tekmar/Dohrmann 3100 sample concentrator	#90	VOA	2005
Hewlett Packard HP5972 MSD 5890 Series II Plus GC Tekmar 3000 P&T concentrator Varian Archon autosampler	#73 700758 94293001 507204	VOA	1/2001
Agilent Technologies Dual P&T GC/MS 6890N Network GC System (G1530N) Agilent 5973 Network Mass Selective Detector (G1530N) Tekman Dohrmann Solartek 72™ Multi-Matrix Dual vial Autosamplers w/Emerson Process Management Tekmar Dohrmann 3100 Dual Sample Concentrators	61/62 US10143053 US0208006 US02056032 US02115002 US02109007	VOA	5/2002
Agilent Technologies Inert 5975 MSD 6890N Network GC System	#91 US54431647 CN10604034	63172A G1530N	2006
Varian 3400 Tekmar LCS2000 Tekmar ALS2016	6952(#68) 90163020	FID Purge & Trap	1989
Varian 3400 Tekmar LCS2000 Tekmar ALS2016	6954(#58) 90038029 91158005	FID Purge & Trap	1990

Table 11.4 VOA GC/MS Laboratory Equipment (continued)

Model No.	Serial No./ID No.	Type	Installation Date
Refrigerators			
Refrigerator #2B			
Refrigerator #4/Freezer #3		22 ft^3	
Refrigerator #5	880101750		
Refrigerator #6	9910245654	5 ft^3	
Freezer #6		22 ft^3	
Water System			
Millipore Milli Q	06731-C		
Oven			
Blue M			
Weights			
Troemner	45823	Class 1	
Balance			
Sartorius B410	40010010	Electronic	

Table 11.5 Inorganics Laboratory Equipment

Model No.	Serial No./ID No.	Type	Installation Date
TJA Trace ICAP P3 Trace ICAP RF Generator Chiller Autosampler Printer PC CD ThermoSPEC software	 303490 2361 K95805204 D2574 None None Revision 6.20	 Simultaneous 12510801 414003030003 Epson LG-570+ Sys/386	1994
TJA Trace ICAP P4 36161 System Power unit Grating Compaq computer OptiQuest Monitor HP Deskjet printer	 10670/13685200 4118 H801C7 6004CKT3A284 UZ94807900 MX9CK1V0F2	 61E Trace purge, simultaneous DeskPro Q71 Deskjet 810C	4/2000
Thermo Elemental ICP/MS 37184 System VG PQ ExCell Plasma Lab Software Merlin Series water chiller CETAC Technologies autosampler PeriMax12 SPECTEC	**MS1** ExCell-226 v. 1.06.02	 ICP/MS M75 Peristaltic pump	8/14/2001
Mercury Analyzer Leeman Labs PC-Standard Printer	**V3** 1056A 3017A88174 11OC0607422	Automated Mercury Analyzer PS200 Vectra ES/12 Okidata Microline 320	1992
Mercury Analyzer **Leeman Labs** **Hydra AA**	 **V4** **7031**	**CVAA Automated** **Mercury Analysis** **System**	**2007**
Buck Scientific Oil in Water IR Analyzer	506	HC-404	
Dionex Ion Chromatograph AS40 Automated Sampler	U503481/IC2		2005
TOC Analyzer Shimadzu TOC-V Shimadzu Solid Sample Module Shimadzu Autosampler Client Pro PC	 H51104335168 H52504300074 H52104301662 4169020-001	 VCSH SM-5000A ASI-V	2006

Table 11.5 Inorganics Laboratory Equipment (continued)

Model No.	Serial No./ID No.	Type	Installation Date
Lachat Instruments IC A5000 XYZ Sampler Auto Diluter Quickchem Proportioning Pump PC Hewlett Packard Printer Hewlett Packard Zellweger Analytics, Inc. QuickChem FIA+ 8000 series	A5000-415 2000-62 2000-021 2000-0076 2000/12 3024A01573 2935A70310 A83000-1605	Ion Chromatograph 2100-000 2900-000 2300-000 2200-00 Vectra 286/12 LaserJet Series II	1990 2000
Spectrophotometer Spectronic 21D Milton Roy	3152073028	Spectrophometer	
Balances Sartorius American Scientific O'Haus E400 O'Haus E400I Demoer Mettler Denver Instruments	 10505094 2904542 2061 6371 H50747 B034903	 LC2200P/Electronic S/P 180/Electronic Electronic Electronic Electronic 4 place PJ300 300	 1993 1993 1993 1993
Weights Troemner Fisher	 NCSN050 NCSN054	 Class 1 Class 1	
Wet Chemistry Lab Refrigerator #1		8 ft^3	
Ovens Fisher ISO Temp200 Series Fisher ISO Temp200 Series	 00143 00179		
Miscellaneous			
Electrothermal Midivap system (2)		10 place midi distillation	
Distillation apparatus (6 units)			
Hot Plates (seven units)			
Fisher pH Meter	50/PH1	Accumet	
Block Digestors			
Lachat	BD46		
Environmental Express SC100 w/SC200 racks		36 well block digestor	10/97

Table 11.5 Inorganics Laboratory Equipment (continued)

Model No.	Serial No./ ID No.	Type	Installation Date
Miscellaneous (continued)			
Baths			
Digestion (2) turkey roasters Fisher Versa Bath, Precision Stainless		183	
Pyrex Burets		10, 25, 50 mL	1999
Fisher Isotemp Oven	00700173	Mode 500 Series	
Fisher Isotemp Oven	472	Mode 200 Series	
Flash Point Instrument Koehler Instruments, Inc.	R02291814	K16200	2006
Electrothermal Electromantles (4 units, 15 place)		ME	
Fisher Centrifuge	00200499	Centrific 228	
Corrosivity testing apparatus		Glass vessel	
Refrigerators			
American Scientific Products	NY 79522-2	SPR 24 A-O-A	
Gerald	6081295V	GR 17A	
Microwave Digestion			
Acid Distillation Unit			

Table 11.6 Organic Sample Preparation Laboratory

Model No.	Serial No./ ID No.	Type	Installation Date
Balances			
O'Haus E400	3156	Electronic	
Sartorius BL310	13008591	Electronic	3/2000
Weights			
Troemner	45824	Class 1	
pH Meters			
pH Meter - Beckman	2721	Hand held	
pH Meter – WTW	3204	Hand held	
Baths			
Branson ultrasonic bath	B-22-4		
Branson ultrasonic bath 8510	RPA 9806516E		
Hot water baths (2 units/cp. 24)			
Ovens			
Fisher Econotemp	477	55G	
Wilt Furnace	90870	210	
Refrigerators			
Whirlpool	EE02722440	Compact	
Centrifuges			
IEC	24760668	Centra 8	
IEC	24760672	Centra 8	
Fisher Centrifuge	1041	225	
Water Purification System			
US Filter DI Water System (250 gal)			
Other			
Fisher Dessicator			
YSI Conductivity Meter	1422	Model 35	
Sonifiers			
Branson Sonifier	NH10245B	350 Four Tips	
Branson Sonifier	NH20102B	350 Four Tips	
Tekmar	11896E2	Model TM 600-2	
Tekmar	10500	Model VC 600-2	
Tekmar	13771B	Model TM375	
Nitrogen Evaporators			
Organomation	8373	115	

Table 11.6 Organic Sample Preparation Laboratory (continued)

Model No.	Serial No./ ID No.	Type	Installation Date
Accelerated Solvent Extractor w/33 cells	9B050385	Dionex 200	3/1999
Environmental Express Extraction Vessels and rotation units			
ZHE			
3 rotation units/8 vessels each			
TCLP/EP Toxicity			
3 rotation units/8 vessels each			
Gel Permeation Chromatograph			
ABC GPC	833B-233	1002B	1997
ABC GPC	834B-234	1002B	1990
ABC GPC	879B-279	1002B	1991
ABC GPC	**887B-287**	**1002B**	**1997**
	GPC-6	**J2 Scientific**	**2007**
Autosampler Model # J2AIM3310	**4738A12420**		
AccuPrep MPS GPC Unit	**07J-1273-4.1DI**		
	GPC-5		
Autosampler Model # J2AIM3310	**4738A12422**	**J2 Scientific**	**2007**
AccuPrep MPS GPC Unit	**07K-1275-4.1DI**		
Recirculating Chillers			
Neslab	8005036	Cool flow 75	
Neslab		Cool flow CFT-75	
Neslab		HX-75	
Automated Soxhlet			
Gerhardt Soxtherm	4032297/4032044	SE-416	
Gerhardt Soxtherm	4022028/4022069	SE-3A/S306A	2003

Table 11.7 Organic Standards Laboratory Equipment

Model No.	Serial No./ ID No.	Type	Installation Date
Weights			
Permas	A302	Class 1	
Balance			
Mettler H31AR	794794	Electronic Analytical	

Table 11.8 Safety Equipment

Model No.	Serial No./ ID No.	Type	Availability
Fire Extinguishers	Various	General Fire Ext., Inc.	In all lab and support areas
Eye Protection			
Safety glasses		Safety glasses	One per person plus surplus
Eye-wash stations		Model 3729	Four portable; two permanent
Protective Clothing		Lab coats North Safety Equipment	One per person plus surplus
Respirators			Two
Safety Showers		Water	Two in the sample prep lab

Table 11.9 Reagent Storage

Reagent	Storage	Location	Conditions
Halogenated solvents	Vented storage cabinets	Inorganics Extractions Extractable GC/GCMS Standards Electronics	Air conditioning
Non-halogenated solvents	Vented storage cabinets	Inorganics Extractions Extractable GC/GCMS Standards Lab Electronics	Air conditioning
Alcohols	Vented storage cabinets	Inorganics Extractions Volatile Preparations Extractable GC/GCMS Standards Electronics	Air conditioning
Inorganic chemicals	Shelving cabinets	Inorganics Extractable GC/GCMS Standards Electronics	Air conditioning
Trace metals	Shelving cabinets	Inorganics	Air conditioning
Peroxides (H_2O_2)	Vented storage cabinets	Inorganics	Air conditioning
Acids (Inorganic)	Vented storage cabinets	Inorganics	Air conditioning
Acids (Organic)	Vented storage cabinets	Extractions Inorganics	Air conditioning
Organic standards	Explosion-proof refrigerators	Volatile GC/GCMS Extractable GC/GCMS Standards	Air conditioning
Stock organic solvents	Vented storage cabinet	Extractions	Air conditioned
Stock inorganic chemicals (NaOH)	Vented storage room	Solvent storage building	Vented ambient outside storage
Stock acids	Vented storage room	Solvent storage building	Vented ambient outside storage

Table 11.10 Waste Disposal

Waste Stream	Storage	Disposal
Dichloromethane	55-gallon steel drums	Reclaimed
Freon 113	55-gallon steel drums	Reclaimed
Used oil	55-gallon steel drums	Reclaimed
Mixed flammable solvents	55-gallon steel drums	Disposed by HW contractor
Vials with flammable solvents	55-gallon steel drums	Disposed by HW contractor
Plant scraps with solvents	55-gallon steel drums	Disposed by HW contractor
019 waste water	55-gallon polyethylene drums	Disposed by HW contractor
Purged soil	55-gallon polyethylene drums	Disposed by HW contractor
Acid water and vials	55-gallon polyethylene drums	Disposed by HW contractor
Mixed acids	55-gallon polyethylene drums	Disposed by HW contractor
NaOH waste	55-gallon polyethylene drums	Disposed by HW contractor
Oil and acid	55-gallon polyethylene drums	Disposed by HW contractor
Cyanide standards	55-gallon polyethylene drums	Disposed by HW contractor
Pyridine and barbituric acid	55-gallon polyethylene drums	Disposed by HW contractor
Metal standards	55-gallon polyethylene drums	Disposed by HW contractor

12.0 Corrective Action

Corrective action is the process of identifying the cause and implementing the procedures to correct nonconforming work and departures from the policies and procedures of the laboratory's quality system. The need for corrective action may arise from the identification of any of the following:

- Nonconformance issues identified during sample processing and analysis
- Deficiencies in the laboratory's quality system as identified as a result of internal and external audits
- Client inquires and complaints

Corrective actions are documented in Corrective Action Reports (CARs) (Figure 12-1), memoranda, management reports (including responses to external audit reports), instruments logs, and work-order/SDG narratives.

12.1 Nonconformance Issues Identified During Sample Processing and Analysis

12.1.1 Sample Receipt

Nonconformance issues identified during sample receipt may include but are not limited to the following:

- Samples received at temperatures outside of acceptable range
- Samples received improperly preserved
- Samples received in damaged or broken containers

In cases such as those listed above, receiving personnel document the nonconformance on the client chain-of-custody (COC) and advise the project manager of the problem. The project manager then immediately contacts the client. The project manager documents the client's instructions in writing on the client COC or separate document.

When the lab receives a sample from a site in North Carolina, which does not meet the requirements for shipping temperature, preservation, volume, or holding time, the lab will inform the client. If the client chooses not to resample but will accept the qualified results from the laboratory, the North Carolina Department of Environment and Natural Resources Division of Water Quality must be notified. This written notification must include the sampling site, client name, client address, and the non-compliance issue.

12.1.2 Sample Preparation

Nonconformance issues identified during sample preparation may include but are not limited to the following:

- Insufficient sample volume for the desired test method
- Sample matrix not amenable to the desired test method
- Laboratory accident during sample handling resulting in loss of sample extract/digestate
- Improper addition of QC reference standards during sample preparation

In cases such as those listed above, the sample preparation technician advises the project manager of the problem and the procedure continues as stated above.

The technician documents instances such as an alternate sample volume used for preparation, a laboratory accident, or the addition of the incorrect volume of QC reference standard on the preparation worksheet.

12.1.3 Sample analysis

Nonconformance issues identified during sample analysis may include but are not limited to the following:

- Initial or continuing calibration fails acceptance criteria
- Field samples fail QC acceptance criteria
- QC samples fail acceptance criteria
- Sample preparation or analysis holding time exceeded

In the case of the failing initial or continuing calibration the analyst evaluates the results and may perform instrument maintenance before recalibration. This is documented in the appropriate instrument log book. Failed QC acceptance criteria for field and QC samples are documented in the instrument run log. Corrective actions for QC sample failure are detailed in the appropriate analytical SOP.

All corrective actions performed during the processing and analyses of samples are documented in the final report to the client. The work-order/SDG narrative summarizes the nonconformance issues and corrective actions taken.

12.2 Deficiencies in the Laboratory's Quality System Identified as a Result of Internal and External Audits

The laboratory's quality system is monitored through the periodic performance of internal and external audits. Deficiencies in the laboratory's quality system that can affect its ability to produce data of known and documented quality may be identified as a result these audits.

Deficiencies identified as a result of internal and external audits may include but are limited to the following:

- Deviations from established laboratory policies and procedures
- Deviations from the requirements of the NELAC standards or other external agency requirements
- Deviations from the requirements of the appropriate CLP statement of work

Deficiencies identified during internal audits are documented in internal CARs, interoffice memoranda, internal audit reports, and monthly management reports. Deficiencies identified during external audits, both on-site and through data and electronic media audits, are documented in external audit reports prepared by the auditing body and internal CARs.

For both internal and external audits, the **Vice President and General Manager** or QA Manager issues an internal CAR to the responsible manager/supervisor. The responsible manager/supervisor then identifies the cause of the deficiency and devises a plan of correction. The plan of correction is documented on the CAR that is returned to the QA department for approval. Additionally, for an external audit, the laboratory's plan of correction for deficiencies is documented in a written response to the auditing body for its acceptance. All records are retained.

12.3 Client Inquiries or Complaints

CompuChem's clients are represented at the laboratory by Project Managers. The Project Manager is the client's point of contact for any questions and/or complaints.

For issues that arise between the time that the client samples are received by the laboratory and the time the final report is completed, the client contacts the Project Manager with any questions or changes. The Project Manager relays the information to the responsible manager/supervisor. This client correspondence is documented in the Project Manager's phone logs.

For issues that arise after the final report has been delivered, the client again contacts the Project Manager. The issue is documented on a Client Inquiry form that is forwarded to the responsible supervisor/manager for resolution.

Issues cited by the client may include but are not limited to the following:

- Missing or illegible page(s) in the final report
- Errors in sample processing and analysis
- Request for further analysis on sample previously analyzed
- Request for further information such as a more detailed report style than originally requested and electronic disk deliverable (EDD)
- Request an additional copy of the report

Once the issue has been resolved and the resolution documented on the Client Inquiry form, the form and any supporting documents are returned to the Project Manager. The Project Manager forwards the information to the client. If an amendment of the final report is required, it is identified as such before being submitted to the client.

12.4 Permitting Departures from Laboratory Policies and Procedures

The Vice President **and General Manager** and the Manager of QA write laboratory policies as the need arises. There are instances, during the course of normal operations, when the laboratory may be allowed to deviate from routine standard operating procedures, internal laboratory policies, or client specifications. An example of this would be if an analyte fails to meet QC limits in the LCS and is not of interest to the client for the project. In these instances, the laboratory staff must speak directly with and obtain permission from the **Vice President and General Manager** or the Manager of QA and the client, if there is questionable impact on the data. Laboratory staff frequent the QA offices to seek clarification and direction on situations that occur outside normal procedures. Project Managers maintain regular communication with clients regarding status of projects and sample analysis.

A laboratory supervisor or analyst who has a question or doubt about whether a deviation is appropriate will contact QA to discuss resolution of the matter. The QA staff member will evaluate the situation relative to documented policies and procedures to determine if the data may be reported or corrective action must occur. A recommendation is made regarding the course of action including contacting the client. In general, any allowed deviation is discussed in the SDG narrative.

The following statement has been added to all logbooks, "The presence of the Chemist's/Analyst's employee ID number, or signature, on this run log attests that strict compliance with the method's SOP has occurred. Any SOP deviations require documentation by the responsible chemist/analyst together with the chemist's/analyst's initials and the initials of the lab supervisor and a QA department representative, signifying approval of the deviation."

This section does not apply to samples analyzed for the Ohio Voluntary Action Program (Ohio VAP). Deviations from Ohio VAP approved laboratory SOPs are not permitted. The Ohio VAP must approve any proposed revisions to previously approved SOPs prior to implementing any changes in the laboratory.

Figure 12-1

Environmental Testing Laboratories
CompuChem
A Division Of
Liberty Analytical Corp.

CORRECTIVE ACTION REPORT

INITIATION

Project:	Date Initiated:
Client Name:	Required Response Date:
Initiator:	CAR#
Deficiency Type: (circle one) CERT – GLP – MDL – NARR – PT – RPT – REV – SOP – SOW – QC	
Recipient:	Lab Area:

NON-CONFORMANCE

Description of Non-Conformance:

CORRECTIVE ACTION

Signature of Responsible Supervisor/Manager:
Plan of Correction:
Target Implementation Date:

IMPLEMENTATION OF CORRECTIVE ACTION

Auditor:
Does SOP need revision? If so, target date of draft revision?
CAR Response Date:
CAR Closure Date:

FOLLOW-UP (completed by QA)

Auditor:	Audit Date:
Follow-up findings:	

13.0 Subcontracting and Support Services and Supplies

CompuChem only uses those outside support services and supplies that are of adequate quality to sustain confidence in the laboratory's tests. Records of all suppliers for support services or supplies required for tests are maintained.

13.1 Control of Subcontracted Analytical Services

CompuChem performs a wide array of analytical methodologies, and on an exception basis, the laboratory must locate a suitable alternate laboratory to perform methods not performed in house. Only NELAC accredited laboratories are used to perform subcontracted analyses. **In addition to NELAP accreditation, subcontract laboratories utilized by the lab must be assessed and approved by the Department of Defense (DOD) component for which the analytical services will be provided.** CompuChem's client agrees to the use of a qualified laboratory for subcontracted analytical services before the samples are sent off-site. The Project Management team coordinates subcontract laboratories on a project-by-project basis through agreement and approval of our client. An evaluation of the laboratory may include a review of standard operating procedures, Quality Manual, Statement of Qualifications, and recent PT study scores. The lab's performance may be monitored through data evaluation.

13.2 Material Procurement and Control

The two prime objectives of CompuChem's purchasing are to maintain sufficient supplies of all required items, and to encourage all forms of competition to aggressively seek the best total value in a combination of supply, price, required quality, and service. Records of all suppliers for support services or supplies required for tests are maintained. Department and laboratory supervisors have primary responsibility for maintaining adequate inventory of supplies and ensuring that all supplies/equipment meet or exceed quality requirements. Supervisors work through the purchasing agent to meet these objectives.

CompuChem uses competitive inquiries or requests for bids, along with appropriate negotiation, to provide equal opportunities for potential and current suppliers to earn CompuChem's business and to allow the laboratory to seek the best overall value. Long-term considerations include reliability, price, required quality, and service. Suppliers must maintain the confidentiality of competitively sensitive information that is obtained from the Accounting department or other CompuChem personnel. Prices and related information, whether accepted or not, are not disclosed.

The laboratory evaluates solvents prior to purchase. If solvent/chemical quality is equivalent, then price and service are considered. Prices are kept low because of the highly competitive market and the high volume used by the laboratory.

13.3 Material Quality Inspection, Outside Support Services and Supplies

Managers interact with the QA department when purchasing supplies/equipment that could potentially affect data quality, and therefore results of sample analyses, before use in production. The Vice President and General Manager or Manager of QA determines the appropriate test procedures and evaluates the resulting test data. A similar validation process is used in testing new instrumentation. When variability is exhibited in the quality of vendor-supplied materials or services, the laboratory department supervisor is responsible for working with Purchasing to find a suitable alternative source.

Information on new chemicals must be supplied to the chemical hygiene officer, safety officer, or the waste management officer. Items and services have been identified that are known to affect quality. Documentation of material quality inspections for solvent lot tests, is maintained in the QA department. Laboratory supervisors maintain other documentation.

14.0 References

14.1 2003 NELAC Standards

14.2 Interim Guidelines and Specifications for Preparing Quality Assurance Project Plans, QAMS-005/80, December 29, 1980, Office of Monitoring Systems and Quality Assurance, ORD, U.S. EPA, Washington, DC 20460.

14.3 RCRA QAPP Instructions, U.S. EPA Region 5, Revision: April 1998

14.4 ASTM D-5283-92. Generation of Environmental Data Related to Waste Management Activities: Quality assurance and Quality Control Planning and Implementation

14.5 "American National Standards Specification and Guidelines for Quality Systems for Environmental Data Collection and Environmental Technology Programs (ANSI/ASQC E-4)", 1994

14.6 EPA 2185 – Good Automated Laboratory Practices, 1995

14.7 ISO/IEC Guide 25: 1990. General requirements for the competence of calibration and testing laboratories

14.8 Guidance for Developing Quality Systems for Environmental Programs (QA/G-1), EPA/240/R-02/008, November 2002

14.9 Guidance on Assessing Quality Systems (QA/G-3), EPA/240/R-03/002, March 2003

14.10 QA/G-4: Guidance for the Data Quality Objectives Process EPA/600/R-96/055, August 2000

14.11 QA/R-5: EPA Requirements for Quality Assurance Project Plans EPA/240/B-01/003, March 2001

14.12 QA/G-5: Guidance for Quality Assurance Project Plans EPA/240/R-02/009, December 2002

14.13 QA/G-6: Guidance for the Preparation of Standard Operating Procedures for Quality-Related Operations EPA/240/B-01/004, March 2001

14.14 QA/G-9: Guidance for the Data Quality Assessment: Practical Methods for Data Analysis EPA/600/R-96/084, July 2000

14.15 Manual for the Certification of Laboratories Analyzing Drinking Water EPA/570/9-90/008

14.16 State of New York Environmental Laboratory Accreditation Program Certification Manual, revised May 2000

14.17 U.S. EPA Contract Laboratory Program Statements of Work OLC03.2, OLM04.3, SOM01.**2**, ILM04.1, and ILM05.**4**

14.18 Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, SW-846, Update III, 12/96

14.19 U.S. Army Corps of Engineers, Shell for Analytical Chemistry Requirements, May 2000

14.20 Department of Defense Quality Systems Manual for Environmental Laboratories, Version 3, January 2006

14.21 Air Force Center for Environmental Excellence (AFCEE) Guidance for Contract Deliverables Appendix C: Quality Assurance Project Plan (QAPP), version 3.1, August 2001

Appendix A

Demonstration of Capability

A demonstration of capability is made prior to using any test method, and at any time there is a significant change in instrument type, personnel or test method.

All demonstrations are documented through the use of the Demonstration of Capability Certification Statement in this Appendix.

The following steps are performed.

a) A quality control sample is obtained from an outside source. If not available, the QC sample is prepared by the laboratory using stock standards that are prepared independently from those used in instrument calibration.

b) The analyte(s) are diluted in a volume of clean matrix sufficient to prepare four aliquots at the concentration specified, or if unspecified, to a concentration approximately 1-4 times the limit of quantitation.

c) Four aliquots are prepared and analyzed according to the test method either concurrently or over a period of days.

d) Using all of the results, the mean recovery and standard deviation are compared to the corresponding acceptance criteria for precision and accuracy in the test method (if applicable) or in laboratory-generated acceptance criteria (if there are not established mandatory criteria). If all parameters meet the acceptance criteria, the analysis of actual samples may begin. If any one of the parameters do not meet the acceptance criteria, the performance is unacceptable for that parameter.

f) When one or more of the tested parameters fail at least one of the acceptance criteria, the laboratory repeats the test for all parameters that failed to meet criteria. If repeated failure occurs, the laboratory will locate and correct the source of the problem and repeat the test for all compounds of interest beginning with c).

Certification Statement:

The following certification statement is used to document the completion of each demonstration of capability. A copy of the certification statement is retained in the training files of each affected employee.

Environmental Testing Laboratories
CompuChem
A Division Of
Liberty Analytical Corp.

Demonstration of Capability
Certification Statement

Study Date:
Laboratory Name: CompuChem, a division of Liberty Analytical Corporation
Laboratory Address: 501 Madison Avenue, Cary, NC 27513
Analyst Name/Employee ID#:

Matrix:
Method Number:
SOP No./Rev#:
Analyte/Class of Analytes/Measured Parameters:

We, the undersigned, CERTIFY that:

1. The analyst identified above, using the cited test method, which is in use at this facility for the analyses of samples under the National Environmental Laboratory Accreditation Program, have met the Demonstration of Capability.

2. The test method was performed by the analyst identified on this certification.

3. A copy of the test method and the laboratory-specific SOPs are available for all personnel on-site.

4. The data associated with the demonstration capability are true, accurate, complete and self-explanatory (1).

5. All raw data (including a copy of this certification form) necessary to reconstruct and validate these analyses have been retained at the facility, and that the associated information is well organized and available for review by authorized assessors.

Technical Director's Name and Title	Signature	Date
Quality Assurance Officer's Name	Signature	Date

This certification form must be completed each time a demonstration of capability study is completed.

(1)
- True: Consistent with supporting data.
- Accurate: Based on good laboratory practices consistent with sound scientific principles and practices.
- Complete: Includes the results of all supporting performance testing.
- Self-Explanatory: Data properly labeled and stored so that the results are clear and require no additional explanation.

14.0 References

14.1 2003 NELAC Standards

14.2 Interim Guidelines and Specifications for Preparing Quality Assurance Project Plans, QAMS-005/80, December 29, 1980, Office of Monitoring Systems and Quality Assurance, ORD, U.S. EPA, Washington, DC 20460.

14.3 RCRA QAPP Instructions, U.S. EPA Region 5, Revision: April 1998

14.4 ASTM D-5283-92. Generation of Environmental Data Related to Waste Management Activities: Quality assurance and Quality Control Planning and Implementation

14.5 "American National Standards Specification and Guidelines for Quality Systems for Environmental Data Collection and Environmental Technology Programs (ANSI/ASQC E-4)", 1994

14.6 EPA 2185 – Good Automated Laboratory Practices, 1995

14.7 ISO/IEC Guide 25: 1990. General requirements for the competence of calibration and testing laboratories

14.8 Guidance for Developing Quality Systems for Environmental Programs (QA/G-1), EPA/240/R-02/008, November 2002

14.9 Guidance on Assessing Quality Systems (QA/G-3), EPA/240/R-03/002, March 2003

14.10 QA/G-4: Guidance for the Data Quality Objectives Process EPA/600/R-96/055, August 2000

14.11 QA/R-5: EPA Requirements for Quality Assurance Project Plans EPA/240/B-01/003, March 2001

14.12 QA/G-5: Guidance for Quality Assurance Project Plans EPA/240/R-02/009, December 2002

14.13 QA/G-6: Guidance for the Preparation of Standard Operating Procedures for Quality-Related Operations EPA/240/B-01/004, March 2001

14.14 QA/G-9: Guidance for the Data Quality Assessment: Practical Methods for Data Analysis EPA/600/R-96/084, July 2000

14.15 Manual for the Certification of Laboratories Analyzing Drinking Water EPA/570/9-90/008

14.16 State of New York Environmental Laboratory Accreditation Program Certification Manual, revised May 2000

14.17 U.S. EPA Contract Laboratory Program Statements of Work OLC03.2, OLM04.3, SOM01.**2**, ILM04.1, and ILM05.**4**

14.18 Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, SW-846, Update III, 12/96

14.19 U.S. Army Corps of Engineers, Shell for Analytical Chemistry Requirements, May 2000

14.20 Department of Defense Quality Systems Manual for Environmental Laboratories, Version 3, January 2006

14.21 Air Force Center for Environmental Excellence (AFCEE) Guidance for Contract Deliverables Appendix C: Quality Assurance Project Plan (QAPP), version 3.1, August 2001

Appendix B

Procedure for Demonstration of Capability

<u>CompuChem's Initial and On-going Demonstrations of Capability (Analyst Qualification) Policy</u>

This policy details procedures for documenting the initial demonstration of capability (IDOC) and the on-going demonstration of capability (ODOC) for analysts in the laboratory following the rules listed below.

Initial Demonstration of Capability

General

1) Trainees are not allowed to process samples independently before they have demonstrated capability to perform the method through acceptable precision and accuracy testing with adequate documentation.

2) During the on-the-job training period no trainee is allowed to sign for his or her work without the signature of a manager/supervisor or an approved analyst, i.e. one who has documented capability for the method and has received approval to process samples independently. The approved analyst must cosign with the trainee on the instrument run logs or extraction worksheets.

3) The manager/supervisor, or designee, will provide the IDOC documentation to the QA department. Documentation includes all associated raw data, log sheets, and precision and accuracy statistics.

4) The precision and accuracy statistics must include the replicate values as concentration, the true value, a mean percent recovery from the true or expected value, and a standard deviation as % relative standard deviation (RSD).

5) The acceptance criteria for precision and accuracy are those stated in the methods or in CompuChem's Standard Operating Procedures (SOP) and Quality Manual. Percent recovery criteria for the LCS and RSD values for the initial calibration standards will be applied to these studies. Exceptions may be made for recovery criteria applied to dilutions of calibration standards for instrument analysts where the extracted LCS recovery may be inappropriate. The Initial Calibration Verification (ICV) criteria are appropriate in this application.

   If any failure occurs, the error must be corrected and the study repeated for the failed analyte(s). This may involve only a reanalysis or a re-preparation followed by analysis. Approval is based on an individual analyte basis.

6) Approval must be made by the QA Department and documented through the NELAC Demonstration of Capability Certification Statement. This form must be signed by both the supervisor and QA Department and is maintained in the employee's training files.

7) Failure to have an IDOC on file for an employee who processes AFCEE samples will result in rejected data under the AFCEE contract.

GC/MS and GC Volatiles

1) For GC and GC/MS volatiles, some methods allow for the continuing calibration standard to serve as the laboratory control sample (LCS). Four consecutive continuing standards may be used to compile the IDOC. The working level of the continuing calibration standard is prepared in the laboratory on each day of analysis.

2) For GC/MS volatile, analysis of an IDOC by any current method will give the analyst credit for all water and soil methods based upon similarities in technologies, methods, and procedures.

Organic Extractions

1) For sample preparation staff, four LCSs will be prepared, following the 40 CFR Part 136 Appendix A guidelines, either concurrently or over a period of days.

2) Precision and accuracy must be demonstrated for all steps of an extraction procedure by the same analyst. The five critical steps are extraction (separatory funnel shake, etc.), KD, nitrogen evaporation or derivatization, bottle up to final volume, and spike standard additions.

3) For semivolatile waters, IDOC credit will be given for both methods 625 and 8270C. IDOC credit will be given for methods OLM04.3, OLC03.2, and **SOM01.2**.

4) For semivolatile soils, IDOC credit will be given for 8270C if OLM04.2/4.3/**SOM01.2** is performed. This credit will not work in reverse. In addition, 8270C soxhlet extractions require a separate IDOC.

5) For pesticides/PCB waters, IDOC credit will be given for methods 8081A/8082, 608, OLM04.3, OLC03.2, and **SOM01.2**.

6) For pesticides/PCB soils, IDOC credit will be given for methods 8081A/8082, OLM04.3, and **SOM01.2**.

7) For herbicide waters, IDOC credit will be given for methods 8151A and 615.

8) For PAH waters, IDOC credit will be given for both methods 610 and 8310.

9) For DRO waters, IDOC credit will be given for both 8015B and CA LUFT methods. TN DRO, JP4, and JP8 each require a unique IDOC. The same is true for soils.

GC/MS Semivolatile and GC/HPLC

1) For GC/HPLC and GC/MS semivolatiles (extractables), each analyst must make four separate dilutions of the high-level calibration standard. Statistics can be calculated for precision and accuracy from the injections of these dilution replicates. The performance of an IDOC using the diluted standard can count for both water and soil methods.

Criteria used to evaluate replicates prepared from a calibration standard are those used to evaluate the initial calibration verification (ICV). For methods with no requirement for an ICV, such as CLP, the criteria are 70-130%. Sporadic marginal failures may be allowed in some instances and on a case-by-case basis. For these compounds, criteria of 50-150% are used.

2) Analysis of four extracted LCSs can also be used to demonstrate capability. The analysis of an extractor's IDOC will also count as an analyst's IDOC, but only for the method(s) and matrix approved under the extraction rules.

Inorganic Preparation

1) For mercury waters, analysis of an IDOC by any current method will give the analyst credit for all remaining water methods based upon similarities in technologies, methods, and procedures. The is true for soil samples.

2) For cyanide waters, analysis of an IDOC by any current method will give the analyst credit for all remaining water methods based upon similarities in technologies, methods, and procedures. The same is true for soil samples.

3) For metal waters, IDOC credit will be given for both methods ILM04.1 and **ILM05.4**. The same is true for soil samples. In addition, for metal waters, IDOC credit will be given for both methods 6010B and 200.7 and 6020 and 200.8.

Inorganic Instrumentation

1) For inorganic analyses, a precision and accuracy study can be generated from the analysis of four consecutive dilution analyses of the initial calibration verification (ICV) standards. These may be collected over a period of days.

2) The performance of an IDOC using the diluted standard can count for both water and soils for mercury and cyanide if the data is quantitated as both.

3) For metal waters using the four diluted standards, credit will be given for methods ILM04.1, **ILM05.4**, 6010B, and 6020, separately for ICP-AES and ICP-MS.

4) For metal soils using the four diluted standards, credit will be given for methods ILM04.1, **ILM05.4**, 6010B, and 6020, separately for ICP-AES and ICP-MS.

5) Analysis of four digested LCSs can also be used to demonstrate capability. The analysis of an extractor's IDOC will also count as an analyst's IDOC, but only for the method(s) and matrix approved under the inorganic preparation rules.

Wet Chemistry

1) For wet chemistry analysts, precision and accuracy studies can be generated using the LCS for all methods. Preliminary preparative steps required by a method should be followed for the LCS.

2) Information regarding cyanide IDOCs is given in the inorganics section of this memo.

3) Whenever possible, IDOC credit will be given to multiple methods based upon similar technologies.

On-going Demonstration of Capabilities (ODOC)

1) Annually, an analyst must demonstrate continued proficiency for a procedure. This proficiency must be documented and approved following the same approach as the IDOC. The ODOC must be in the analyst's training file to allow continued performance of a test.

2) ODOC credit can be given for the successful completion of a PT sample or QC reference. The sample must be a single blind to count in this category. This credit can be given for all similar technologies for the specific matrix.

3) ODOC credit can be given for the acceptable performance of four consecutive LCSs. ODOC credit can be given for multiple methods using the rules defined for an IDOC.

4) ODOC credit can also be given for the completion of a new IDOC. ODOC credit can be given for multiple methods using the rules defined for an IDOC.

5) For extractions, ODOC credit is needed for each step of an extraction procedure. The five critical steps are the same as those stated in the IDOC procedure.

The QA department maintains summary tables of IDOC and ODOC information. Copies are currently available upon request. This table will soon be available on-line for review. The supervisors and analysts are responsible for satisfying these requirements, performing these tests in a timely manner, and providing the data to the QA department.

Appendix C

Table of Contents for Standard Operating Procedures

SOP#	Title
1.1.3.1	**Preparation and GC Analysis of Gasoline Range Organics (GRO) in Aqueous Samples by Purge and Trap Following SW-846, CA LUFT, and TN GRO**
1.1.3.2	**Preparation and Analysis of Gasoline Range Organics (GRO) in Soil/Sediment Samples by Purge and Trap Following SW-846, CA LUFT, and TN GRO**
1.1.4.1	**Preparation of Soil/Sediment/Sludge Samples for the Analysis of Volatile Organic Compounds by Closed-System Purge and Trap using SW-846 Method 5035 (Also Applicable to EPA CLP SOW Document OLM04.3)**
1.2.1.3	**Methanol Extraction of Soil/Sediment Samples for the Analysis of Medium Level Volatile Organics by EPA CLP & NYSASP**
1.2.3.1	**Preparation of Low Concentration Soil Samples for the Analysis of Volatile Compounds by EPA CLP**
1.2.3.2	**GC/MS Analysis of Low-Level Volatiles in Solid Samples by EPA CLP and NYSASP**
1.2.3.3	**GC/MS Analysis of Volatile Organic Compounds in Aqueous Samples and Medium-Level Volatiles in Solid Samples by EPA CLP and NYSASP**
1.2.3.4	**GC/MS Analysis of Aqueous and Medium Level Solids for Volatile Organic Compounds using USEPA SOW SOM01.2**
1.2.3.5	**GC/MS Analysis of Low Level Solids for Volatile Organic Compounds using USEPA SOW SOM01.2**
1.2.4.1	**GC/MS Volatiles in Low Concentration Water by EPA CLP SOW**
1.2.4.2	**GC/MS Analysis of Trace Level Volatiles in Water Scan and SIM using EPA CLP SOW SOM01.2**
1.3.2.2	**Analysis of Volatile Organic Compounds in Aqueous and Medium/High Concentration Soil Samples by SW-846**
1.3.2.4	**GC/MS Analysis of Low Concentration Volatiles in Soil/Sediment/Sludge Samples by SW-846**
1.3.2.5	**GC/MS Aqueous Direct Injection for Volatile Organics by SIM**

SOP#	Title
1.3.3.1	Analysis of Low-Level Liquid Volatile Organics Using the Federal Register Method 624
2.1.1.1	Preparation of Water Samples for the Analysis of Pesticide/PCB by CLP & NYSASP
2.1.1.2	Preparation of Soil/Sediment/Sludge Samples for the Analysis of Pesticides/PCBs by EPA CLP plus NYSASP
2.1.1.5	Sulfur Clean-up of Pesticide and PCB Extracts by Copper or Tetrabutylammonium (TBA) Sulfite by CLP, SW846 and NYSASP
2.1.1.6	GC/ECD Analysis of Pesticides/PCBs in Aqueous and Solid Sample Extracts by EPA CLP and NYSASP
2.1.2.2	GC/ECD Analysis of Pesticides/PCBs in Low Concentration Water Samples by CLP
2.1.2.3	GC/ECD Analysis of Pesticides in Aqueous and Solid Sample Extracts by EPA CLP SOW SOM01.2
2.1.2.4	GC/ECD Analysis of Polychlorinated Biphenyls (PCBs) as Aroclors in Water and Soil Extracts by EPA CLP SOW SOM01.2
2.1.3.1	Aqueous Sample Preparation for Pesticides/ PCBs by Low Concentration (OLC03.2 and NYSASP)
2.1.3.2	Preparation of Water Samples for the Analysis of Pesticides by CLP SOW SOM01.2
2.1.3.3	Preparation of Water Samples for the Analysis of Arochlors by CLP SOW SOM01.2
2.1.3.4	Preparation of Soil/Sediment/Sludge Samples for the Analysis of Pesticides by EPA CLP SOM01.2
2.1.3.5	Preparation of Soil/Sediment/Sludge Samples for the Analysis of Aroclors by EPA CLP SOM01.2
2.2.2.1	Extraction of Water Samples for Analysis of Pesticides/PCBs Using the Federal Register Method 608 and 608.2 (Methoxychlor)
2.2.2.2	Analysis of Organochlorine Pesticides and PCBs in Water Samples by the Federal Register Method 608 and Method 608.2 (Methoxychlor)

SOP#	Title
2.2.3.1	Preparation of Water Samples for Diesel Range Organics (DRO) by SW-846 and TN DEC
2.2.3.7	Analysis of Diesel Range Organics (DRO), JP4, JP8, and Total Jet Fuel in Aqueous and Solid Samples by SW846, CA LUFT, and TN DRO
2.2.3.8	Preparation of Soil/Sediment/Sludge Samples for Diesel Range Organics (DRO) by SW-846, CA LUFT, and TN DEC
2.2.4.1	Sample Preparation for Pesticides/PCBs in Water SW-846 and NYSASP
2.2.4.2	Low Level Preparation for Analysis of Pesticides/PCBs Soil/Sediment/Sludge by SW-846 and NYSASP
2.2.4.3	Extraction of TCLP Leachate for Determination of Pesticides/PCBs by SW-846 and NYSASP
2.2.4.5	Soxhlet Extraction of Fish Samples for Pesticides/PCBs with Provisions for % Lipid Determination by SW-846
2.2.4.7	Diluting and Processing of Oil Samples for Analysis of PCBs by SW-846
2.2.4.8	Diluting and Processing Non-Aqueous Waste Samples for Analysis of Pest/PCBS
2.2.4.10	GC/ECD Analysis of Organochlorine Pesticides in Water and Soil Extracts by SW-846
2.2.5.1	PCBs in Water Preparation Procedure (SW-846 and NYSASP)
2.2.5.2	Low Level Preparation for the Analysis of PCBs only in Soil/Sediment/Sludge by SW-846 and NYSASP
2.2.5.3	GC/ECD Analysis of Polychlorinated Biphenyls (PCBs) as Aroclors in Water and Soil by SW-846 and NYSASP
2.2.6.1	Preparation of Aqueous Samples for Analysis of Organophosphorus Pesticides by SW-846 and NYSASP
2.2.6.2	GC/FPD Analysis of Organophosphorus Pesticides in Water and Soil Extracts by SW-846
2.2.7.1	Extraction and Methylation of Chlorinated Herbicides in Water by Method 8151A & 615
2.2.7.2	Extraction and Methylation of Chlorinated Herbicides in Soil by SW-846 and NYSASP
2.2.7.3	Extraction of TCLP Leachates for the Determination of Herbicides by SW-846 and NYSASP

SOP#	Title
2.2.7.4	GC/ECD Analysis of Chlorinated Herbicides in Soil and Water by Methods 8151A & 615
2.2.9.1	Methane, Ethane, Ethene, Propane in Water by RSK-175
2.3.1.1	Preparation of Water Samples for HPLC Analysis of Polynuclear Aromatic Hydrocarbons by Methods 8310 and 610
2.3.1.2	Preparation of Solid Samples for Polynuclear Aromatic Hydrocarbons (PAH) Analysis by SW-846 Method 8310
2.3.1.3	Analysis of Polynuclear Aromatic Hydrocarbons in Soil and Water Using High Performance Liquid Chromatography by Methods 8310 and 610
2.3.2.1	Preparation of Water Samples for the Analysis of Nitroaromatics and Nitramines by High Performance Liquid Chromatography (HPLC) by SW-846 and NYSASP
2.3.2.2	Preparation of Solid Samples for the Analysis of Nitroaromatics and Nitramines by SW-846 Method 8330
2.3.2.4	Analysis of Nitroaromatics and Nitramines in Water and Soil Samples by HPLC in SW-846 and NYSASP
2.3.2.5	Analysis of Explosives by High Performance Liquid Chromatography (HPLC) using SW-846 Method 8332
2.3.2.6	Solid Phase Extraction of Water Samples for the Analysis of Nitroaromatics and Nitramines by High Performance Liquid Chromatography (HPLC) by SW-846
2.4.1.5	Concentration of GC Pesticide/PCB Extract for GC/MS Confirmation by EPA CLP and SW846
2.4.1.6	GC/MS Confirmation of Extractable Pesticides/PCBs by EPA CLP and SW846
2.4.3.1	Preparation of Water Samples for the Analysis of Semivolatiles by EPA CLP and NYSASP
2.4.3.2	Preparation of S/S/S Samples for Analysis of Low Level Semivolatiles (EPA CLP SOW plus NYSASP)
2.4.3.3	Preparation of S/S/S Samples for Analysis of Medium Level Semivolatiles (EPA CLP SOW plus NYSASP)

SOP#	Title
2.4.3.4	Analysis of Semivolatile Organic Compounds in Aqueous and Solid Sample Extracts by EPA CLP and NYSASP
2.4.3.5	Preparation of S/S/S Samples for Analysis of Low Level Semivolatiles (EPA CLP SOW SOM01.2)
2.4.3.6	Preparation of S/S/S Samples for Analysis of Medium Level Semivolatiles (EPA CLP SOW SOM01.2)
2.4.4.1	Water Preparation For Low Concentration Semivolatiles (OLC03.2 + NYSASP)
2.4.4.2	GC/MS Semivolatiles in Low Concentration Water Samples by EPA CLP SOW OLC03.2 and NYSASP
2.4.4.3	GC/MS Scan and SIM Analyses of Semivolatiles in Water and Soil Matrices by EPA CLP SOM01.2
2.4.4.4	Preparation of Aqueous Samples For Semivolatile GC/MS Analysis According to SOW SOM01.2
2.4.4.5	GC/MS Selected Ion Monitoring (SIM) Semivolatile Analyses of Aqueous and Soil Samples using SW-846 and EPA CLP Methodologies (OLC03.2 and OLM04.3)
2.5.1.1	Preparation of Commercial Base Neutral and Acid Water Samples by Federal Register Method 625
2.5.1.2	Analysis of Aqueous Acid and Base-Neutral Extractables by the Federal Register Method 625 with Library Searches
2.5.2.1	Preparation of Water Samples for the Analysis of Semivolatiles by SW-846 Method 3510C and EPA 625
2.5.2.2	Extraction of TCLP Leachate for Semivolatiles by SW-846 and NYSASP
2.5.2.3	Preparation of Soil/Sediment/Sludge Samples for the Analysis of Low-Level Semivolatiles by SW-846
2.5.2.4	Medium Level Preparation Procedure for Semivolatile Organics in Soil Samples by SW-846 and NYSASP
2.5.2.6	Diluting and Processing Non-Aqueous Waste Samples for Analysis of Semivolatiles
2.5.2.7	GC/MS Analysis of Extractable Semivolatiles in Aqueous and Solid Samples by SW-846

SOP#	Title
2.5.2.8	Analysis of Bis(2-chloroethyl)ether using Selected Ion Monitoring (SIM) in Aqueous and Soil Samples by SW-846
2.5.2.12	Preparation of Wipe Samples for CS
2.6.1	Gel Permeation Chromatography (GPC) Cleanup of Soil and Water Extracts for GC/ECD Analysis of Pesticides/PCBs by EPA CLP SOW OLM04.3
2.6.1-NJ	Gel Permeation Chromatography (GPC) Cleanup of Soil and Water Extracts for GC/ECD Analysis of Pesticides/PCBs by EPA CLP SOW SOM01.2
2.6.3	Gel Permeation Chromatography (GPC) Cleanup of Semivolatile Soil Sample Extracts by CLP, SW-846 and NYSASP
2.6.3-NJ	Gel Permeation Chromatography (GPC) Cleanup of Semivolatile (SV) Soil Sample Extracts by CLP SOW SOM01.2
2.6.4	Sulfuric Acid Wash of PCB-Only Hexane Extract (SW846)
2.6.5	Manual Florisil Cartridge Cleanup of Water and Soil Extracts for the Analysis of Pesticide/PCB by CLP and SW-846
2.6.5-NJ	Manual Florisil Cartridge Cleanup of Water and Soil Extracts for the Analysis of Pesticides by CLP SOW SOM01.2
2.7.2	Toxicity Characteristic Leaching Procedure (TCLP) by SW846
2.7.3	Zero Headspace Extraction (ZHE) / Toxicity Characteristic Leaching Procedure (TCLP) by SW846
2.7.5	Leachate Generation with Water from Solid Waste Samples
2.7.6	Synthetic Precipitation Leaching Procedure by SW-846
2.8.1	Undecanted Percent Moisture Determination in Soil/Sediment/Sludge by CLP, SW-846, and NYSASP
2.8.2	Decanted Percent Moisture in Soil/Sediment/ Sludge by EPA CLP, NYSASP, and SW-846

SOP#	Title
2.8.3	Percent Solids Determination in Inorganic Samples by CLP & NYSASP
2.8.4	pH Measurement for Solid Samples by EPA CLP and NYSASP
2.8.7	Soxhlet Extraction of Soil/Sediment/Sludge and Wipe Samples by SW-846 plus NYSASP
2.8.8	Conductivity in Water
2.8.10	Automated Soxhlet Extraction of Solid Samples (encluding Wipes) by SW-846
2.8.11	Homogenization of Biota and Soil Samples
3.1.1.2	Digestion Block Preparation of Aqueous Samples for Total or Dissolved Metals by CLP SOW ILM04.1 and NYSASP
3.1.1.3	Digestion Block Preparation of Soil Samples for Total Metals for ICP Analysis by CLP and NYSASP
3.1.1.4	Determination of Metals by Inductively Coupled Plasma (ICP) by EPA CLP and NYSASP(ILM04.1, ILM05.4 SOW Documents)
3.1.1.5	Digestion Block Preparation of Aqueous Samples for Total Metals or dissolved Metals by CLP ILM05.4 (ICP-AES) and NYSASP
3.1.1.6	Digestion Block Preparation of Soil Samples for Total Metals for ICP-AES Analysis by CLP SOW ILM05.4 and NYSASP
3.1.2.1	Preparation of Aqueous Samples for Total or Dissolved Metals Analysis by ICP-MS using CLP SOW ILM05.4 and NYSASP
3.1.2.2	Determination of Metals by Inductively Coupled Plasma -Mass Spectometry (ICP-MS) by EPA CLP
3.2.1.4	Digestion Block Preparation of Aqueous Samples for ICP Analysis of Total or Dissolved Metals by SW-846, MCAWW, Standard Methods, and NYSASP
3.2.1.5	Digestion Block Preparation of Soil Samples for ICP Determination of Total Metals by SW-846 and NYSASP
3.2.1.6	Inductively Coupled Plasma Atomic Emission Spectroscopy by SW-846 Method 6010B

SOP#	Title
3.2.1.7	Digestion Block Preparation of Solid Samples for ICP-MS Determination of Total Metals by SW-846
3.2.1.8	Determination of Metals using Inductively Coupled Plasma-Atomic Emission Spectrometry (ICP-AES) by MCAWW
3.2.1.9	Determination of Metals by Inductively Coupled Plasma -Mass Spectometry (ICP-MS) by SW-846 and NYSASP
3.2.1.13	Digestion Block Preparation of Aqueous Samples for ICP-MS Analysis of Total or Dissolved Metals by SW-846 Method 3005A
3.3.1	Mercury in Water, Manual Digestion Procedure for EPA CLP, NYSASP, SW-846, and MCAWW
3.3.2	Solid Sample Mercury Digestion by SW-846 Method 7471A
3.3.3	Solid Sample Mercury Digestion by CLP, NYSASP, and MCAWW
3.3.4	Automated Cold Vapor Determination for Mercury by CLP, SW-846, MCAWW, and NYSASP
3.4.1	Aqueous Sample Cyanide Midi Distillation, by CLP, NYSASP
3.4.2	Midi Distillation of Aqueous Samples for the Determination of Total and Free Cyanide by SW-846 and Standard Methods
3.4.3	Solid Sample for Total Cyanide Midi-Distillation by CLP and NYSASP
3.4.4	Reactive (Total Releasable) Cyanide by SW-846
3.4.5	Cyanide Analysis of Water and Soil/Sediment Distillates by CLP, MCAWW, SW-846, NYSASP & Lachat
3.4.6	Solid Sample for Total and Free Cyanide Midi Distillation by SW-846 Method 9010B and Standard Methods 4500-CnI

SOP#	Title
3.4.7	**Midi Distillation of Aqueous Samples for Amenable Cyanide by CLP, SW-846, and NYSASP**
3.5.1.1	**Alkalinity in Waters and Leachates by MCAWW and Lachat**
3.5.2.1	**Ammonia (Phenolate) in Water by MCAWW and Lachat**
3.5.2.2	**Distilling Samples for Ammonia Analysis**
3.5.6.1	**Distilling Samples for Fluoride Analysis by Standard Methods**
3.5.7.1	**Total Hardness as Calcium Carbonate in Water by Lachat and MCAWW**
3.5.8.1	**Colorimetric Determination of Hexavalent Chromium in Aqueous Samples by Lachat, Standard Methods, and SW-846**
3.5.8.2	**Alkaline Digestion of Solid Matrices by Method 3060A for Analysis of Hexavalent Chromium [Cr (VI))]**
3.5.8.3	**Determination of Hexavalent Chromium in Soil Matrices using SW-846 Method 7196A**
3.5.9.1	**Ignitability by SW-846**
3.5.11.1	**Nitrate/Nitrite-N, NO3-N, or NO2-N in Water by MCAWW and Lachat**
3.5.12.1	**Determination of Total Kjeldahl Nitrogen by Flow Injection Analysis Colorimetry (Block Digestor Method) by MCAWW and Lachat**
3.5.13.1	**Distillation of Aqueous Samples for Total Recoverable Phenol by Lachat, MCAWW and, SW-846**
3.5.13.2	**Distilling Samples for Phenols in Soil/Sediment/Sludge by SW-846 (amended for soils)**
3.5.13.3	**Determination of Total Recoverable Phenolics in Aqueous Distillates of Water and Soil Samples by MCAWW and SW-846**
3.5.14.1	**pH Determination**
3.5.14.2	**Corrosivity Characterization by pH Determination in SW-846**
3.5.14.3	**Soil and Waste pH by Methods 9045C and 9045D (SW-846 plus NYSASP)**

SOP#	Title
3.5.15.1	Determination of Total Phosphorus by Flow Injection Analysis Colorimenry, by MCAWW and Lachat
3.5.17.1	Determination of Sulfide in Aqueous Samples
3.5.18.1	Reactive (Total Releasable) Sulfide by SW-846
3.5.19.1	Nonfilterable Residue, Total Suspended Solids, by Standard Methods for the Examination of Water and Wastewater
3.5.19.2	Filterable Residue, Total Dissolved Solids, by Standard Methods for the Examination of Water and Wastewater
3.5.19.3	Total Solids by Standard Methods for the Examination of Water and Wastewater
3.5.20.1	Acidity, Titrimetric by MCAWW
3.5.21.1	Paint Filter Liquids Test
3.5.22.1	Determination of Inorganic Anions by Ion Chromatography
3.5.22.2	Determination of Perchlorate by Ion Chromatography
3.5.23.1	Ferric/Ferrous Iron Phenanthroline Method
3.6.1.4	Preparation of Soil/Sediment Samples for Analysis of Total Petroleum Hydrocarbons by IR using SW-846
3.6.1.5	Analysis of Samples for Total Petroleum Hydrocarbons and Oil and Grease by IR in MCAWW & SW846
3.6.1.7	n-Hexane Extractable Material (HEM) for Sludge, Sediment, and Solid Samples by SW-846
3.6.1.8	Gravimetric Oil and Grease in Water by Method 1664A
3.6.2.1	Total Organic Carbon (TOC) in Water by MCAWW and SW-846
3.6.2.2	Analysis of Soil Samples for Total Organic Carbon (TOC) by SW-846 and Lloyd Kahn
4.1	Receiving Samples
4.3	Checking and Recording pH of Metals, Cyanides, Phenols, and Wet Chemistry Samples
4.4	Sample Custody and Responsibilities of the Sample Custodian

SOP#	Title
4.5	Ensuring Sample Security
4.6	Storing Samples
4.7	Organizing and Designating Raw Samples for Disposal
4.8	Purging, Storing, and Preparing "Completed" Extracts for Disposal
4.9	Preparing and Handling Test Samples
4.12	Document Storage Control
4.13	Handling & Verifying Proper Preservation of Samples Being Analyzed for Cyanides and Phenols
4.14	Complete SDG File Organization and Assembly
4.15	Training Procedures for Receiving Personnel
4.16	Data Scanning Procedures
4.17	Glassware Shipping Procedures
5.1	CompuChem Subcontracting Contingency Plan
5.2	Resolution of Complaints and Inquiries for Commercial Clients
5.3	Use and Selection of Subcontract Laboratories
5.5	Subcontract Chain of Custody
5.6	Project Profile Sheet
5.8	Creating the Gray Folder
5.10	Client Setup and Creating Profiles in Horizon
5.11	Order Entry in Horizon
5.12	Invoice Generation Using Horizon
6.1	Production Planning and Scheduling
6.2	Scheduling Repeats for Organic Parameters
6.3	Baseline Configuration of Data Flow
8.1	Diazomethane Generation
8.2	Sonication Procedure
8.4	Training for Sample Preparation Personnel
8.5	Pesticide & Semivolatile Lot Checks
9.1	Calibrating Automatic Pipettes in the Inorganic Laboratory
9.5	Training Procedures for Inorganic Sample Preparation Personnel
9.10	Acid Distillation
10.1	Preparing Glassware for the Organics Sample Preparation Laboratory (Organics, Acid B/N Extractables, and Pesticides/PCBs)
10.2	Preparing Glassware for the Inorganics Laboratory

SOP#	Title
10.4	Cleaning Procedure for the Zero Headspace Extractor (ZHE) and Associated Glassware
11.1.1	Preparing Glassware for Volatile Sample Preparations
11.2.1.3	Training for GC/HPLC Personnel
11.2.2.3	Naming Conventions
11.2.2.9	Sample Quantitation
11.2.2.11	Training Procedures for Semivolatile GC/MS Personnel
11.3.1.4	Instrument Maintenance Procedures
11.3.1.5	Performing Quarterly and Annual Verification Studies of Method and Instrument Parameters for Inorganics
11.3.2.1	Wavelength Calibration Check for Spectronic 21D Spectrophotmeter
12.1	Hazardous Waste Disposal
12.2	Spill Control and Cleanup
13.1	Creating New Standard Operating Procedures
13.2	Revising Standard Operating Procedures
13.4	Numerical Data Reduction
13.5	Assessing Blank Water Purity
13.6	Proper Documentation Procedures
13.7	Laboratory Control Sample and Control Charting Program
13.8	Creating Control Chart Files
13.9	Printing Control Charts
13.10	Archiving and Deleting Control Chart Data
13.11	Performing Annual Organic Method Detection Limit (MDL) Studies
13.12	Equipment Maintenance Records and Tag-Out Procedures
13.13	Updating Control Limits
13.14	Quality Control of Laboratory-Generated Water and Vendor Pre-Cleaned and Certified Bottles
13.15	Documenting Refrigerator and Freezer Temperatures
13.16	Top Loading Balance Calibration & Maintenance
13.17	Analytical Balance Calibration and Maintenance
13.18	Manual Chromatographic Peak Integration Procedures
13.19	Traceability of Purchased and Prepared Standard Reference Material, Solvents and Reagents

SOP#	Title
13.20	Batching, Posting, and Lab Inquiries Using Horizon LIM System
14.1.1.2	ThruPut Method Creation
14.1.1.12	Data Review Procedures for Volatile CLP Reports
14.2.1.1	GC Data Review for CLP
14.2.1.2	GC Data Review for SW-846
14.2.1.3	Thru-Put* Method Creation and Verification (Gilbert: Target 3.4)
14.2.1.4	GC Data Review for SOM01.1
14.2.2.8	Data Review Procedures for Semivolatile CLP Reports
14.2.2.9	Semivolatile Case Review
14.2.2.10	Thru-Put* Method Creation and Verification (Einstein: Target 3.5)
14.3.1.2	Data Review of Inorganic Cases/SDGs for EPA/CLP, SW846, and Commercial Non-CLP
14.3.1.3	Case Review of SW846 and Commercial Non-CLP
14.3.1.4	Case Review of EPA and non-EPA CLP Cases
14.3.1.6	Using MARRs Software to Produce EPA CLP Data Package Deliverables and Agency Standard Diskettes
14.3.2.1	Data Management: Wet Chemistry Data Review and Verification
15.1	Data Security
15.2	Software Documentation
15.3	System Backup and Archival for the HP 9000 systems Dante, Homer, Gilbert, and Einstein.
15.4	System Backup and Archival for all Windows-based Computer Systems
15.5	Assigning User Classes in Horizon
15.6	Creating Compound Lists in Horizon
15.7	Creating Analysis Codes in Horizon
15.8	Entering Detection Limits in Horizon
15.9	Entering Control Limits in Horizon
15.10	Entering Spike Standards in Horizon
15.11	Entering Analysis Code Containers in Horizon
15.12	Entering Calibration Standards in Horizon
15.13	Software Validation
16.1	Hiring, Training, and Promotion Qualifications Program

SOP#	Title
17.1	SOP Review, Distribution, and Document Control
17.2	Corrective Action Reports (CARs) and Documenting Exceptions
17.3	Quality Assurance Audits
17.4	Performing an Audit Trail/ThruPut/Target Audit
17.6	Performing an Audit of Sample Storage and Chain-of-Custody Procedures
17.7	Performing an Audit of Safety Practices and Equipment
17.8	Performing a Reagent (Solvent and Chemical) and Standard Storage and Control Audit
17.10	Performing a Logbook and Record-Keeping Audit
17.12	Calibrating Laboratory Temperature Measurement Devices
17.13	Corrective Action Response Procedures for EPA CLP Evidence Audit Reports
17.14	Processing Proficiency Test (PT) Samples
17.16	Precision, Accuracy, and Estimation of Measurement Uncertainty in the Laboratory
17.17	Document Control of Quality Assurance Records
17.18	Process for Product Development
17.19	Ethical Conduct and Data Integrity
17.20	Compiling Electronic Data for Data/Tape Audit Submissions to the U.S. Environmental Protection Agency (EPA)

Appendix D

Certification Summary Table

Accrediting Body	ID Number	Type
Connecticut Department of Public Health	PH-0522	State
Florida Department of Health	E87047	Primary NELAP accreditation
State of Illinois Environmental Protection Agency	200034	Secondary NELAP accreditation
State of Kansas Department of Health and Environment	E-10312	Secondary NELAP accreditation
State of Louisiana Department of Environmental Quality	AI 8366 03071	Secondary NELAP accreditation
Massachusetts Department of Environmental Protection and Energy	M-NC028	State
New Hampshire Department of Environmental Services	201606	Secondary NELAP accreditation
New Jersey Department of Environmental Protection	NC249	Secondary NELAP accreditation
New York Department of Health	10065	Secondary NELAP accreditation
North Carolina Department of Environment, and Natural Resources	79	Home state certification
Ohio EPA Voluntary Action Program (VAP)	CL0060	State
Oklahoma Division of Environmental Quality	9410	State
Pennsylvania Department of Environmental Protection	68-00672	Secondary NELAP accreditation
South Carolina Department of Health and Environmental Control	99055002	State
Wisconsin Department of Natural Resources	999314910	State
Department of the Navy Naval Facilities Engineering Service Center	NFESC 413	Agency
U.S. EPA Contract Laboratory Program (CLP)	LIBRTY	Agency

Accrediting Body	ID Number	Type
National Environmental Laboratory Accreditation Program (NELAP)	E87047	NELAP accreditation based upon FLDOH primary accreditation. Accepted by states marked on this chart and OR, and UT and the non-NELAC states: GA, ME, VT, and WA
U.S. Department of Agriculture	RAL-99-04	Permit to receive soil from foreign sources

LABORATORY ACCREDITATION BUREAU

Certificate # L2251

Scope of Accreditation For CompuChem, a Division of Liberty Analytical Corporation, Inc.

501 Madison Avenue
Cary, NC 27513
Mark Ross
919-379-4006

In recognition of a successful assessment to ISO/IEC 17025:2005 and the requirements of the DoD Environmental Laboratory Accreditation Program (DoD ELAP) as detailed in the DoD Quality Systems Manual for Environmental Laboratories (DoD QSM v4.1) based on the National Environmental Laboratory Accreditation Conference Chapter 5 Quality Systems Standard (NELAC Voted Revision June 5, 2003), accreditation is granted to CompuChem to perform the following tests:

Accreditation granted through: April 23, 2013

Testing - Environmental

Non-Potable Water		
Technology	**Method**	**Analyte**
GC-MS	EPA 8260B	1,1,1,2-Tetrachloroethane
GC-MS	EPA 8260B	1,1,1-Trichloro-2,2,2-trifluoroethane
GC-MS	EPA 8260B	1,1,1-Trichloroethane
GC-MS	EPA 8260B	1,1,2,2-Tetrachloroethane
GC-MS	EPA 8260B	1,1,2-Trichloro-1,2,2-trifluoroethane
GC-MS	EPA 8260B	1,1,2-Trichloroethane
GC-MS	EPA 8260B	1,1-Dichloroethane
GC-MS	EPA 8260B	1,1-Dichloroethene
GC-MS	EPA 8260B	1,1-Dichloropropene
GC-MS	EPA 8260B	1,2,3-Trichlorobenzene
GC-MS	EPA 8260B	1,2,3-Trichloropropane
GC-MS	EPA 8260B	1,2,4-Trichlorobenzene
GC-MS	EPA 8260B	1,2,4-Trimethylbenzene
GC-MS	EPA 8260B	1,2-Dibromo-3-chloropropane
GC-MS	EPA 8260B	1,2-Dibromoethane
GC-MS	EPA 8260B	1,2-Dichlorobenzene
GC-MS	EPA 8260B	1,2-Dichloroethane
GC-MS	EPA 8260B	1,2-Dichloroethene (total)
GC-MS	EPA 8260B	1,2-Dichloropropane

Non-Potable Water		
Technology	**Method**	**Analyte**
GC-MS	EPA 8260B	1,3,5-Trimethylbenzene
GC-MS	EPA 8260B	1,3-Dichloropropane
GC-MS	EPA 8260B	1,3-Dicholorobenzene
GC-MS	EPA 8260B	1,4-Dichlorobenzene
GC-MS	EPA 8260B	1,4-Dioxane
GC-MS	EPA 8260B	1-Chlorohexane
GC-MS	EPA 8260B	2,2'-Dichloropropane
GC-MS	EPA 8260B	2-Butanone (MEK)
GC-MS	EPA 8260B	2-Chloro-1,3-butadiene (Chloroprene)
GC-MS	EPA 8260B	2-Chloroethyl vinyl ether
GC-MS	EPA 8260B	2-Chlorotoluene
GC-MS	EPA 8260B	2-Hexanone
GC-MS	EPA 8260B	4-Chlorotoluene
GC-MS	EPA 8260B	4-Methyl-2-pentanone (MIBK)
GC-MS	EPA 8260B	Acetone
GC-MS	EPA 8260B	Acetonitrile
GC-MS	EPA 8260B	Acrolein
GC-MS	EPA 8260B	Acrylonitrile
GC-MS	EPA 8260B	Allyl chloride (3-chloro-1-propene)(3-Chloropropene)
GC-MS	EPA 8260B	Benzene
GC-MS	EPA 8260B	Bromobenzene
GC-MS	EPA 8260B	Bromochloromethane
GC-MS	EPA 8260B	Bromodichloromethane
GC-MS	EPA 8260B	Bromoform
GC-MS	EPA 8260B	Bromomethane
GC-MS	EPA 8260B	Carbon disulfide
GC-MS	EPA 8260B	Carbon tetrachloride
GC-MS	EPA 8260B	Chlorobenzene
GC-MS	EPA 8260B	Chloroethane
GC-MS	EPA 8260B	Chloroform
GC-MS	EPA 8260B	Chloromethane
GC-MS	EPA 8260B	cis-1,2-Dichloroethene
GC-MS	EPA 8260B	cis-1,3-Dichloropropene
GC-MS	EPA 8260B	Cyclohexane
GC-MS	EPA 8260B	Dibromochloromethane
GC-MS	EPA 8260B	Dibromomethane
GC-MS	EPA 8260B	Dichlorodifluoromethane
GC-MS	EPA 8260B	Ethylbenzene
GC-MS	EPA 8260B	Ethylmethacrylate

Non-Potable Water		
Technology	**Method**	**Analyte**
GC-MS	EPA 8260B	Hexachlorobutadiene
GC-MS	EPA 8260B	Isobutanol
GC-MS	EPA 8260B	Isopropylbenzene
GC-MS	EPA 8260B	Isopropylether
GC-MS	EPA 8260B	Methacrylonitrile
GC-MS	EPA 8260B	Methyl acetate
GC-MS	EPA 8260B	Methyl iodide
GC-MS	EPA 8260B	Methyl methacrylate
GC-MS	EPA 8260B	Methylcyclohexane
GC-MS	EPA 8260B	Methylene chloride
GC-MS	EPA 8260B	Methyl-tert-butyl ether (MTBE)
GC-MS	EPA 8260B	Naphthalene
GC-MS	EPA 8260B	n-Butylbenzene
GC-MS	EPA 8260B	n-Propyl Benzene
GC-MS	EPA 8260B	Pentachloroethane
GC-MS	EPA 8260B	p-Isopropyl Toluene
GC-MS	EPA 8260B	Propionitrile
GC-MS	EPA 8260B	sec-Butyl benzene
GC-MS	EPA 8260B	Styrene
GC-MS	EPA 8260B	tert-Butyl benzene
GC-MS	EPA 8260B	Tetrachloroethene
GC-MS	EPA 8260B	Toluene
GC-MS	EPA 8260B	Total Xylenes
GC-MS	EPA 8260B	trans-1,2-Dichloroethene
GC-MS	EPA 8260B	trans-1,3-Dichloropropene
GC-MS	EPA 8260B	trans-1,4-Dichloro-2-butene
GC-MS	EPA 8260B	Trichloroethene
GC-MS	EPA 8260B	Trichlorofluoromethane
GC-MS	EPA 8260B	Vinyl acetate
GC-MS	EPA 8260B	Vinyl chloride
GC-MS	EPA 8260B	Xylene, Meta + Para
GC-MS	EPA 8260B	Xylene, Ortho
GC-MS	EPA 8270C/8270D	1,1'-Biphenyl
GC-MS	EPA 8270C/8270D	1,2,4,5-Tetrachlorobenzene
GC-MS	EPA 8270C/8270D	1,2,4-Trichlorobenzene
GC-MS	EPA 8270C/8270D	1,2-Dichlorobenzene
GC-MS	EPA 8270C/8270D	1,2-Diphenylhydrazine
GC-MS	EPA 8270C/8270D	1,3,5-Trinitrobenzene
GC-MS	EPA 8270C/8270D	1,3-Dichlorobenzene

Non-Potable Water

Technology	Method	Analyte
GC-MS	EPA 8270C/8270D	1,3-Dinitrobenzene
GC-MS	EPA 8270C/8270D	1,4-Dichlorobenzene
GC-MS	EPA 8270C/8270D	1,4-Naphthoquinone
GC-MS	EPA 8270C/8270D	1-Methylnaphthalene
GC-MS	EPA 8270C/8270D	1-Naphthylamine
GC-MS	EPA 8270C/8270D	2,3,4,6-Tetrachlorophenol
GC-MS	EPA 8270C/8270D	2,4,5-Trichlorophenol
GC-MS	EPA 8270C/8270D	2,4,6-Trichlorophenol
GC-MS	EPA 8270C/8270D	2,4-Dichlorophenol
GC-MS	EPA 8270C/8270D	2,4-Dimethylphenol
GC-MS	EPA 8270C/8270D	2,4-Dinitrophenol
GC-MS	EPA 8270C/8270D	2,4-Dinitrotoluene
GC-MS	EPA 8270C/8270D	2,6-Dichlorophenol
GC-MS	EPA 8270C/8270D	2,6-Dinitrotoluene
GC-MS	EPA 8270C/8270D	2-Acetylaminofluorene
GC-MS	EPA 8270C/8270D	2-Chloronaphthalene
GC-MS	EPA 8270C/8270D	2-Chlorophenol
GC-MS	EPA 8270C/8270D	2-Methylnaphthalene
GC-MS	EPA 8270C/8270D	2-Methylphenol
GC-MS	EPA 8270C/8270D	2-Naphthylamine
GC-MS	EPA 8270C/8270D	2-Nitroaniline
GC-MS	EPA 8270C/8270D	2-Nitrophenol
GC-MS	EPA 8270C/8270D	3,3'-Dichlorobenzidine
GC-MS	EPA 8270C/8270D	3,3'-Dimethylbenzidine
GC-MS	EPA 8270C/8270D	3-Methylcholanthrene
GC-MS	EPA 8270C/8270D	3-Methylphenol(1)
GC-MS	EPA 8270C/8270D	3-Nitroaniline
GC-MS	EPA 8270C/8270D	4,6-Dinitro-2-methylphenol
GC-MS	EPA 8270C/8270D	4-Aminobiphenyl
GC-MS	EPA 8270C/8270D	4-Bromophenyl phenyl ether
GC-MS	EPA 8270C/8270D	4-Chloro-3-methylphenol
GC-MS	EPA 8270C/8270D	4-Chloroaniline
GC-MS	EPA 8270C/8270D	4-Chlorophenyl phenyl ether
GC-MS	EPA 8270C/8270D	4-Methylphenol(1)
GC-MS	EPA 8270C/8270D	4-Nitroaniline
GC-MS	EPA 8270C/8270D	4-Nitrophenol
GC-MS	EPA 8270C/8270D	5-Nitro-o-toluidine
GC-MS	EPA 8270C/8270D	7,12-Dimethylbenz(a)-anthracene
GC-MS	EPA 8270C/8270D	Acenaphthene
GC-MS	EPA 8270C/8270D	Acenaphthylene

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Non-Potable Water		
Technology	**Method**	**Analyte**
GC-MS	EPA 8270C/8270D	Acetophenone
GC-MS	EPA 8270C/8270D	Aniline
GC-MS	EPA 8270C/8270D	Anthracene
GC-MS	EPA 8270C/8270D	Atrazine
GC-MS	EPA 8270C/8270D	Benzyl alcohol
GC-MS	EPA 8270C/8270D	Benzaldehyde
GC-MS	EPA 8270C/8270D	Benzo(a)anthracene
GC-MS	EPA 8270C/8270D	Benzo(a)pyrene
GC-MS	EPA 8270C/8270D	Benzo(b)fluoranthene
GC-MS	EPA 8270C/8270D	Benzo(g,h,i)perylene
GC-MS	EPA 8270C/8270D	Benzo(k)fluoranthene
GC-MS	EPA 8270C/8270D	bis(2-chloroethoxy)methane
GC-MS	EPA 8270C/8270D	bis(2-chloroethyl)ether
GC-MS	EPA 8270C/8270D	bis(2-chloroisopropyl)ether (2,2'-oxybis(1-Chloropropane))
GC-MS	EPA 8270C/8270D	bis(2-ethylhexyl)phthalate
GC-MS	EPA 8270C/8270D	Butyl benzyl phthalate
GC-MS	EPA 8270C/8270D	Caprolactam
GC-MS	EPA 8270C/8270D	Carbazole
GC-MS	EPA 8270C/8270D	Chlorobenzilate
GC-MS	EPA 8270C/8270D	Chrysene
GC-MS	EPA 8270C/8270D	Diallate
GC-MS	EPA 8270C/8270D	Dibenzo(a,h)anthracene
GC-MS	EPA 8270C/8270D	Dibenzofuran
GC-MS	EPA 8270C/8270D	Diethyl phthalate
GC-MS	EPA 8270C/8270D	Dimethoate
GC-MS	EPA 8270C/8270D	Dimethyl phthalate
GC-MS	EPA 8270C/8270D	Di-n-butyl phthalate
GC-MS	EPA 8270C/8270D	Di-n-octyl phthalate
GC-MS	EPA 8270C/8270D	Diphenylamine(2)
GC-MS	EPA 8270C/8270D	Disulfoton
GC-MS	EPA 8270C/8270D	Ethyl methacrylate
GC-MS	EPA 8270C/8270D	Ethyl methane sulfonate
GC-MS	EPA 8270C/8270D	Fluoranthene
GC-MS	EPA 8270C/8270D	Fluorene
GC-MS	EPA 8270C/8270D	Hexachlorobenzene
GC-MS	EPA 8270C/8270D	Hexachlorobutadiene
GC-MS	EPA 8270C/8270D	Hexachlorocyclopentadiene
GC-MS	EPA 8270C/8270D	Hexachloroethane
GC-MS	EPA 8270C/8270D	Hexachloropropene

Non-Potable Water

Technology	Method	Analyte
GC-MS	EPA 8270C/8270D	Indeno(1,2,3-cd)pyrene
GC-MS	EPA 8270C/8270D	Isodrin
GC-MS	EPA 8270C/8270D	Isophorone
GC-MS	EPA 8270C/8270D	Isosafrole
GC-MS	EPA 8270C/8270D	Methyl methane sulfonate
GC-MS	EPA 8270C/8270D	Methyl Parathion
GC-MS	EPA 8270C/8270D	Naphthalene
GC-MS	EPA 8270C/8270D	Nitrobenzene
GC-MS	EPA 8270C/8270D	n-Nitrosodiethylamine
GC-MS	EPA 8270C/8270D	n-Nitrosodimethylamine
GC-MS	EPA 8270C/8270D	n-Nitrosodi-n-butylamine
GC-MS	EPA 8270C/8270D	n-Nitrosodi-n-propylamine
GC-MS	EPA 8270C/8270D	n-Nitroso-diphenylamine(2)
GC-MS	EPA 8270C/8270D	n-Nitrosomethylethylamine
GC-MS	EPA 8270C/8270D	n-Nitrosomorpholine
GC-MS	EPA 8270C/8270D	n-Nitrosopiperidine
GC-MS	EPA 8270C/8270D	n-Nitrosopyrrolidine
GC-MS	EPA 8270C/8270D	o,o,o-Triethyl phosphorothioate
GC-MS	EPA 8270C/8270D	o-Toluidine
GC-MS	EPA 8270C/8270D	p-(Dimethylamino) azobenzene
GC-MS	EPA 8270C/8270D	Parathion
GC-MS	EPA 8270C/8270D	Pentachlorobenzene
GC-MS	EPA 8270C/8270D	Pentachloronitrobenzene
GC-MS	EPA 8270C/8270D	Pentachlorophenol
GC-MS	EPA 8270C/8270D	Pentachloroethane
GC-MS	EPA 8270C/8270D	Phenacetin
GC-MS	EPA 8270C/8270D	Phenanthrene
GC-MS	EPA 8270C/8270D	Phenol
GC-MS	EPA 8270C/8270D	Phorate
GC-MS	EPA 8270C/8270D	Pyrene
GC-MS	EPA 8270C/8270D	Pyridine
GC-MS	EPA 8270C/8270D	Safrole
GC-MS	EPA 8270C/8270D	Sulfotepp
GC-MS	EPA 8270C/8270D	Thionazin (Zinophos)
GC-ECD	EPA 8081A/8081B	Aldrin
GC-ECD	EPA 8081A/8081B	Alpha-BHC
GC-ECD	EPA 8081A/8081B	Alpha-chlordane
GC-ECD	EPA 8081A/8081B	Beta-BHC
GC-ECD	EPA 8081A/8081B	4,4'-DDD
GC-ECD	EPA 8081A/8081B	4,4'-DDE

Non-Potable Water		
Technology	**Method**	**Analyte**
GC-ECD	EPA 8081A/8081B	4,4'-DDT
GC-ECD	EPA 8081A/8081B	Delta-BHC
GC-ECD	EPA 8081A/8081B	Dieldrin
GC-ECD	EPA 8081A/8081B	Endosulfan I
GC-ECD	EPA 8081A/8081B	Endosulfan II
GC-ECD	EPA 8081A/8081B	Endosulfan sulfate
GC-ECD	EPA 8081A/8081B	Endrin
GC-ECD	EPA 8081A/8081B	Endrin aldehyde
GC-ECD	EPA 8081A/8081B	Endrin ketone
GC-ECD	EPA 8081A/8081B	Gamma-BHC (Lindane)
GC-ECD	EPA 8081A/8081B	Gamma-chlordane
GC-ECD	EPA 8081A/8081B	Heptachlor
GC-ECD	EPA 8081A/8081B	Heptachlor epoxide
GC-ECD	EPA 8081A/8081B	Methoxychlor
GC-ECD	EPA 8081A/8081B	Toxaphene
GC-ECD	EPA 8081A/8081B	Technical Chlordane
GC-ECD	EPA 8082/8082A	Aroclor-1016
GC-ECD	EPA 8082/8082A	Aroclor-1221
GC-ECD	EPA 8082/8082A	Aroclor-1232
GC-ECD	EPA 8082/8082A	Aroclor-1242
GC-ECD	EPA 8082/8082A	Aroclor-1248
GC-ECD	EPA 8082/8082A	Aroclor-1254
GC-ECD	EPA 8082/8082A	Aroclor-1260
GC-ECD	EPA 8082/8082A	Aroclor-1262
GC-ECD	EPA 8082/8082A	Aroclor-1268
GC-ECD	EPA 8151A	Dalapon
GC-ECD	EPA 8151A	4-Nitrophenol
GC-ECD	EPA 8151A	Dicamba
GC-ECD	EPA 8151A	Dichloroprop
GC-ECD	EPA 8151A	2,4-DB
GC-ECD	EPA 8151A	2,4-D
GC-ECD	EPA 8151A	2,4,5-T
GC-ECD	EPA 8151A	2,4,5-TP (Silvex)
GC-ECD	EPA 8151A	Dinoseb
GC-ECD	EPA 8151A	Pentachlorophenol
ICP-AES	EPA 6010B/6010C	Aluminum
ICP-AES	EPA 6010B/6010C	Antimony
ICP-AES	EPA 6010B/6010C	Arsenic
ICP-AES	EPA 6010B/6010C	Barium
ICP-AES	EPA 6010B/6010C	Beryllium

Non-Potable Water

Technology	Method	Analyte
ICP-AES	EPA 6010B/6010C	Cadmium
ICP-AES	EPA 6010B/6010C	Calcium
ICP-AES	EPA 6010B/6010C	Chromium
ICP-AES	EPA 6010B/6010C	Cobalt
ICP-AES	EPA 6010B/6010C	Copper
ICP-AES	EPA 6010B/6010C	Iron
ICP-AES	EPA 6010B/6010C	Lead
ICP-AES	EPA 6010B/6010C	Magnesium
ICP-AES	EPA 6010B/6010C	Manganese
CVVA	EPA 7470A	Mercury
ICP-AES	EPA 6010B/6010C	Molybdenum
ICP-AES	EPA 6010B/6010C	Nickel
ICP-AES	EPA 6010B/6010C	Potassium
ICP-AES	EPA 6010B/6010C	Selenium
ICP-AES	EPA 6010B/6010C	Silver
ICP-AES	EPA 6010B/6010C	Sodium
ICP-AES	EPA 6010B/6010C	Thallium
ICP-AES	EPA 6010B/6010C	Tin
ICP-AES	EPA 6010B/6010C	Titanium
ICP-AES	EPA 6010B/6010C	Vanadium
ICP-AES	EPA 6010B/6010C	Zinc
ICP-MS	EPA 6020/6020A	Antimony
ICP-MS	EPA 6020/6020A	Arsenic
ICP-MS	EPA 6020/6020A	Barium
ICP-MS	EPA 6020/6020A	Beryllium
ICP-MS	EPA 6020/6020A	Cadmium
ICP-MS	EPA 6020/6020A	Chromium
ICP-MS	EPA 6020/6020A	Cobalt
ICP-MS	EPA 6020/6020A	Copper
ICP-MS	EPA 6020/6020A	Lead
ICP-MS	EPA 6020/6020A	Manganese
ICP-MS	EPA 6020/6020A	Nickel
ICP-MS	EPA 6020/6020A	Selenium
ICP-MS	EPA 6020/6020A	Silver
ICP-MS	EPA 6020/6020A	Thallium
ICP-MS	EPA 6020/6020A	Vanadium
ICP-MS	EPA 6020/6020A	Zinc
UV-VIS	EPA 9012A	Cyanide
TITR	SM 4500 S2F	Sulfide
IC	EPA 300.0	Chloride

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Non-Potable Water

Technology	Method	Analyte
IC	EPA 300.0	Bromide
IC	EPA 300.0	Fluoride
IC	EPA 300.0	Sulfate
IC	EPA 300.0	Nitrate
IC	EPA 300.0	Nitrite
IC	EPA 300.0	Orthophosphate
HPLC	EPA 8330/8330A/8330B	HMX
HPLC	EPA 8330/8330A/8330B	RDX
HPLC	EPA 8330/8330A/8330B	1,3,5-Trinitrobenzene
HPLC	EPA 8330/8330A/8330B	1,3-Dinitrobenzene
HPLC	EPA 8330/8330A/8330B	Nitrobenzene
HPLC	EPA 8330/8330A/8330B	Tetryl
HPLC	EPA 8330/8330A/8330B	2,4,6-Trinitrotoluene
HPLC	EPA 8330/8330A/8330B	4-Amino-2,6-dinitrotoluene
HPLC	EPA 8330/8330A/8330B	2-Amino-4,6-dinitrotoluene
HPLC	EPA 8330/8330A/8330B	2,6-Dinitrotoluene
HPLC	EPA 8330/8330A/8330B	2,4-Dinitrotoluene
HPLC	EPA 8330/8330A/8330B	2-Nitrotoluene
HPLC	EPA 8330/8330A/8330B	4-Nitrotoluene
HPLC	EPA 8330/8330A/8330B	3-Nitrotoluene
HPLC	EPA 8332	Nitroglycerin
HPLC	EPA 8332	PETN (Pentaerythritol tetranitrate)
HPLC	EPA 8332	TMETN (Trimethylolethane trinitrate)
UV-VIS	EPA 9066	Phenolics
GC-FID	EPA RSK-175	Methane
GC-FID	EPA RSK-175	Ethane
GC-FID	EPA RSK-175	Ethene
GC-FID	EPA RSK-175	Propane
GC/FID	EPA 8015B/8015C	GRO
GC/FID	EPA 8015B/8015C	DRO
TOC	EPA 9060A	Total Organic Carbon
TOC	SM 5310B	Total Organic Carbon
TITR	EPA 310.2	Alkalinity
Pensky-Martens Closed-Cup	EPA 1010A	Ignitability
ISE	EPA 9040 B	Corrosivity
ISE	SM 4500H+B	pH
Gravimetric	SM 2540 B	Total Solids
Gravimetric	SM 2540 C	Total Dissolved Solids
Gravimetric	SM 2540 D	Total Suspended Solids
IC	EPA 314.0	Perchlorate

Non-Potable Water		
Technology	**Method**	**Analyte**
UV-VIS	SM 3500 Cr-B	Hexavalent Chromium
UV-VIS	EPA 7196A	Hexavalent Chromium
UV-VIS	SM 3500 Fe-B	Ferrous Iron
Preparation	**Method**	**Type**
Separatory Funnel Liquid-Liquid Extraction	EPA 3510C	Semivolatile and Nonvolatile Organics
Liquid Extraction	EPA 3520C	Continuous Liquid-liquid
Purge and Trap	EPA 5030B	Volatile Organic Compounds
Acid Digestion (Aqueous)	EPA 3010A	Inorganics
Acid Digestion (Aqueous)	EPA 3005A	Total Recoverable or Dissolved Metals
Distillation and UV-VIS	EPA 9010B	Total and Amenable Cyanide

Solid and Chemical Materials		
Technology	**Method**	**Analyte**
GC-MS	EPA 8260B	1,1,1,2-Tetrachloroethane
GC-MS	EPA 8260B	1,1,2,2-Tetrachloroethane
GC-MS	EPA 8260B	1,1,1-Trichloro-2,2,2-trifluoroethane
GC-MS	EPA 8260B	1,1,1-Trichloroethane
GC-MS	EPA 8260B	1,1,2-Trichloro-1,2,2-trifluoroethane
GC-MS	EPA 8260B	1,1,2-Trichloroethane
GC-MS	EPA 8260B	1,1-Dichloroethane
GC-MS	EPA 8260B	1,1-Dichloroethene
GC-MS	EPA 8260B	1,1-Dichloropropene
GC-MS	EPA 8260B	1,2,3-Trichlorobenzene
GC-MS	EPA 8260B	1,2,3-Trichloropropane
GC-MS	EPA 8260B	1,2,4-Trichlorobenzene
GC-MS	EPA 8260B	1,2,4-Trimethylbenzene
GC-MS	EPA 8260B	1,2-Dibromo-3-chloropropane
GC-MS	EPA 8260B	1,2-Dibromoethane
GC-MS	EPA 8260B	1,2-Dichlorobenzene
GC-MS	EPA 8260B	1,2-Dichloroethane
GC-MS	EPA 8260B	1,2-Dichloroethene (Total)
GC-MS	EPA 8260B	1,2-Dichloropropane
GC-MS	EPA 8260B	1,3,5-Trimethylbenzene
GC-MS	EPA 8260B	1,3-Dichloropropane
GC-MS	EPA 8260B	1,3-Dicholorobenzene
GC-MS	EPA 8260B	1,4-Dichlorobenzene
GC-MS	EPA 8260B	1,4-Dioxane
GC-MS	EPA 8260B	1-Chlorohexane

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Solid and Chemical Materials

Technology	Method	Analyte
GC-MS	EPA 8260B	2,2'-Dichloropropane
GC-MS	EPA 8260B	2-Butanone (MEK)
GC-MS	EPA 8260B	2-Chloro-1,3-butadiene (Chloroprene)
GC-MS	EPA 8260B	2-Chloroethyl vinyl ether
GC-MS	EPA 8260B	2-Chlorotoluene
GC-MS	EPA 8260B	2-Hexanone
GC-MS	EPA 8260B	4-Chlorotoluene
GC-MS	EPA 8260B	4-Methyl-2-pentanone (MIBK)
GC-MS	EPA 8260B	Acetone
GC-MS	EPA 8260B	Acetonitrile
GC-MS	EPA 8260B	Acrolein
GC-MS	EPA 8260B	Acrylonitrile
GC-MS	EPA 8260B	Allyl chloride (3-chloro-1-propene) (3-Chloropropene)
GC-MS	EPA 8260B	Benzene
GC-MS	EPA 8260B	Bromobenzene
GC-MS	EPA 8260B	Bromochloromethane
GC-MS	EPA 8260B	Bromodichloromethane
GC-MS	EPA 8260B	Bromoform
GC-MS	EPA 8260B	Bromomethane
GC-MS	EPA 8260B	Carbon disulfide
GC-MS	EPA 8260B	Carbon tetrachloride
GC-MS	EPA 8260B	Chlorobenzene
GC-MS	EPA 8260B	Chloroethane
GC-MS	EPA 8260B	Chloroform
GC-MS	EPA 8260B	Chloromethane
GC-MS	EPA 8260B	cis-1,2-Dichloroethene
GC-MS	EPA 8260B	cis-1,3-Dichloropropene
GC-MS	EPA 8260B	Cyclohexane
GC-MS	EPA 8260B	Dibromochloromethane
GC-MS	EPA 8260B	Dibromomethane
GC-MS	EPA 8260B	Dichlorodifluoromethane
GC-MS	EPA 8260B	Ethylbenzene
GC-MS	EPA 8260B	Ethylmethacrylate
GC-MS	EPA 8260B	Hexachlorobutadiene
GC-MS	EPA 8260B	Iodomethane
GC-MS	EPA 8260B	Isobutanol
GC-MS	EPA 8260B	Isopropylbenzene
GC-MS	EPA 8260B	Isopropylether
GC-MS	EPA 8260B	Methacrylonitrile

Solid and Chemical Materials		
Technology	**Method**	**Analyte**
GC-MS	EPA 8260B	Methyl acetate
GC-MS	EPA 8260B	Methyl methacrylate
GC-MS	EPA 8260B	Methylcyclohexane
GC-MS	EPA 8260B	Methylene chloride
GC-MS	EPA 8260B	Methyl-tert-butyl ether (MTBE)
GC-MS	EPA 8260B	Naphthalene
GC-MS	EPA 8260B	n-Butylbenzene
GC-MS	EPA 8260B	n-Propyl Benzene
GC-MS	EPA 8260B	Pentachloroethane
GC-MS	EPA 8260B	p-Isopropyl Toluene
GC-MS	EPA 8260B	Propionitrile
GC-MS	EPA 8260B	sec-Butyl benzene
GC-MS	EPA 8260B	Styrene
GC-MS	EPA 8260B	tert-Butyl benzene
GC-MS	EPA 8260B	Tetrachloroethene
GC-MS	EPA 8260B	Toluene
GC-MS	EPA 8260B	Total Xylenes
GC-MS	EPA 8260B	trans-1,2-Dichloroethene
GC-MS	EPA 8260B	trans-1,3-Dichloropropene
GC-MS	EPA 8260B	trans-1,4-Dichloro-2-butene
GC-MS	EPA 8260B	Trichloroethene
GC-MS	EPA 8260B	Trichlorofluoromethane
GC-MS	EPA 8260B	Vinyl acetate
GC-MS	EPA 8260B	Vinyl chloride
GC-MS	EPA 8260B	Xylene, Meta + Para
GC-MS	EPA 8260B	Xylene, Ortho
GC-MS	EPA 8270C/8270D	1,1'-Biphenyl
GC-MS	EPA 8270C/8270D	1,2,4,5-Tetrachlorobenzene
GC-MS	EPA 8270C/8270D	1,2,4-Trichlorobenzene
GC-MS	EPA 8270C/8270D	1,2-Dichlorobenzene
GC-MS	EPA 8270C/8270D	1,2-Diphenylhydrazine
GC-MS	EPA 8270C/8270D	1,3,5-Trinitrobenzene
GC-MS	EPA 8270C/8270D	1,3-Dichlorobenzene
GC-MS	EPA 8270C/8270D	1,3-Dinitrobenzene
GC-MS	EPA 8270C/8270D	1,4-Dichlorobenzene
GC-MS	EPA 8270C/8270D	1-Methylnaphthalene
GC-MS	EPA 8270C/8270D	1-Naphthylamine
GC-MS	EPA 8270C/8270D	2,3,4,6-Tetrachlorophenol
GC-MS	EPA 8270C/8270D	2,4,5-Trichlorophenol
GC-MS	EPA 8270C/8270D	2,4,6-Trichlorophenol

Solid and Chemical Materials		
Technology	**Method**	**Analyte**
GC-MS	EPA 8270C/8270D	2,4-Dichlorophenol
GC-MS	EPA 8270C/8270D	2,4-Dimethylphenol
GC-MS	EPA 8270C/8270D	2,4-Dinitrophenol
GC-MS	EPA 8270C/8270D	2,4-Dinitrotoluene
GC-MS	EPA 8270C/8270D	2,6-Dichlorophenol
GC-MS	EPA 8270C/8270D	2,6-Dinitrotoluene
GC-MS	EPA 8270C/8270D	2-Acetylaminofluorene
GC-MS	EPA 8270C/8270D	2-Chloronaphthalene
GC-MS	EPA 8270C/8270D	2-Chlorophenol
GC-MS	EPA 8270C/8270D	2-Methylnaphthalene
GC-MS	EPA 8270C/8270D	2-Methylphenol
GC-MS	EPA 8270C/8270D	2-Naphthylamine
GC-MS	EPA 8270C/8270D	2-Nitroaniline
GC-MS	EPA 8270C/8270D	2-Nitrophenol
GC-MS	EPA 8270C/8270D	2-Picoline
GC-MS	EPA 8270C/8270D	3,3’-Dichlorobenzidine
GC-MS	EPA 8270C/8270D	3,3’-Dimethylbenzidine
GC-MS	EPA 8270C/8270D	3-Methylcholanthrene
GC-MS	EPA 8270C/8270D	3-Methylphenol(1)
GC-MS	EPA 8270C/8270D	3-Nitroaniline
GC-MS	EPA 8270C/8270D	4,6-Dinitro-2-methylphenol
GC-MS	EPA 8270C/8270D	4-Aminobiphenyl
GC-MS	EPA 8270C/8270D	4-Bromophenyl phenyl ether
GC-MS	EPA 8270C/8270D	4-Chloro-3-methylphenol
GC-MS	EPA 8270C/8270D	4-Chloroaniline
GC-MS	EPA 8270C/8270D	4-Chlorophenyl phenyl ether
GC-MS	EPA 8270C/8270D	4-Methylphenol(1)
GC-MS	EPA 8270C/8270D	4-Nitroaniline
GC-MS	EPA 8270C/8270D	4-Nitrophenol
GC-MS	EPA 8270C/8270D	4-Nitroquinoline-1-oxide
GC-MS	EPA 8270C/8270D	5-Nitro-o-toluidine
GC-MS	EPA 8270C/8270D	7,12-Dimethylbenz(a)-anthracene
GC-MS	EPA 8270C/8270D	Acenaphthene
GC-MS	EPA 8270C/8270D	Acenaphthylene
GC-MS	EPA 8270C/8270D	Acetophenone
GC-MS	EPA 8270C/8270D	Aniline
GC-MS	EPA 8270C/8270D	Anthracene
GC-MS	EPA 8270C/8270D	Aramite
GC-MS	EPA 8270C/8270D	Atrazine
GC-MS	EPA 8270C/8270D	Benzaldehyde

Solid and Chemical Materials		
Technology	**Method**	**Analyte**
GC-MS	EPA 8270C/8270D	Benzo(a)anthracene
GC-MS	EPA 8270C/8270D	Benzo(a)pyrene
GC-MS	EPA 8270C/8270D	Benzo(b)fluoranthene
GC-MS	EPA 8270C/8270D	Benzo(g,h,i)perylene
GC-MS	EPA 8270C/8270D	Benzo(k)fluoranthene
GC-MS	EPA 8270C/8270D	Benzoic Acid
GC-MS	EPA 8270C/8270D	Benzyl alcohol
GC-MS	EPA 8270C/8270D	bis(2-chloroethoxy)methane
GC-MS	EPA 8270C/8270D	bis(2-chloroethyl)ether
GC-MS	EPA 8270C/8270D	bis(2-chloroisopropyl)ether (2,2'-oxybis(1-Chloropropane))
GC-MS	EPA 8270C/8270D	bis(2-ethylhexyl)phthalate
GC-MS	EPA 8270C/8270D	Butyl benzyl phthalate
GC-MS	EPA 8270C/8270D	Caprolactam
GC-MS	EPA 8270C/8270D	Carbazole
GC-MS	EPA 8270C/8270D	Chlorobenzilate
GC-MS	EPA 8270C/8270D	Chrysene
GC-MS	EPA 8270C/8270D	Diallate
GC-MS	EPA 8270C/8270D	Dibenzo(a,h)anthracene
GC-MS	EPA 8270C/8270D	Dibenzofuran
GC-MS	EPA 8270C/8270D	Diethyl phthalate
GC-MS	EPA 8270C/8270D	Dimethoate
GC-MS	EPA 8270C/8270D	Dimethyl phthalate
GC-MS	EPA 8270C/8270D	Di-n-butyl phthalate
GC-MS	EPA 8270C/8270D	Di-n-octyl phthalate
GC-MS	EPA 8270C/8270D	Diphenylamine(2)
GC-MS	EPA 8270C/8270D	Disulfoton
GC-MS	EPA 8270C/8270D	Ethyl methacrylate
GC-MS	EPA 8270C/8270D	Ethyl methane sulfonate
GC-MS	EPA 8270C/8270D	Fluoranthene
GC-MS	EPA 8270C/8270D	Fluorene
GC-MS	EPA 8270C/8270D	Hexachlorobenzene
GC-MS	EPA 8270C/8270D	Hexachlorobutadiene
GC-MS	EPA 8270C/8270D	Hexachlorocyclopentadiene
GC-MS	EPA 8270C/8270D	Hexachloroethane
GC-MS	EPA 8270C/8270D	Hexachloropropene
GC-MS	EPA 8270C/8270D	Indeno(1,2,3-cd)pyrene
GC-MS	EPA 8270C/8270D	Isodrin
GC-MS	EPA 8270C/8270D	Isophorone
GC-MS	EPA 8270C/8270D	Isosafrole

Solid and Chemical Materials

Technology	Method	Analyte
GC-MS	EPA 8270C/8270D	Methyl methane sulfonate
GC-MS	EPA 8270C/8270D	Methyl Parathion
GC-MS	EPA 8270C/8270D	Naphthalene
GC-MS	EPA 8270C/8270D	Nitrobenzene
GC-MS	EPA 8270C/8270D	n-Nitrosodiethylamine
GC-MS	EPA 8270C/8270D	n-Nitrosodimethylamine
GC-MS	EPA 8270C/8270D	n-Nitrosodi-n-butylamine
GC-MS	EPA 8270C/8270D	n-Nitrosodi-n-propylamine
GC-MS	EPA 8270C/8270D	n-Nitroso-diphenylamine(2)
GC-MS	EPA 8270C/8270D	n-Nitrosomethylethylamine
GC-MS	EPA 8270C/8270D	n-Nitrosomorpholine
GC-MS	EPA 8270C/8270D	n-Nitrosopiperidine
GC-MS	EPA 8270C/8270D	n-Nitrosopyrrolidine
GC-MS	EPA 8270C/8270D	o,o,o-Triethyl phosphorothioate
GC-MS	EPA 8270C/8270D	o-Toluidine
GC-MS	EPA 8270C/8270D	p-(Dimethylamino) azobenzene
GC-MS	EPA 8270C/8270D	Parathion
GC-MS	EPA 8270C/8270D	Pentachlorobenzene
GC-MS	EPA 8270C/8270D	Pentachloronitrobenzene
GC-MS	EPA 8270C/8270D	Pentachlorophenol
GC-MS	EPA 8270C/8270D	Pentachloroethane
GC-MS	EPA 8270C/8270D	Phenacetin
GC-MS	EPA 8270C/8270D	Phenanthrene
GC-MS	EPA 8270C/8270D	Phenol
GC-MS	EPA 8270C/8270D	Phorate
GC-MS	EPA 8270C/8270D	Pronamide
GC-MS	EPA 8270C/8270D	Pyrene
GC-MS	EPA 8270C/8270D	Pyridine
GC-MS	EPA 8270C/8270D	Safrole
GC-MS	EPA 8270C/8270D	Sulfotepp
GC-MS	EPA 8270C/8270D	Thionazin (Zinophos)
GC-ECD	EPA 8081A/8081B	Aldrin
GC-ECD	EPA 8081A/8081B	Alpha-BHC
GC-ECD	EPA 8081A/8081B	Alpha-chlordane
GC-ECD	EPA 8081A/8081B	Beta-BHC
GC-ECD	EPA 8081A/8081B	4,4'-DDD
GC-ECD	EPA 8081A/8081B	4,4'-DDE
GC-ECD	EPA 8081A/8081B	4,4'-DDT
GC-ECD	EPA 8081A/8081B	Delta-BHC
GC-ECD	EPA 8081A/8081B	Dieldrin

Solid and Chemical Materials

Technology	Method	Analyte
GC-ECD	EPA 8081A/8081B	Endosulfan I
GC-ECD	EPA 8081A/8081B	Endosulfan II
GC-ECD	EPA 8081A/8081B	Endosulfan sulfate
GC-ECD	EPA 8081A/8081B	Endrin
GC-ECD	EPA 8081A/8081B	Endrin aldehyde
GC-ECD	EPA 8081A/8081B	Endrin ketone
GC-ECD	EPA 8081A/8081B	Gamma-BHC (Lindane)
GC-ECD	EPA 8081A/8081B	Gamma-chlordane
GC-ECD	EPA 8081A/8081B	Heptachlor
GC-ECD	EPA 8081A/8081B	Heptachlor epoxide
GC-ECD	EPA 8081A/8081B	Methoxychlor
GC-ECD	EPA 8081A/8081B	Toxaphene
GC-ECD	EPA 8081A/8081B	Technical Chlordane
GC-ECD	EPA 8082/8082A	Aroclor-1016
GC-ECD	EPA 8082/8082A	Aroclor-1221
GC-ECD	EPA 8082/8082A	Aroclor-1232
GC-ECD	EPA 8082/8082A	Aroclor-1242
GC-ECD	EPA 8082/8082A	Aroclor-1248
GC-ECD	EPA 8082/8082A	Aroclor-1254
GC-ECD	EPA 8082/8082A	Aroclor-1260
GC-ECD	EPA 8082/8082A	Aroclor-1262
ICP-AES	EPA 6010B/6010C	Aluminum
ICP-AES	EPA 6010B/6010C	Antimony
ICP-AES	EPA 6010B/6010C	Arsenic
ICP-AES	EPA 6010B/6010C	Barium
ICP-AES	EPA 6010B/6010C	Beryllium
ICP-AES	EPA 6010B/6010C	Cadmium
ICP-AES	EPA 6010B/6010C	Calcium
ICP-AES	EPA 6010B/6010C	Chromium
ICP-AES	EPA 6010B/6010C	Cobalt
ICP-AES	EPA 6010B/6010C	Copper
ICP-AES	EPA 6010B/6010C	Iron
ICP-AES	EPA 6010B/6010C	Lead
ICP-AES	EPA 6010B/6010C	Magnesium
ICP-AES	EPA 6010B/6010C	Manganese
ICP-AES	EPA 6010B/6010C	Molybdenum
CVVA	EPA 7471A/7471B	Mercury
ICP-AES	EPA 6010B/6010C	Nickel
ICP-AES	EPA 6010B/6010C	Potassium
ICP-AES	EPA 6010B/6010C	Selenium

Solid and Chemical Materials

Technology	Method	Analyte
ICP-AES	EPA 6010B/6010C	Silver
ICP-AES	EPA 6010B/6010C	Sodium
ICP-AES	EPA 6010B/6010C	Thallium
ICP-AES	EPA 6010B/6010C	Titanium
ICP-AES	EPA 6010B/6010C	Vanadium
ICP-AES	EPA 6010B/6010C	Zinc
ICP-AES	EPA 6010B/6010C	Tin
ICP-MS	EPA 6020/6020A	Antimony
ICP-MS	EPA 6020/6020A	Arsenic
ICP-MS	EPA 6020/6020A	Barium
ICP-MS	EPA 6020/6020A	Beryllium
ICP-MS	EPA 6020/6020A	Cadmium
ICP-MS	EPA 6020/6020A	Chromium
ICP-MS	EPA 6020/6020A	Cobalt
ICP-MS	EPA 6020/6020A	Copper
ICP-MS	EPA 6020/6020A	Lead
ICP-MS	EPA 6020/6020A	Manganese
ICP-MS	EPA 6020/6020A	Nickel
ICP-MS	EPA 6020/6020A	Selenium
ICP-MS	EPA 6020/6020A	Silver
ICP-MS	EPA 6020/6020A	Thallium
ICP-MS	EPA 6020/6020A	Vanadium
ICP-MS	EPA 6020/6020A	Zinc
UV-VIS	EPA 9012A	Cyanide
Gravimetric	EPA 9071B	Oil and Grease HEM
GC/FID	EPA 8015B/8015C	GRO
GC/FID	EPA 8015B/8015C	DRO
TOC	EPA 9060A Mod	Total Organic Carbon
Pensky-Martens Closed-Cup	EPA 1010A	Ignitability
ISE	EPA 9045C/9045D	pH
UV-VIS	EPA 7196A	Hexavalent Chromium
UV-VIS	SW-846 Ch. 7/ EPA 9014	Reactive Cyanide
TITR	SW-847 Ch. 7/ EPA 9034	Reactive Sulfide
Preparation	**Method**	**Type**
Ultrasonic Extraction	EPA 3550B/3550C	Semivolatile and Nonvolatile Organics
Waste Dilution	EPA 3580A	Semivolatile and Nonvolatile Organics
Purge and Trap	EPA 5035/5035A	Volatile Organic Compounds
Acid Digestion	EPA 3050B	Hotblock Assisted
TCLP Extraction	EPA 1311	Toxicity Characteristic Leaching Procedure

Solid and Chemical Materials		
Preparation	**Method**	**Type**
SPLP Extraction	EPA 1312	Synthetic Precipitation Leaching Procedure
Extraction	EPA 3540C	Soxhlet
Extraction	EPA 3541	Automated Soxhlet Extraction
Leachate Generation	ASTM D3987-85	Leachate Generation with Water from Solid Waste Samples
Alkaline Digestion	EPA 3060A	Hexavalent Chromium
Distillation and UV-VIS	EPA 9010B	Total and Amenable Cyanide
Titrimetric and Manual Spectrophotometric	EPA 9014	Cyanide
Titrimetric	EPA 9034	Acid-Soluble and Acid-Insoluble Sulfides

Biological Tissue		
Technology	**Method**	**Analyte**
GC-MS	EPA 8260B	1,1,1,2-Tetrachloroethane
GC-MS	EPA 8260B	1,1,1-Trichloro-1,2,2-trifluoroethane
GC-MS	EPA 8260B	1,1,1-Trichloroethane
GC-MS	EPA 8260B	1,1,2,2-Tetrachloroethane
GC-MS	EPA 8260B	1,1,2-Trichloro-1,2,2-trifluoroethane
GC-MS	EPA 8260B	1,1,2-Trichloroethane
GC-MS	EPA 8260B	1,1-Dichloroethane
GC-MS	EPA 8260B	1,1-Dichloroethene
GC-MS	EPA 8260B	1,1-Dichloropropene
GC-MS	EPA 8260B	1,2,3-Trichlorobenzene
GC-MS	EPA 8260B	1,2,3-Trichloropropane
GC-MS	EPA 8260B	1,2,4-Trichlorobenzene
GC-MS	EPA 8260B	1,2,4-Trimethylbenzene
GC-MS	EPA 8260B	1,2-Dibromo-3-chloropropane
GC-MS	EPA 8260B	1,2-Dibromoethane
GC-MS	EPA 8260B	1,2-Dichlorobenzene
GC-MS	EPA 8260B	1,2-Dichloroethane
GC-MS	EPA 8260B	1,2-Dichloroethene (Total)
GC-MS	EPA 8260B	1,2-Dichloropropane
GC-MS	EPA 8260B	1,3,5-Trimethylbenzene
GC-MS	EPA 8260B	1,3-Dichloropropane
GC-MS	EPA 8260B	1,3-Dicholorobenzene
GC-MS	EPA 8260B	1,4-Dichlorobenzene
GC-MS	EPA 8260B	1,4-Dioxane
GC-MS	EPA 8260B	1-Chlorohexane
GC-MS	EPA 8260B	2,2'-Dichloropropane
GC-MS	EPA 8260B	2-Butanone (MEK)

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Biological Tissue		
Technology	**Method**	**Analyte**
GC-MS	EPA 8260B	2-Chloro-1,3-butadiene (Chloroprene)
GC-MS	EPA 8260B	2-Chloroethyl vinyl ether
GC-MS	EPA 8260B	2-Chlorotoluene
GC-MS	EPA 8260B	2-Hexanone
GC-MS	EPA 8260B	4-Chlorotoluene
GC-MS	EPA 8260B	4-Methyl-2-pentanone (MIBK)
GC-MS	EPA 8260B	Acetone
GC-MS	EPA 8260B	Acetonitrile
GC-MS	EPA 8260B	Acrolein
GC-MS	EPA 8260B	Acrylonitrile
GC-MS	EPA 8260B	Allyl chloride (3-chloro-1-propene) (3-Chloropropene)
GC-MS	EPA 8260B	Benzene
GC-MS	EPA 8260B	Bromobenzene
GC-MS	EPA 8260B	Bromochloromethane
GC-MS	EPA 8260B	Bromodichloromethane
GC-MS	EPA 8260B	Bromoform
GC-MS	EPA 8260B	Bromomethane
GC-MS	EPA 8260B	Carbon disulfide
GC-MS	EPA 8260B	Carbon tetrachloride
GC-MS	EPA 8260B	Chlorobenzene
GC-MS	EPA 8260B	Chloroethane
GC-MS	EPA 8260B	Chloroform
GC-MS	EPA 8260B	Chloromethane
GC-MS	EPA 8260B	cis-1,2-Dichloroethene
GC-MS	EPA 8260B	cis-1,3-Dichloropropene
GC-MS	EPA 8260B	Cyclohexane
GC-MS	EPA 8260B	Dibromochloromethane
GC-MS	EPA 8260B	Dibromomethane
GC-MS	EPA 8260B	Dichlorodifluoromethane
GC-MS	EPA 8260B	Ethylbenzene
GC-MS	EPA 8260B	Ethylmethacrylate
GC-MS	EPA 8260B	Hexachlorobutadiene
GC-MS	EPA 8260B	Iodomethane
GC-MS	EPA 8260B	Isobutanol
GC-MS	EPA 8260B	Isopropylbenzene
GC-MS	EPA 8260B	Isopropylether
GC-MS	EPA 8260B	Methacrylonitrile
GC-MS	EPA 8260B	Methyl acetate
GC-MS	EPA 8260B	Methyl methacrylate

Biological Tissue		
Technology	**Method**	**Analyte**
GC-MS	EPA 8260B	Methylcyclohexane
GC-MS	EPA 8260B	Methylene chloride
GC-MS	EPA 8260B	Methyl-tert-butyl ether (MTBE)
GC-MS	EPA 8260B	Naphthalene
GC-MS	EPA 8260B	n-Butylbenzene
GC-MS	EPA 8260B	n-Propyl Benzene
GC-MS	EPA 8260B	Pentachloroethane
GC-MS	EPA 8260B	p-Isopropyl Toluene
GC-MS	EPA 8260B	Propionitrile
GC-MS	EPA 8260B	sec-Butyl benzene
GC-MS	EPA 8260B	Styrene
GC-MS	EPA 8260B	tert-Butyl benzene
GC-MS	EPA 8260B	Tetrachloroethene
GC-MS	EPA 8260B	Toluene
GC-MS	EPA 8260B	Total Xylenes
GC-MS	EPA 8260B	trans-1,2-Dichloroethene
GC-MS	EPA 8260B	trans-1,3-Dichloropropene
GC-MS	EPA 8260B	trans-1,4-Dichloro-2-butene
GC-MS	EPA 8260B	Trichloroethene
GC-MS	EPA 8260B	Trichlorofluoromethane
GC-MS	EPA 8260B	Vinyl acetate
GC-MS	EPA 8260B	Vinyl chloride
GC-MS	EPA 8260B	Xylene, Meta + Para
GC-MS	EPA 8260B	Xylene, Ortho
GC-MS	EPA 8270C/8270D	1,1'-Biphenyl
GC-MS	EPA 8270C/8270D	1,2,4,5-Tetrachlorobenzene
GC-MS	EPA 8270C/8270D	1,2,4-Trichlorobenzene
GC-MS	EPA 8270C/8270D	1,2-Dichlorobenzene
GC-MS	EPA 8270C/8270D	1,2-Diphenylhydrazine
GC-MS	EPA 8270C/8270D	1,3,5-Trinitrobenzene
GC-MS	EPA 8270C/8270D	1,3-Dichlorobenzene
GC-MS	EPA 8270C/8270D	1,3-Dinitrobenzene
GC-MS	EPA 8270C/8270D	1,4-Dichlorobenzene
GC-MS	EPA 8270C/8270D	1-Methylnaphthalene
GC-MS	EPA 8270C/8270D	1-Naphthylamine
GC-MS	EPA 8270C/8270D	2,3,4,6-Tetrachlorophenol
GC-MS	EPA 8270C/8270D	2,4,5-Trichlorophenol
GC-MS	EPA 8270C/8270D	2,4,6-Trichlorophenol
GC-MS	EPA 8270C/8270D	2,4-Dichlorophenol
GC-MS	EPA 8270C/8270D	2,4-Dimethylphenol

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Biological Tissue

Technology	Method	Analyte
GC-MS	EPA 8270C/8270D	2,4-Dinitrophenol
GC-MS	EPA 8270C/8270D	2,4-Dinitrotoluene
GC-MS	EPA 8270C/8270D	2,6-Dichlorophenol
GC-MS	EPA 8270C/8270D	2,6-Dinitrotoluene
GC-MS	EPA 8270C/8270D	2-Acetylaminofluorene
GC-MS	EPA 8270C/8270D	2-Chloronaphthalene
GC-MS	EPA 8270C/8270D	2-Chlorophenol
GC-MS	EPA 8270C/8270D	2-Methylnaphthalene
GC-MS	EPA 8270C/8270D	2-Methylphenol
GC-MS	EPA 8270C/8270D	2-Naphthylamine
GC-MS	EPA 8270C/8270D	2-Nitroaniline
GC-MS	EPA 8270C/8270D	2-Nitrophenol
GC-MS	EPA 8270C/8270D	2-Picoline
GC-MS	EPA 8270C/8270D	3,3’-Dichlorobenzidine
GC-MS	EPA 8270C/8270D	3,3’-Dimethylbenzidine
GC-MS	EPA 8270C/8270D	3-Methylcholanthrene
GC-MS	EPA 8270C/8270D	3-Methylphenol(1)
GC-MS	EPA 8270C/8270D	3-Nitroaniline
GC-MS	EPA 8270C/8270D	4,6-Dinitro-2-methylphenol
GC-MS	EPA 8270C/8270D	4-Aminobiphenyl
GC-MS	EPA 8270C/8270D	4-Bromophenyl phenyl ether
GC-MS	EPA 8270C/8270D	4-Chloro-3-methylphenol
GC-MS	EPA 8270C/8270D	4-Chloroaniline
GC-MS	EPA 8270C/8270D	4-Chlorophenyl phenyl ether
GC-MS	EPA 8270C/8270D	4-Methylphenol(1)
GC-MS	EPA 8270C/8270D	4-Nitroaniline
GC-MS	EPA 8270C/8270D	4-Nitrophenol
GC-MS	EPA 8270C/8270D	4-Nitroquinoline-1-oxide
GC-MS	EPA 8270C/8270D	5-Nitro-o-toluidine
GC-MS	EPA 8270C/8270D	7,12-Dimethylbenz(a)-anthracene
GC-MS	EPA 8270C/8270D	Acenaphthene
GC-MS	EPA 8270C/8270D	Acenphthylene
GC-MS	EPA 8270C/8270D	Acetophenone
GC-MS	EPA 8270C/8270D	Aniline
GC-MS	EPA 8270C/8270D	Anthracene
GC-MS	EPA 8270C/8270D	Aramite
GC-MS	EPA 8270C/8270D	Atrazine
GC-MS	EPA 8270C/8270D	Benzaldehyde
GC-MS	EPA 8270C/8270D	Benzo(a)anthracene
GC-MS	EPA 8270C/8270D	Benzo(a)pyrene

Biological Tissue

Technology	Method	Analyte
GC-MS	EPA 8270C/8270D	Benzo(b)fluoranthene
GC-MS	EPA 8270C/8270D	Benzo(g,h,i)perylene
GC-MS	EPA 8270C/8270D	Benzo(k)fluoranthene
GC-MS	EPA 8270C/8270D	Benzoic Acid
GC-MS	EPA 8270C/8270D	Benzyl alcohol
GC-MS	EPA 8270C/8270D	bis(2-chloroethoxy)methane
GC-MS	EPA 8270C/8270D	bis(2-chloroethyl)ether
GC-MS	EPA 8270C/8270D	bis(2-chloroisopropyl)ether (2,2'-oxybis(1-Chloropropane))
GC-MS	EPA 8270C/8270D	bis(2-ethylhexyl)phthalate
GC-MS	EPA 8270C/8270D	Butyl benzyl phthalate
GC-MS	EPA 8270C/8270D	Caprolactam
GC-MS	EPA 8270C/8270D	Carbazole
GC-MS	EPA 8270C/8270D	Chlorobenzilate
GC-MS	EPA 8270C/8270D	Chrysene
GC-MS	EPA 8270C/8270D	Diallate
GC-MS	EPA 8270C/8270D	Dibenzo(a,h)anthracene
GC-MS	EPA 8270C/8270D	Dibenzofuran
GC-MS	EPA 8270C/8270D	Diethyl phthalate
GC-MS	EPA 8270C/8270D	Dimethoate
GC-MS	EPA 8270C/8270D	Dimethyl phthalate
GC-MS	EPA 8270C/8270D	Di-n-butyl phthalate
GC-MS	EPA 8270C/8270D	Di-n-octyl phthalate
GC-MS	EPA 8270C/8270D	Diphenylamine(2)
GC-MS	EPA 8270C/8270D	Disulfoton
GC-MS	EPA 8270C/8270D	Ethyl methacrylate
GC-MS	EPA 8270C/8270D	Ethyl methane sulfonate
GC-MS	EPA 8270C/8270D	Fluoranthene
GC-MS	EPA 8270C/8270D	Fluorene
GC-MS	EPA 8270C/8270D	Hexachlorobenzene
GC-MS	EPA 8270C/8270D	Hexachlorobutadiene
GC-MS	EPA 8270C/8270D	Hexachlorocyclopentadiene
GC-MS	EPA 8270C/8270D	Hexachloroethane
GC-MS	EPA 8270C/8270D	Hexachloropropene
GC-MS	EPA 8270C/8270D	Indeno(1,2,3-cd)pyrene
GC-MS	EPA 8270C/8270D	Isodrin
GC-MS	EPA 8270C/8270D	Isophorone
GC-MS	EPA 8270C/8270D	Isosafrole
GC-MS	EPA 8270C/8270D	Methyl methane sulfonate
GC-MS	EPA 8270C/8270D	Methyl Parathion

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Biological Tissue		
Technology	**Method**	**Analyte**
GC-MS	EPA 8270C/8270D	Naphthalene
GC-MS	EPA 8270C/8270D	Nitrobenzene
GC-MS	EPA 8270C/8270D	n-Nitrosodiethylamine
GC-MS	EPA 8270C/8270D	n-Nitrosodimethylamine
GC-MS	EPA 8270C/8270D	n-Nitrosodi-n-butylamine
GC-MS	EPA 8270C/8270D	n-Nitrosodi-n-propylamine
GC-MS	EPA 8270C/8270D	n-Nitroso-diphenylamine(2)
GC-MS	EPA 8270C/8270D	n-Nitrosomethylethylamine
GC-MS	EPA 8270C/8270D	n-Nitrosomorpholine
GC-MS	EPA 8270C/8270D	n-Nitrosopiperidine
GC-MS	EPA 8270C/8270D	n-Nitrosopyrrolidine
GC-MS	EPA 8270C/8270D	o,o,o-Triethyl phosphorothioate
GC-MS	EPA 8270C/8270D	o-Toluidine
GC-MS	EPA 8270C/8270D	p-(Dimethylamino) azobenzene
GC-MS	EPA 8270C/8270D	Parathion
GC-MS	EPA 8270C/8270D	Pentachlorobenzene
GC-MS	EPA 8270C/8270D	Pentachloronitrobenzene
GC-MS	EPA 8270C/8270D	Pentachlorophenol
GC-MS	EPA 8270C/8270D	Pentachloroethane
GC-MS	EPA 8270C/8270D	Phenacetin
GC-MS	EPA 8270C/8270D	Phenanthrene
GC-MS	EPA 8270C/8270D	Phenol
GC-MS	EPA 8270C/8270D	Phorate
GC-MS	EPA 8270C/8270D	Pronamide
GC-MS	EPA 8270C/8270D	Pyrene
GC-MS	EPA 8270C/8270D	Pyridine
GC-MS	EPA 8270C/8270D	Safrole
GC-MS	EPA 8270C/8270D	Sulfotepp
GC-MS	EPA 8270C/8270D	Thionazin (Zinophos)
GC-ECD	EPA 8081A/8081B	Aldrin
GC-ECD	EPA 8081A/8081B	Alpha-BHC
GC-ECD	EPA 8081A/8081B	Alpha-chlordane
GC-ECD	EPA 8081A/8081B	Beta-BHC
GC-ECD	EPA 8081A/8081B	4,4'-DDD
GC-ECD	EPA 8081A/8081B	4,4'-DDE
GC-ECD	EPA 8081A/8081B	4,4'-DDT
GC-ECD	EPA 8081A/8081B	Delta-BHC
GC-ECD	EPA 8081A/8081B	Dieldrin
GC-ECD	EPA 8081A/8081B	Endosulfan I
GC-ECD	EPA 8081A/8081B	Endosulfan II

Biological Tissue		
Technology	**Method**	**Analyte**
GC-ECD	EPA 8081A/8081B	Endosulfan sulfate
GC-ECD	EPA 8081A/8081B	Endrin
GC-ECD	EPA 8081A/8081B	Endrin aldehyde
GC-ECD	EPA 8081A/8081B	Endrin ketone
GC-ECD	EPA 8081A/8081B	Gamma-BHC (Lindane)
GC-ECD	EPA 8081A/8081B	Gamma-chlordane
GC-ECD	EPA 8081A/8081B	Heptachlor
GC-ECD	EPA 8081A/8081B	Heptachlor epoxide
GC-ECD	EPA 8081A/8081B	Methoxychlor
GC-ECD	EPA 8081A/8081B	Toxaphene
GC-ECD	EPA 8081A/8081B	Technical Chlordane
GC-ECD	EPA 8082/8082A	Aroclor-1016
GC-ECD	EPA 8082/8082A	Aroclor-1221
GC-ECD	EPA 8082/8082A	Aroclor-1232
GC-ECD	EPA 8082/8082A	Aroclor-1242
GC-ECD	EPA 8082/8082A	Aroclor-1248
GC-ECD	EPA 8082/8082A	Aroclor-1254
GC-ECD	EPA 8082/8082A	Aroclor-1260
GC-ECD	EPA 8082/8082A	Aroclor-1262
ICP-AES	EPA 6010B/6010C	Aluminum
ICP-AES	EPA 6010B/6010C	Antimony
ICP-AES	EPA 6010B/6010C	Arsenic
ICP-AES	EPA 6010B/6010C	Barium
ICP-AES	EPA 6010B/6010C	Beryllium
ICP-AES	EPA 6010B/6010C	Cadmium
ICP-AES	EPA 6010B/6010C	Calcium
ICP-AES	EPA 6010B/6010C	Chromium
ICP-AES	EPA 6010B/6010C	Cobalt
ICP-AES	EPA 6010B/6010C	Copper
ICP-AES	EPA 6010B/6010C	Iron
ICP-AES	EPA 6010B/6010C	Lead
ICP-AES	EPA 6010B/6010C	Magnesium
ICP-AES	EPA 6010B/6010C	Manganese
CVVA	EPA 7471A/7471B	Mercury
ICP-AES	EPA 6010B/6010C	Molybdenum
ICP-AES	EPA 6010B/6010C	Nickel
ICP-AES	EPA 6010B/6010C	Potassium
ICP-AES	EPA 6010B/6010C	Selenium
ICP-AES	EPA 6010B/6010C	Silver
ICP-AES	EPA 6010B/6010C	Sodium
ICP-AES	EPA 6010B/6010C	Thallium

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Biological Tissue		
Technology	**Method**	**Analyte**
ICP-AES	EPA 6010B/6010C	Tin
ICP-AES	EPA 6010B/6010C	Titanium
ICP-AES	EPA 6010B/6010C	Vanadium
ICP-AES	EPA 6010B/6010C	Zinc
ICP-MS	EPA 6020/6020A	Antimony
ICP-MS	EPA 6020/6020A	Arsenic
ICP-MS	EPA 6020/6020A	Barium
ICP-MS	EPA 6020/6020A	Beryllium
ICP-MS	EPA 6020/6020A	Cadmium
ICP-MS	EPA 6020/6020A	Chromium
ICP-MS	EPA 6020/6020A	Cobalt
ICP-MS	EPA 6020/6020A	Copper
ICP-MS	EPA 6020/6020A	Lead
ICP-MS	EPA 6020/6020A	Manganese
ICP-MS	EPA 6020/6020A	Nickel
ICP-MS	EPA 6020/6020A	Selenium
ICP-MS	EPA 6020/6020A	Silver
ICP-MS	EPA 6020/6020A	Thallium
ICP-MS	EPA 6020/6020A	Vanadium
ICP-MS	EPA 6020/6020A	Zinc
UV-VIS	EPA 9012A	Cyanide
Gravimetric	EPA 9071B	Oil and Grease HEM
GC/FID	EPA 8015B/8015C	GRO
GC/FID	EPA 8015B/8015C	DRO
TOC	EPA 9060AMod	Total Organic Carbon
Pensky-Martens Closed-Cup	EPA 1010A	Ignitability
ISE	EPA 9045C/D	pH
UV-VIS	EPA 7196A	Hexavalent Chromium
Preparation	**Method**	**Type**
Purge and Trap	EPA 5035/5035A	Volatile Organic Compounds
Acid Digestion	EPA 3050B	Hotblock Assisted
Extraction	EPA 3540C	Soxhlet
Extraction	EPA 3541	Automated Soxhlet Extraction
Alkaline Digestion	EPA 3060A	Hexavalent Chromium
Distillation and UV-VIS	EPA 9010B	Total and Amenable Cyanide

Notes:

1) This laboratory offers commercial testing service.

Approved By: ______________ Date: August 12, 2010

R. Douglas Leonard
Chief Technical Officer

Issued: 04/23/10 Revised 04/26/10 Revised: 5/17/10 Revised: 5/20/10 Revised: 6/12/10 Revised: 7/29/10 Revised: 8/12/10

APPENDIX I

MC SAMPLING RATIONALE MEMORANDUM

APPENDIX I – MC SAMPLING RATIONALE MEMORANDUM

MILITARY MUNITIONS RESPONSE PROGRAM
PROJECT 7
BOAT BASIN, VISITORS INFORMATION CENTER
REMEDIAL INVESTIGATION
WALLOPS FLIGHT FACILITY FORMERLY USED DEFENSE SITE
WALLOPS ISLAND, VIRGINIA

1.0 INTRODUCTION

Munitions constituents (MC) concentrations in surface soil, subsurface soil, sediment, surface water, and groundwater will be characterized at the Boat Basin, Visitors Information Center as part of the Wallops Flight Facility (WFF) Formerly Used Defense Site (FUDS) Military Munitions Response Program (MMRP). MC may be present at the Boat Basin, Visitors Information Center site as a result of former military munitions operations. The results of the MC characterization will be used to perform a baseline risk assessment and to support Munitions Response Site Prioritization Protocol scoring. This MC Sampling Rationale Memorandum documents the decision logic for the MC sampling process.

Section 2 of this memorandum describes the various munitions and explosives of concern (MEC) and MC release scenarios that may be encountered at the Boat Basin, Visitors Information Center during the remedial investigation (RI). Section 3 details specific MC that may be present at the Boat Basin, Visitors Information Center based on former munitions and weapons systems used during historical activities.

A thorough review of numerous documents was completed to develop the information presented here. A list of these resources is presented in Attachment 1 to Appendix I. Unless otherwise noted, all statements of fact presented in this appendix are based on the review of these documents and the *Final Site Inspection Report for Wallops Flight Facility Project 07, Accomack County, Virginia* (SI), June 2012 by TerranearPMC, LLC/Human Factors Applications, Inc.

2.0 DECISION LOGIC AND SAMPLING CRITERIA

The Boat Basin, Visitors Information Center encompasses approximately 1.53 acres of land that includes four investigation areas: Pyrotechnics Burn Area, Gun Butt Nos. 1 and 2, and South Bank Boat Basin. The Department of the Navy acquired the WFF area in 1942 through condemnation to establish the Chincoteague Naval Air Station (CNAS) as a training facility for World War II naval aviators. The Naval Aviation Ordnance Test Station (NAOTS) was established at the CNAS to conduct secret aviation ordnance tests and munitions experiments. The CNAS was used by NAOTS between 1946 and 1959. In June 1959, the U.S. Navy ceased training and flight operations and the WFF FUDS, including the Boat Basin, Visitors Information Center, was declared excess and transferred to the newly formed National Aeronautics and Space Administration (NASA) in 1961.

The Pyrotechnics Burn Area is an approximately 20-foot by 25-foot fenced in area formerly used by the Navy to dispose of parachute flares and practice bomb signals, using either gasoline or trinitrotoluene (TNT). The former disposal sites are still visible in specific locations within the fenced area. Neither the date of construction nor of the first use of the Pyrotechnics Burn Area is known. The fencing remains and the Pyrotechnics Burn Area is overgrown with vegetation.

Gun Butt No. 1 was constructed in 1952 and used to test and perfect the use of medium-caliber (20 millimeter (mm) to 37mm) aviation guns and ammunition. The test cell target range included a firing point and a concrete impact berm filled with sand or soil. Aircraft guns fired medium-caliber ammunition from Building (Bldg.) J-8 (firing point) into the impact berm (Bldg. J-130) located approximately 350 feet to the southeast of the firing point.

Gun Butt No. 2 was constructed in 1952 prior to Gun Butt No. 1, and, similar to Gun Butt No. 1, was used to test and perfect the use of medium caliber (20mm to 37mm) aviation guns and ammunition. The test cell target range included a firing point and a concrete impact berm filled with sand or soil. Aircraft guns fired medium-caliber ammunition from Bldg. J-17 (firing point) into the impact bunker (Bldg. J-18), which was located approximately 150 feet to the south of the firing point. A structure adjacent to the Gun Butt Nos. 1 and 2 is operated by NASA as a visitors information center.

The South Bank Boat Basin consists of a boat basin and the surrounding bank. Dredging of the boat basin and channel was completed on 26 April 1949 by the Navy in order to establish a boat dock and basin to transport rocket testing materials from the Wallops Main Base to the Wallops Island test facilities.

As part of the RI, geophysical surveys will be performed to investigate the potential presence of MEC on the ground surface, in the subsurface, and in the sediments in and adjacent to the Boat Basin, Visitors Information Center. If the geophysical surveys identify areas of high anomaly densities, these areas will be investigated to determine whether MEC or munitions debris (MD) is present. The presence of significant amounts of MEC or MD may indicate the potential presence of MC. During the RI, MC investigations will be initiated when any of the following conditions are encountered:

- Individual or multiple MEC items or significant MD locations (e.g., on the surface, in burial pits) or areas where soil staining or visible evidence of a potential MC release is observed.
- Known munitions disposal areas, including the Pyrotechnics Burn Area, that potentially contain MC with or without indicators of a MEC release.
- Locations required to delineate the horizontal and vertical extent of MC or munitions-related contaminants, including the potential for sampling in biased and unbiased locations in the Gun Butt Areas to assess potential widespread contamination resulting from the dispersion of the former berm area.

An appropriately biased number of environmental samples will be collected from locations where MEC is uncovered or has been recovered during past disposal activities (i.e., burning within the Pyrotechnics Burn Area). Potential MEC releases identified during the RI will be reported to the project team stakeholders. Details of the sampling methods (i.e., incremental and discrete) that may be used for the RI are presented in Section 3.9 of the RI Work Plan and in the SOPs either presented in the UFP-QAPP or the WFF FUDS Site-Wide UFP-QAPP.

3.0 MC ANALYSIS

This section presents the specific MC that can be anticipated at the Boat Basin, Visitors Information Center based on the historical munitions and weapons systems used. The identification of the anticipated MC permits laboratory analysis of samples collected during the RI to focus on the specific MC that is expected to be present and indicative of potential contamination. Generally, MC at the Boat Basin, Visitors Information Center can be classified into two groups: metals and explosives.

The media to be analyzed during the RI are surface and subsurface soil, sediment, surface water, and groundwater. The Molena (Gun Butt No. 1 and 2), Magotha (Pyrotechnics Burn Area), and Udorthent and Udipsamment (South Bank Boat Basin) soil associations are present within the Boat Basin, Visitors Information Center. The Molena soil series is very deep, rarely flooded, and well drained. The Magotha soil series is very deep, frequently flooded, poorly drained, and typically found in salt marshes ranging from 0 to 2 percent slope. The Udorthent and Udipsamment soils are rarely flooded and well drained (USDA, 2009).

The first step in determining the MC associated with the Boat Basin, Visitors Information Center is to identify the munitions used. The following table identifies the MC potentially associated with the munitions types and impact areas of the Boat Basin, Visitors Information Center investigated during the SI.

Name	Area Name	Munitions ID	Munitions Type	Associated SI MC Analysis
Project 7, Boat Basin, Visitors Information Center	Gun Butt No. 1 and Gun Butt No. 2	Large Caliber (37mm and larger), Medium Caliber (20mm), high explosive (HE) and practice (CTT18), small arms (CTT01)	37mm HE, tracer and practice, 20mm HE tracer and practice, small arms 0.50 machine gun. Although perchlorates were not in widespread use prior to 1957 (approximate timeframe of FUDS use), this facility was a research and development facility and perchlorate may have been used in some of the pyrotechnic devices disposed of at this area.	Explosive constituents: 2,4-dinitrotoluene (DNT); 2,6-DNT; 2-nitrotoluene; 3-nitrotoluene; 2-amino-4,6-DNT; 4-amino-2,6-DNT; and 4-nitrotoluene; 2,4,6-trinitrotoluene (TNT); 1,3,5-trinitrobenzene; 1,3-dinitrobenzene; pentaerythritol tetranitrate (PETN); hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX); nitrobenzene; tetryl; and nitroglycerin (NG) Metals: antimony, copper, iron, lead, nickel. Perchlorate.
	South Bank Boat Basin	Large Caliber (CTT18) and Medium Caliber (CTT18)	37mm, HE, tracer and practice, 20mm HE tracer and practice	Explosive constituents: 2,4-DNT; 2,6-DNT; 2-nitrotoluene; 3-nitrotoluene; 2-amino-4,6-DNT; 4- amino-2,6-DNT; and 4-nitrotoluene; 2,4,6-TNT; 1,3,5-trinitrobenzene; 1,3-dinitrobenzene; PETN; RDX; nitrobenzene; tetryl; and NG Metals: antimony, copper, iron, lead, nickel
	Pyrotechnics Burn Area	Pyrotechnics	Parachute Flare (MK6), AN (MK4) Signals, ANMK5/MK23/MK43 practice bombs	Explosive constituents: 2-amino-4,6-dinitrotoluene; 4-amino-2,6-DNT; nitrobenzene; 2,6-DNT; 1,3,5-trinitrobenzene Metals: aluminum, antimony, barium, iron, lead, magnesium, zinc Other: Polycyclic aromatic hydrocarbons (PAHs) (soil only)

Based on the information presented in the above table, the compounds potentially associated with the Boat Basin, Visitors Information Center are evaluated for the RI MC sampling and the evaluation is presented in the following section.

4.0 MC SAMPLING

The Boat Basin, Visitors Information Center was used by NAOTS from 1946 to 1959. Gun Butt No. 1 and Gun Butt No. 2 were constructed in 1952 and used to test and perfect the use of medium-caliber (20mm to 37mm) aviation guns and ammunition. The South Bank Boat Basin consists of a boat basin and the surrounding bank. Dredging of the boat basin and channel was completed on 26 April 1949 by the Navy in order to establish a boat dock and basin to transport rocket testing materials from the Wallops Main Base to the Wallops Island test facilities. Neither the date of the construction nor of the first use of the Pyrotechnics Burn Area is known.

During the 2011 SI field activities, soil, sediment, groundwater and surface water samples were collected from within the Boat Basin, Visitors Information Center and analyzed for explosives, metals, polycyclic aromatic hydrocarbons (PAHs), and perchlorate. No explosives constituents, perchlorate, or PAHs were detected at concentrations above their respective reporting limits. Several metals were detected above their respective screening limits in samples collected at the Boat Basin, Visitors Information Center.

The final Risk Screening Assessment data presented in the SI report indicated antimony, copper, lead, and zinc in surface soil at the Pyrotechnics Burn Area may present potentially unacceptable risks to ecological receptors. The potential for MC at the Boat Basin, Visitors Information Center was evaluated to determine the constituents and analyses to be performed during the RI (see the following table).

Analyte	Analysis Available?	Analysis Required?	Notes
Metals EPA Method SW-846 3010A/3050B/ 6010B			
Aluminum	Yes	No	Known MC associated with munitions; however, detections observed during the SI indicate concentrations are not expected to present an unacceptable risk to human receptors.
Antimony	Yes	Yes	Known MC associated with munitions. Surface soil detections observed during the SI indicate concentrations may present potentially unacceptable risk to ecological receptors.
Barium	Yes	No	Known MC associated with munitions; however, detections observed during the SI indicate concentrations are not expected to present an unacceptable risk to receptors.
Bismuth	Yes	No	Known MC associated with munitions; however, it is not anticipated to be present at levels that would be potentially harmful because it is a minimal component of munitions.

Analyte	Analysis Available?	Analysis Required?	Notes
Cadmium	Yes	No	Known MC associated with munitions; however, it is not anticipated to be present at levels that would be potentially harmful because it is a minimal component of munitions.
Chromium	Yes	No	Known MC associated with munitions; however, it is not anticipated to be present at levels that would be potentially harmful because it is a minimal component of munitions.
Cobalt	Yes	No	Known MC associated with munitions; however, it is not anticipated to be present at levels that would be potentially harmful because it is a minimal component of munitions.
Copper	Yes	Yes	Known MC associated with munitions. Surface soil detections observed during the SI indicate concentrations may present potentially unacceptable risk to ecological receptors.
Iron	Yes	Yes	Known MC associated with munitions. Groundwater detections observed at Gun Butt No 1 and 2 during the SI indicate concentrations may present potentially unacceptable risk to human receptors.
Lead	Yes	Yes	Known MC associated with munitions. Surface soil detections observed during the SI indicate concentrations may present potentially unacceptable risk to ecological receptors.
Magnesium	Yes	Yes	Known MC associated with munitions; however, screening criteria not available.
Manganese	Yes	No	Known MC associated with munitions; however, it is not anticipated to be present at levels that would be potentially harmful to human health and the environment.
Mercury	Yes	No	Known MC associated with munitions; however, it is not anticipated to be present at levels that would be potentially harmful to human health and the environment.
Nickel	Yes	No	Known MC associated with munitions; however, detections observed during the SI indicate concentrations are not expected to present an unacceptable risk to receptors.
Potassium	Yes	No	Known MC associated with munitions; however, screening criteria not available.
Titanium	Yes	No	Known MC associated with munitions; however, it is not anticipated to be present at levels that would be potentially harmful because it is a minimal component of munitions.
Strontium	Yes	Yes	Known MC associated with tracer munitions.
Vanadium	Yes	No	Known MC associated with munitions; however, it is not anticipated to be present at levels that would be potentially harmful because it is a minimal component of munitions.

Analyte	Analysis Available?	Analysis Required?	Notes
Zinc	Yes	Yes	Known MC associated with munitions. Surface soil detections observed during the SI indicate concentrations may present potentially unacceptable risk to ecological receptors.
Explosives EPA Method SW-846 3535A/8330B or 8330A			
Nitroglycerin (NG)	Yes	Yes	Known MC associated with munitions
Hexahydro-1,3,5- trinitro-1,3,5-triazine (RDX)	Yes	Yes	Known MC associated with munitions
Pentaerythritol Tetranitrate (PETN)	Yes	Yes	Known MC associated with munitions
Tetryl	Yes	Yes	Known MC associated with munitions
2,4,6-Trinitrotoluene (TNT)	Yes	Yes	Known MC associated with munitions
2,4-Dinitrotoluene (2,4-DNT)	Yes	Yes	Breakdown product of TNT
2,6-Dintrotoluene (2,6-DNT)	Yes	Yes	Breakdown product of TNT
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	Yes	Yes	Breakdown product of TNT
2-Nitrotoluene	Yes	Yes	Breakdown product of TNT
3-Nitrotoluene	Yes	Yes	Breakdown product of TNT
4-Nitrotoluene	Yes	Yes	Breakdown product of TNT
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	Yes	Yes	Breakdown product of TNT
1,3,5-Trinitrobenzene	Yes	Yes	Breakdown product of TNT
1,3-Dinitrobenzene	Yes	Yes	Breakdown product of TNT
Nitrobenzene	Yes	Yes	Breakdown product of TNT
Other Components			
Ammonium nitrate Antimony sulfate Antimony sulfide	Not available	No	Note 1
Diethylphthalate Diphenylamine Ethyl centralite	Yes (SW-846 8270C)	No	Note 2
Lead thiocyanate Mercury fulminate	Not available	No	Note 1
Perchlorate	Yes	Yes	May be present due to rocket testing.
Picric acid	Yes (SW-846 8330B)	No	Note 3
Potassium chlorate Potassium nitrate Potassium sulfate	Not available	No	Note 1
Sulfur	Yes	No	Known MC associated with munitions; however, screening criteria not available
Other site-related constituents - PAHs EPA Method SW-846 8270C (soil)			
Acenaphthene	Yes	Yes	PAHs may be present due to the use of gasoline as an accelerant in the Pyrotechnics Burn Area
Acenaphthylene	Yes	Yes	PAHs may be present due to the use of gasoline as an accelerant in the Pyrotechnics Burn Area
Anthracene	Yes	Yes	PAHs may be present due to the use of gasoline as an accelerant in the Pyrotechnics Burn Area
Benz[a]anthracene	Yes	Yes	PAHs may be present due to the use of gasoline as an accelerant in the Pyrotechnics Burn Area

Analyte	Analysis Available?	Analysis Required?	Notes
Benzo[a]pyrene	Yes	Yes	PAHs may be present due to the use of gasoline as an accelerant in the Pyrotechnics Burn Area
Benzo[b]fluoranthene	Yes	Yes	PAHs may be present due to the use of gasoline as an accelerant in the Pyrotechnics Burn Area
Benzo[ghi]perylene	Yes	Yes	PAHs may be present due to the use of gasoline as an accelerant in the Pyrotechnics Burn Area
Benzo[k]fluoranthene	Yes	Yes	PAHs may be present due to the use of gasoline as an accelerant in the Pyrotechnics Burn Area
Chrysene	Yes	Yes	PAHs may be present due to the use of gasoline as an accelerant in the Pyrotechnics Burn Area
Dibenz(a,h)anthracene	Yes	Yes	PAHs may be present due to the use of gasoline as an accelerant in the Pyrotechnics Burn Area
Fluoranthene	Yes	Yes	PAHs may be present due to the use of gasoline as an accelerant in the Pyrotechnics Burn Area
Fluorene	Yes	Yes	PAHs may be present due to the use of gasoline as an accelerant in the Pyrotechnics Burn Area
Indeno(1,2,3-cd)pyrene	Yes	Yes	PAHs may be present due to the use of gasoline as an accelerant in the Pyrotechnics Burn Area
Naphthalene	Yes	Yes	PAHs may be present due to the use of gasoline as an accelerant in the Pyrotechnics Burn Area
Phenanthrene	Yes	Yes	PAHs may be present due to the use of gasoline as an accelerant in the Pyrotechnics Burn Area
Pyrene	Yes	Yes	PAHs may be present due to the use of gasoline as an accelerant in the Pyrotechnics Burn Area
Other site-related constituents - VOCs EPA Method SW-846 8260B (groundwater)			
1,1,1-Trichloroethane	Yes	Yes	Volatile organic compounds (VOCs) may be present due to the use of gasoline and possibly other propellants as accelerants in the Pyrotechnics Burn Area
1,1,2,2-Tetrachloroethane	Yes	Yes	VOCs may be present due to the use of gasoline and possibly other propellants as accelerants in the Pyrotechnics Burn Area
1,1,2-Trichloro-1,2,2-trifluoroethane	Yes	Yes	VOCs may be present due to the use of gasoline and possibly other propellants as accelerants in the Pyrotechnics Burn Area
1,1,2-Trichloroethane	Yes	Yes	VOCs may be present due to the use of gasoline and possibly other propellants as accelerants in the Pyrotechnics Burn Area
1,1-Dichloroethane	Yes	Yes	VOCs may be present due to the use of gasoline and possibly other propellants as accelerants in the Pyrotechnics Burn Area
1,1-Dichloroethene	Yes	Yes	VOCs may be present due to the use of gasoline and possibly other propellants as accelerants in the Pyrotechnics Burn Area
1,2,3-Trichlorobenzene	Yes	Yes	VOCs may be present due to the use of gasoline and possibly other propellants as accelerants in the Pyrotechnics Burn Area
1,2,4-Trichlorobenzene	Yes	Yes	VOCs may be present due to the use of gasoline and possibly other propellants as accelerants in the Pyrotechnics Burn Area

Analyte	**Analysis Available?**	**Analysis Required?**	**Notes**
1,2-Dibromo-3-chloropropane	Yes	Yes	VOCs may be present due to the use of gasoline and possibly other propellants as accelerants in the Pyrotechnics Burn Area
1,2-Dibromoethane	Yes	Yes	VOCs may be present due to the use of gasoline and possibly other propellants as accelerants in the Pyrotechnics Burn Area
1,2-Dichlorobenzene	Yes	Yes	VOCs may be present due to the use of gasoline and possibly other propellants as accelerants in the Pyrotechnics Burn Area
1,2-Dichloroethane	Yes	Yes	VOCs may be present due to the use of gasoline and possibly other propellants as accelerants in the Pyrotechnics Burn Area
1,2-Dichloropropane	Yes	Yes	VOCs may be present due to the use of gasoline and possibly other propellants as accelerants in the Pyrotechnics Burn Area
1,3-Dichlorobenzene	Yes	Yes	VOCs may be present due to the use of gasoline and possibly other propellants as accelerants in the Pyrotechnics Burn Area
1,4-Dichlorobenzene	Yes	Yes	VOCs may be present due to the use of gasoline and possibly other propellants as accelerants in the Pyrotechnics Burn Area
2-Butanone	Yes	Yes	VOCs may be present due to the use of gasoline and possibly other propellants as accelerants in the Pyrotechnics Burn Area
2-Hexanone	Yes	Yes	VOCs may be present due to the use of gasoline and possibly other propellants as accelerants in the Pyrotechnics Burn Area
4-Methyl-2-pentanone	Yes	Yes	VOCs may be present due to the use of gasoline and possibly other propellants as accelerants in the Pyrotechnics Burn Area
Acetone	Yes	Yes	VOCs may be present due to the use of gasoline and possibly other propellants as accelerants in the Pyrotechnics Burn Area
Benzene	Yes	Yes	VOCs may be present due to the use of gasoline and possibly other propellants as accelerants in the Pyrotechnics Burn Area
Bromochloromethane	Yes	Yes	VOCs may be present due to the use of gasoline and possibly other propellants as accelerants in the Pyrotechnics Burn Area
Bromodichloromethane	Yes	Yes	VOCs may be present due to the use of gasoline and possibly other propellants as accelerants in the Pyrotechnics Burn Area
Bromoform	Yes	Yes	VOCs may be present due to the use of gasoline and possibly other propellants as accelerants in the Pyrotechnics Burn Area
Bromomethane	Yes	Yes	VOCs may be present due to the use of gasoline and possibly other propellants as accelerants in the Pyrotechnics Burn Area
Carbon Disulfide	Yes	Yes	VOCs may be present due to the use of gasoline and possibly other propellants as accelerants in the Pyrotechnics Burn Area

Analyte	Analysis Available?	Analysis Required?	Notes
Carbon Tetrachloride	Yes	Yes	VOCs may be present due to the use of gasoline and possibly other propellants as accelerants in the Pyrotechnics Burn Area
Chlorobenzene	Yes	Yes	VOCs may be present due to the use of gasoline and possibly other propellants as accelerants in the Pyrotechnics Burn Area
Chloroethane	Yes	Yes	VOCs may be present due to the use of gasoline and possibly other propellants as accelerants in the Pyrotechnics Burn Area
Chloroform	Yes	Yes	VOCs may be present due to the use of gasoline and possibly other propellants as accelerants in the Pyrotechnics Burn Area
Chloromethane	Yes	Yes	VOCs may be present due to the use of gasoline and possibly other propellants as accelerants in the Pyrotechnics Burn Area
cis-1,2-Dichloroethene	Yes	Yes	VOCs may be present due to the use of gasoline and possibly other propellants as accelerants in the Pyrotechnics Burn Area
cis-1,3-Dichloropropene	Yes	Yes	VOCs may be present due to the use of gasoline and possibly other propellants as accelerants in the Pyrotechnics Burn Area
Cyclohexane	Yes	Yes	VOCs may be present due to the use of gasoline and possibly other propellants as accelerants in the Pyrotechnics Burn Area
Dibromochloromethane	Yes	Yes	VOCs may be present due to the use of gasoline and possibly other propellants as accelerants in the Pyrotechnics Burn Area
Dichlorodifluoromethane	Yes	Yes	VOCs may be present due to the use of gasoline and possibly other propellants as accelerants in the Pyrotechnics Burn Area
Ethylbenzene	Yes	Yes	VOCs may be present due to the use of gasoline and possibly other propellants as accelerants in the Pyrotechnics Burn Area
Isopropylbenzene	Yes	Yes	VOCs may be present due to the use of gasoline and possibly other propellants as accelerants in the Pyrotechnics Burn Area
Methyl Acetate	Yes	Yes	VOCs may be present due to the use of gasoline and possibly other propellants as accelerants in the Pyrotechnics Burn Area
Methyl tert-Butyl Ether	Yes	Yes	VOCs may be present due to the use of gasoline and possibly other propellants as accelerants in the Pyrotechnics Burn Area
Methylcyclohexane	Yes	Yes	VOCs may be present due to the use of gasoline and possibly other propellants as accelerants in the Pyrotechnics Burn Area
Methylene Chloride	Yes	Yes	VOCs may be present due to the use of gasoline and possibly other propellants as accelerants in the Pyrotechnics Burn Area
Styrene	Yes	Yes	VOCs may be present due to the use of gasoline and possibly other propellants as accelerants in the Pyrotechnics Burn Area

Analyte	Analysis Available?	Analysis Required?	Notes
Tetrachloroethene	Yes	Yes	VOCs may be present due to the use of gasoline and possibly other propellants as accelerants in the Pyrotechnics Burn Area
Toluene	Yes	Yes	VOCs may be present due to the use of gasoline and possibly other propellants as accelerants in the Pyrotechnics Burn Area
trans-1,2-Dichloroethene	Yes	Yes	VOCs may be present due to the use of gasoline and possibly other propellants as accelerants in the Pyrotechnics Burn Area
trans-1,3-Dichloropropene	Yes	Yes	VOCs may be present due to the use of gasoline and possibly other propellants as accelerants in the Pyrotechnics Burn Area
Trichloroethene	Yes	Yes	VOCs may be present due to the use of gasoline and possibly other propellants as accelerants in the Pyrotechnics Burn Area
Trichlorofluoromethane	Yes	Yes	VOCs may be present due to the use of gasoline and possibly other propellants as accelerants in the Pyrotechnics Burn Area
Vinyl Chloride	Yes	Yes	VOCs may be present due to the use of gasoline and possibly other propellants as accelerants in the Pyrotechnics Burn Area
Xylenes (Total)	Yes	Yes	VOCs may be present due to the use of gasoline and possibly other propellants as accelerants in the Pyrotechnics Burn Area
Other site-related constituents - Dioxins/Furans EPA Method SW-846 8290 (groundwater)			
2378-TCDD	Yes	Yes	May be present due to the use of an accelerant in the Pyrotechnics Burn Area
12378-PeCDD	Yes	Yes	May be present due to the use of an accelerant in the Pyrotechnics Burn Area
123478-HxCDD	Yes	Yes	May be present due to the use of an accelerant in the Pyrotechnics Burn Area
123678-HxCDD	Yes	Yes	May be present due to the use of an accelerant in the Pyrotechnics Burn Area
123789-HxCDD	Yes	Yes	May be present due to the use of an accelerant in the Pyrotechnics Burn Area
1234678-HpCDD	Yes	Yes	May be present due to the use of an accelerant in the Pyrotechnics Burn Area
OCDD	Yes	Yes	May be present due to the use of an accelerant in the Pyrotechnics Burn Area
2378-TCDF	Yes	Yes	May be present due to the use of an accelerant in the Pyrotechnics Burn Area
12378-PeCDF	Yes	Yes	May be present due to the use of an accelerant in the Pyrotechnics Burn Area
23478-PeCDF	Yes	Yes	May be present due to the use of an accelerant in the Pyrotechnics Burn Area
123478-HxCDF	Yes	Yes	May be present due to the use of an accelerant in the Pyrotechnics Burn Area
123678-HxCDF	Yes	Yes	May be present due to the use of an accelerant in the Pyrotechnics Burn Area
123789-HxCDF	Yes	Yes	May be present due to the use of an accelerant in the Pyrotechnics Burn Area

Analyte	Analysis Available?	Analysis Required?	Notes
234678-HxCDF	Yes	Yes	May be present due to the use of an accelerant in the Pyrotechnics Burn Area
1234678-HpCDF	Yes	Yes	May be present due to the use of an accelerant in the Pyrotechnics Burn Area
1234789-HpCDF	Yes	Yes	May be present due to the use of an accelerant in the Pyrotechnics Burn Area
OCDF	Yes	Yes	May be present due to the use of an accelerant in the Pyrotechnics Burn Area
Total Tetra-Dioxins	Yes	Yes	May be present due to the use of an accelerant in the Pyrotechnics Burn Area
Total Penta-Dioxins	Yes	Yes	May be present due to the use of an accelerant in the Pyrotechnics Burn Area
Total Hexa-Dioxins	Yes	Yes	May be present due to the use of an accelerant in the Pyrotechnics Burn Area
Total Hepta-Dioxins	Yes	Yes	May be present due to the use of an accelerant in the Pyrotechnics Burn Area
Total Tetra-Furans	Yes	Yes	May be present due to the use of an accelerant in the Pyrotechnics Burn Area
Total Penta-Furans	Yes	Yes	May be present due to the use of an accelerant in the Pyrotechnics Burn Area
Total Hexa-Furans	Yes	Yes	May be present due to the use of an accelerant in the Pyrotechnics Burn Area
Total Hepta-Furans	Yes	Yes	May be present due to the use of an accelerant in the Pyrotechnics Burn Area

Notes:

Note 1 – These explosives compounds do not have developed laboratory methods but methods may exist for the individual components of these compounds. Because the mass of the individual components is small, it is not anticipated that the components would be detected in the soil samples. Furthermore, the explosives used in the greatest quantity at the Boat Basin, Visitors Information Center were TNT and nitroglycerin, which are insoluble in water and do not hydrolyze, volatilize, or bioconcentrate under normal environmental conditions. They also have average adsorption coefficients suggesting that they will reasonably adsorb to soil and sediments and maintain low soil mobility. Also, the volatilization rate from soil is extremely low[1]. Therefore, TNT; its breakdown products; and NG, PETN, RDX, and tetryl are anticipated to remain in the environment and are good indicators for explosives at the Boat Basin, Visitors Information Center. Analysis for TNT; its breakdown products; and NG, PETN, RDX, and tetryl will be sufficient indicators of explosives contamination at the sites and analysis will not be performed for other explosives compounds or their individual components.

Note 2 – Based on the review of the Munitions Items Disposition Action System **(**MIDAS**)** database for munitions similar to those used at the Boat Basin, Visitors Information Center, it has been determined that this semivolatile organic compound (SVOC) would be present only in trace amounts in munitions used at the Boat Basin, Visitors Information Center. The compound is not anticipated to be present at detectable concentrations in site soils. Therefore, sampling is not planned for the RI. This decision is based on a determination that, for this SVOC, the total mass present at the Boat Basin, Visitors Information Center would be very small.

Note 3 – Based on the review of the MIDAS database for munitions similar to those used at the Boat Basin, Visitors Information Center, it has been determined this explosive compound would be present only in trace amounts within munitions used at the Boat Basin, Visitors Information Center and is not anticipated to be present at detectable concentrations in the soils. Therefore, sampling is not planned for the RI. This decision is based on a determination that for this explosive, the total mass present at the Boat Basin, Visitors Information Center would be very small.

[1] Ware, G. W. 2007. *Reviews of Environmental Contamination and Toxicology, Volume 191.* New York: Springer Science + Business Media, LLC.

The predominant pathway for introducing MC to the environment at the Boat Basin, Visitors Information Center is from a MEC source. Source areas within the Boat Basin, Visitors Information Center include areas where MEC may potentially be distributed on the surface and in the subsurface from former firing, burning, and disposal activities throughout the Boat Basin, Visitors Information Center. MC may also potentially be located at the Pyrotechnics Burn Area even if a MEC source area is not identified. Therefore, the sampling of surface and subsurface (to the depth of observed MEC) soils and sediment is recommended. Additional delineation in the Boat Basin, Visitors Information Center soils, sediment, surface water, and groundwater may be warranted based on initial MC sampling in soils.

MC sampling will be conducted at the Boat Basin, Visitors Information Center during the RI based on geophysical survey and intrusive investigation results and visual observations. Based on the evaluation in the above table, the following MC analyses and analytes are proposed for samples collected during the RI at the Boat Basin, Visitors Information Center:

- Explosives (Method EPA SW-846 8330B or 8330A): 2,4-DNT; 2,6-DNT; 2-nitrotoluene; 3-nitrotoluene; 2-amino-4,6-DNT; 4-amino-2,6-DNT; and 4-nitrotoluene; 2,4,6-TNT; 1,3,5-trinitrobenzene; 1,3-dinitrobenzene; PETN; RDX; nitrobenzene; tetryl; and NG.
- Perchlorates (Method EPA SW-846 6850) (groundwater only).
- Metals (Method EPA SW-846 6010B): antimony, copper, iron, lead, magnesium, strontium, and zinc.

ATTACHMENT 1: REFERENCES

Army Documents

- Office of the Chief of Ordnance, Technical Division, Catalogue of Standard Ordnance Items, Volume III, 1944.
- Office of the Chief of Ordnance, Handbook Number 1939, History of Artillery Projectiles, 1921.
- Notes on Ammunition, U.S. Army Coast Artillery School, Fort Monroe, VA, 1918.
- TM 4-205, Coast Artillery Ammunition, 1940.
- TM 43-0001-27, Army Ammunition Data Sheets, Small Caliber Ammunition.
- TM 43-0001-28, Army Ammunition Data Sheets, Artillery Ammunition, Guns, Howitzers, Mortars, Recoilless Rifles, Grenade Launchers, and Artillery Fuzes.
- TM 9-1300-200, Ammunition General.
- TM 9-1300-203, Ammunition for Antiaircraft, Tank, Antitank, and Field Artillery Weapons.
- TM 9-1300-214, Military Explosives.
- TM 9-1900, Ammunition General.
- TM 9-1901, Artillery Ammunition.
- TM 9-1910, Military Explosives.
- TM 9-1990, Small Arms Ammunition.

Navy Documents

- OP 1664, U.S. Explosive Ordnance, 1947.

APPENDIX J

CONTRACTOR FORMS

Daily MEC Report

Date: ____________________________ Contract Number: ______________________________

Delivery Order Number: _________________________ Location: _____________________________________

Weather Conditions: ____

I. Work Summary:

a. Work Planned:

b. Work Accomplished:

c. Explanation of Discrepancy:

d. Inspection Results:

II. Instructions Received from Customer Representative(s):

III. Safety Comments:

IV. UXO Summary

a. UXO Destroyed:

Type	Qty	Disposition

b. Demolition Supplies Used:

Type	Qty	U/I	Disposition

c. Scrap Generation/Disposition:

V. Personnel/Equipment Utilization:

a. Personnel Onsite (e.g., Environmental Engineer, 1st Aid Specialist, Heavy Equipment Operator, Helper, Project Manager, Magnetometer Operator, Senior UXO Specialist, Site Safety Officer, Quality Control Specialist, Surveyor, UXO Tech I, UXO Tech II, UXO Tech III, Unskilled Labor)

Description	Number of Personnel	Man-Hours	Weston/Subcontractor

b. Equipment Utilization (e.g., Backhoe, wheeled; Backhoe, tracked; Car (sedan); Pickup (1/2 ton); Pickup (3/4 ton); Radio, handheld; Sport utility Vehicle; EM-61; Schonstedt; Forrester; Digital Camera; GPS; Remote Firing Device (RFD))

Description	Number of Pieces	Hours

VI. Comments/Concerns:

VII. Signature(s)/Date

Project Manager

Senior UXO Supervisor

PROJECT QUALITY CONTROL/QUALITY ASSURANCE QC/QA CHECKLIST

WORK ORDER NO.: ______________________________

CLIENT: ______________________________

PROJECT TITLE/ DESCRIPTION: ______________________________

LOCATION: ______________________________

PROJECT DIRECTOR: ______________________________

PROJECT MANAGER: ______________________________

CHECKLIST COMPLETED BY: ______________________________

DATE COMPLETED: ______________ **FILE NO.:** ______________

REVIEWER: ______________________________

REVIEWER SIGNATURE AND DATE: ______________________________

LEVEL OF QC/QA *(Basic, normal or critical, as defined in Table 1 of Project QC/QA Plan Work Instruction)*:

☐ Basic ☐ Normal ☐ Critical

PROJECT ORGANIZATION AND RESPONSIBILITY *(Name, project role, and responsibility, including supervisory and management personnel and subconsultants)*:

WESTON PROJECT TEAM:

NAME	PROJECT ROLE/RESPONSIBILITY

CLIENT PROJECT TEAM *(Name, project role, and responsibility, including other consultants and contractors working on the project)*:

NAME	PROJECT ROLE

PROJECT QUALITY CONTROL/QUALITY ASSURANCE QC/QA CHECKLIST (continued)

STATEMENT OF PROJECT PURPOSE AND OBJECTIVES: ______________________________

____

WESTON SCOPE *(by project task)*: Complete attached Table A. List specific tasks *(e.g., items in work breakdown structure)*.

QC OBJECTIVES AND PROCEDURES: Complete Table A. For each specific project task, identify the QC objectives *(for examples, see Subsection 5.1.5 of Project QC/QA Plan)* and QC procedures *(for examples, see Subsection 5.1.6 of Project QC/QA Plan)*.

DOCUMENTATION PROCEDURES *(e.g., procedures for documenting verbal instructions, meetings, telephone conversations, and calculations, such as completion of minutes, reports, letters, memoranda; distribution of documentation; filing requirements, etc.)*:

____

DOCUMENT CONTROL *(procedures for the preparation, review, approval, issuance, and revision of documents that prescribe activities, specify requirements, or establish design and deliverable documents)*:

____

QA AUDITS OF COMPLIANCE TO PROJECT QC/QA PLAN *(schedule, auditor, distribution of findings, identification of corrective action, etc.)*:

____

CORRECTIVE ACTION PROCEDURES *(corrective action, person responsible for implementing corrective action, schedule, and person responsible for evaluation of appropriate corrective action and follow-up to verify proper implementation)*:

____

PROJECT QUALITY CONTROL/QUALITY ASSURANCE QC/QA CHECKLIST (continued)

TABLE A

SUMMARY OF QC OBJECTIVES/PROCEDURES BY PROJECT TASK

PROJECT TASK	QC OBJECTIVES*	TASK COMPONENTS	QC PROCEDURES*

* Examples of QC objectives and procedures are summarized in Subsections 5.1.5 and 5.1.6 of Project QC/QA Work Instruction. Table B also contains some examples for typical tasks.

PROJECT QUALITY CONTROL/QUALITY ASSURANCE QC/QA CHECKLIST (continued)

TABLE B

EXAMPLE QC OBJECTIVES/PROCEDURES FOR PROJECT TASKS

PROJECT TASK	QC OBJECTIVES*	TYPICAL TASK COMPONENTS	QC PROCEDURES*
Completion of Sampling and Analysis Summary Report	Comply with Sampling and Analysis Plan (SAP) procedures	Review SAP to determine Scope of Work (number of samples, analytical methods and parameters, etc.) and QC criteria (types and numbers of QC samples, allowable ranges, etc.).	Compare Scope of Work elements in SAP to completed work elements to ensure all required items will have been completed. Document the comparison. Compare results of laboratory QC samples to allowable criteria outlined in laboratory control charts or SAP. Document the comparison.
	Complete Summary Report as required by specifications and contract.	Review specifications and contract to determine requirements for Summary Report. Prepare table of contents. Prepare draft and final reports using approved table of contents (incorporating comments as necessary).	Have peer or PM concur that elements required in a Summary Report are included in the table of contents. Document the concurrence. Have peer or PM review reports. Document comments or concurrence.
Off-Site Disposal of Hazardous Wastes	Comply with specifications and contract. Comply with applicable federal and state regulations.	Review specifications and contract to determine requirements for off-site disposal. Prepare summary of requirements. Review regulations to determine applicable requirements (e.g., manifests, placards, etc.). Prepare summary of requirements. Contact RCRA Hotline for confirmation not clear on requirements.	Have peer or PM review summary of requirements, including regulations, to ensure concurrence. Document review. Distribute approved summary of requirements to project team to ensure clear understanding. Develop checklists for site personnel to ensure requirements are satisfied prior to transport. When completed, distribute checklists, including filing system.

* Examples of QC objectives and procedures are summarized in Subsections 5.1.5 and 5.1.6 of Project QC/QA Work Instruction.

WESTON SOLUTIONS

Quality Control/ Quality Assurance Checklist

Date: ____________ Time: ____________ Work Order #: ______________________

Contract #: ______________________ Location: ______________________

Level of QC/QA: Basic _____ Normal _____ Critical _____

Instructions from Clients:

Quality Controlled Items

Requirement	Feature	Identifier	Grid # (If applicable)	Pass/Fail	Comments

IV. Signatures: I acknowledge that I have been briefed on the results of this inspection and will take corrective actions (if necessary).

______________________ Site QC Specialist Officer

______________________ Sr. UXO Supervisor/Project Manager

Examples of Requirement, Feature, and Identifier combinations to be used in the above grid:

Requirement	Feature	Identifier
Brush Removal	Brush removal	Grid #
DGM	Data analysis	Grid #
DGM	Data collection	Grid #
DGM	Equipment check	EM61
DGM	Equipment check	EM61 HH
DGM	Equipment check	EM61 MKII
DGM	Equipment check	G858
Explosives	Receipt	Receipt

Requirement	Feature	Identifier
Explosives	Storage	Storage
Explosives	Transportation	Transportation
Explosives	Use	Use
MEC removal	Subsurface	Grid #
MEC removal	Surface	Grid #
Survey	Boundary	Boundary
Survey	Grid	Grid #
Survey	Reacquisition	Grid #

Safety Inspection Log

Date: _______________ Time: _______________ Work Order #: ____

Contract #: _______________ Location: ____

Weather Conditions: ____

Type of Inspection: Daily ______ Weekly ______ Special ______ Reinspection ______

Location Inspection: (List by grid Number, coordinates, or description) ____

Activity: ____

II. Inspection Requirement	Satisfactory	Unsatisfactory	N/A
Surface Sweep			
Subsurface Sweep			
Evacuation Technique			
Personal Protection Equipment			
Work Practices			
Site Control			
First Aid Equipment			
Fire Fighting Equipment			
Explosives Transportation			
Explosives Storage			
Disposal Operations			

Overall Inspection Results: Satisfactory ______ Unsatisfactory ______

III. Comment ____

____

Work_stopped due to safety violation: Yes ______ No ______

Safety violations noted: ____

Corrective Measures: ____

Reinspection required: Yes ______ No ______

IV. Signatures: I acknowledge that I have been briefed on the results of this inspection and will take corrective actions (if necessary).

_________________________________ Site Safety Officer

_________________________________ Sr. UXO Supervisor/Project Manager

WESTON SOLUTIONS SM

Safety Meeting Attendance Log

Date:		Time:		Contract Number:	

Delivery Order Number:		Location:	

Weather Conditions:	

I. Safety Meeting Topics (Briefly describe):	

II. Attendees:	

Name (Print)	Signature	Company

Name (Print)	Signature	Company

III. Verification:

I certify that the personnel listed on this roster received the briefing described above. Site personnel not attending this meeting will be briefed before beginning their assigned duties.

______________________________ ______________________________

Site Safety Officer Date

Site Visitors Log

Contract No. ____________________ Delivery Order No. ________________________________ Location: - ____

Date Name		Company	Telephone Number	Safety Briefing Received	Time		Escort Required
					In	Out	

Weston Solutions, Inc., 1400 Weston Way, West Chester, PA 19380
(610) 701-3500

Custody Document

Document Number: ______________________________ **Date:** ______________________________

I certify that the items listed below have been transferred to the United States Army.

Printed Name: ____ **Date:** ______________________________
Signature: ____

Item	Quantity/Description

The United States Army accepts all responsibilityand liability for the above listed items. All items are received in an as is condition with no guarantees provided or implied.

Remarks/Comments: ____

Acknowledgement of Receipt/Transfer

Print Name:	**Signature:**	**Date:**
Print Name:	**Signature:**	**Date:**
Print Name:	**Signature:**	**Date:**
Print Name:	**Signature:**	**Date:**
Print Name:	**Signature:**	**Date:**

Schonstedt Daily Check Out and Return Procedure

Month ____________________ Work Site _________________

Serial No. _________________ Project No. ________________

Signature of Operator	Comments	Date		CHECK OUT PROCEDURE	Check case for damage; open case	Check instrument for damage	Open battery compartment	Install batteries	Audio switch in "A" position	Power up; adjust sensitivity control	Set volume control	Verify digital display	Report to test grid	Test grid result; Pass/Fail	RETURN PROCEDURE	Clean instrument	Open battery compartment	Remove and store batteries	Close battery compartment	Return instrument to storage case	Return case to storage area	
		1																				
		2																				
		3																				
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Heavy Equipment Inspection Log

Month ____________________ Work Site ________________

Serial No. ________________ Project No. ______________

Signature of Operator	Comments	Date	Brakes	Track Condition	First Aid Kit	Oil Level	Water Level	Hydraulic Level	Horn	Back-up Alarm	Exhaust System	Windshield Wipers	Mirrors	Glass/Cab	Fuel Tank/Piping						
		1																			
		2																			
		3																			
		4																			
		5																			
		6																			
		7																			
		8																			
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		31																			

Grid Sweep Log

Project Name/Location: ______________________________

Grid No.: ____________________ Size _____ X _____

Date Started: ____________________________

Date Completed: _________________________

Insert
Magnetic
North
Direction

Work Order No.: ______________

Team No.: ______________________________

UXO Supervisor: __________________________

UXO Supervisor ______________________________

Total Anomalies	Total Excavations	Anomalies > _____ ft.	Total UXO	Pounds MEC Scrap	Pounds Non-MEC Scrap

UXO	NOMENCLATURE	DEPTH

REFERENCE PT. EACH INCREMENT LINE EQUALS _______ X _______ FT.

ACTION:	DATE	SIGNATURE
Mag Sweep Complete		
Excavation Complete		
Quality Control Complete		
Client Quality Assurance Complete		

REMARKS:

Weston Solutions, Inc

Demolition Material Accountability Form

1. Project Name: ______________________ 2. Project Location: ______________________ 3. Deltek No. __________

4. Explosive Description: ______________________ 5. Marks and Identification: ______________________

6. Manufacturer ______________________ 7. Storage Location: ______________________

8. Date Received	9. Quantity In	10. Unit of Issue	11. Quantity Out	12. Balance	13. Date Expended	14. Printed Name and Initials

Demolition Material Accountability Form -- Instructions

1. Project Name - Name assigned project. (For example: Tobyhanna Artillery Ranges).
2. Geographical location. (For example: Tobyhanna, PA).
3. Project Number - Assigned by Weston Corporate office.
4. Explosives Description - Item name (For example: blasting caps, boosters, and detonating cord).
5. Marks and Identification - Identification as specified by the Manufacturer; Lot number for U.S. military explosives.
6. Manufacturer - manufacturer of item and country of origin (For example: Atlas Powder, USA; Govt).
7. Storage Location - Proper name of storage magazine (For example: Igloo J180; Bldg. #18; USACE Bunker #1; Mag 2).
8. Date Received - Date that the transaction occurs.
9. Quantity In - Quantity gained by the transaction; if no quantity is lost, mark column with -0-.
10. Unit of Issue - Unit of measure (For example: each, case, foot).
11. Quantity Out - Quantity lost by the transaction; if no quantity is gained, mark column with -0-.
12. Balance - Running balance of quantity on hand after the transaction.
13. Printed Name and Initials - Name and initials of individual performing the transaction (Print clearly).

Additional Instructions:

1. All data entered on Demolition Material Accountability Form should be entered in ink.
2. Lines not used on Demolition Material Accountability Form should be marked through with a line and marked "not used."
3. When a mistake is written on Demolition Material Accountability Form, DO NOT ERASE OR WHITE OUT--- mark through data with single line, initial change, and make correct entry on new line.

Weston Solutions, Inc.

Magazine Data Card

1. Project Name, Location:	Project Number:	3. Explosive Manufacturer	4. Marks of Identification:
5. Storage Location:	6. Explosive Description:		

7. Date	8. Action/Purpose	9. Qty In	10. Qty Out	11. Balance	12. Printed Name	13. Signature

Magazine Data Card Instructions

1. Project Name, Location - Name assigned project and geographical location. (For example: TOAR Artillery Ranges,Pennslyvania)
2. Project Number - Assigned by Weston Corporate office
3. Explosive Manufacturer - Manufacturer of item and country of origin (For example: Atlas Powder, USA; Govt
4. Marks and Identification - Identification as specified by the Manufacturer; Lot number for US military explosives
5. Storage Location - Proper name of storage magazine (For example: Igloo J180; Bldg. #18; COE Bunker #1; Mag 2)
6. Explosives Description - Item name (For example: blasting caps, boosters, and detonating cord)
7. Date - Date the transaction occurs.
8. Action/Purpose - Purpose for transaction. (For example: intial receipt, inventory, demolition use, return to inventory, transfer, and previous balance.)
9. Quantity In - Quantity gained by the transaction; if no quantity is lost, mark column with -0-.
10. Quantity Out - Quantity lost by the transaction; if no quantity is gained, mark column with -0-.
11. Balance - Running balance of quantity on hand after the transaction.
12. Printed Name and Initials - Name of the individual performing the transaction (Print clearly).
13. Signature - Signature of the individual performing the transaction.

Additional Instruction:

1. All data entered on Magazine Data Card Form should be entered in ink.
2. Lines not used on Magazine Data Card Form should be marked through with a line and marked "not used".
3. When a mistake is written on Magazine Data Card Form, DO NOT ERASE OR WHITE OUT--- mark through data with single line, initial change, and make correct entry on new line.

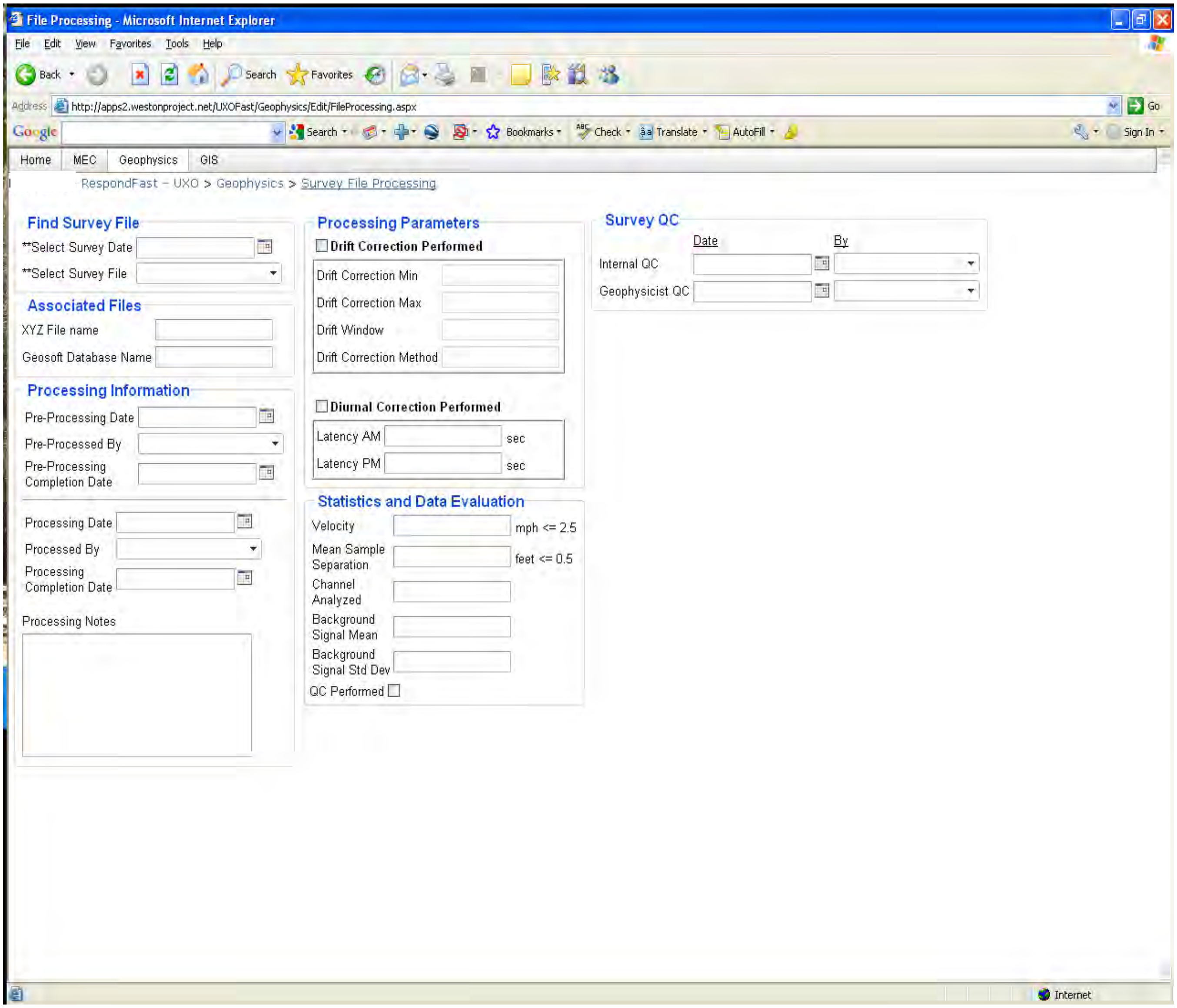
Daily Notes

Project	Date

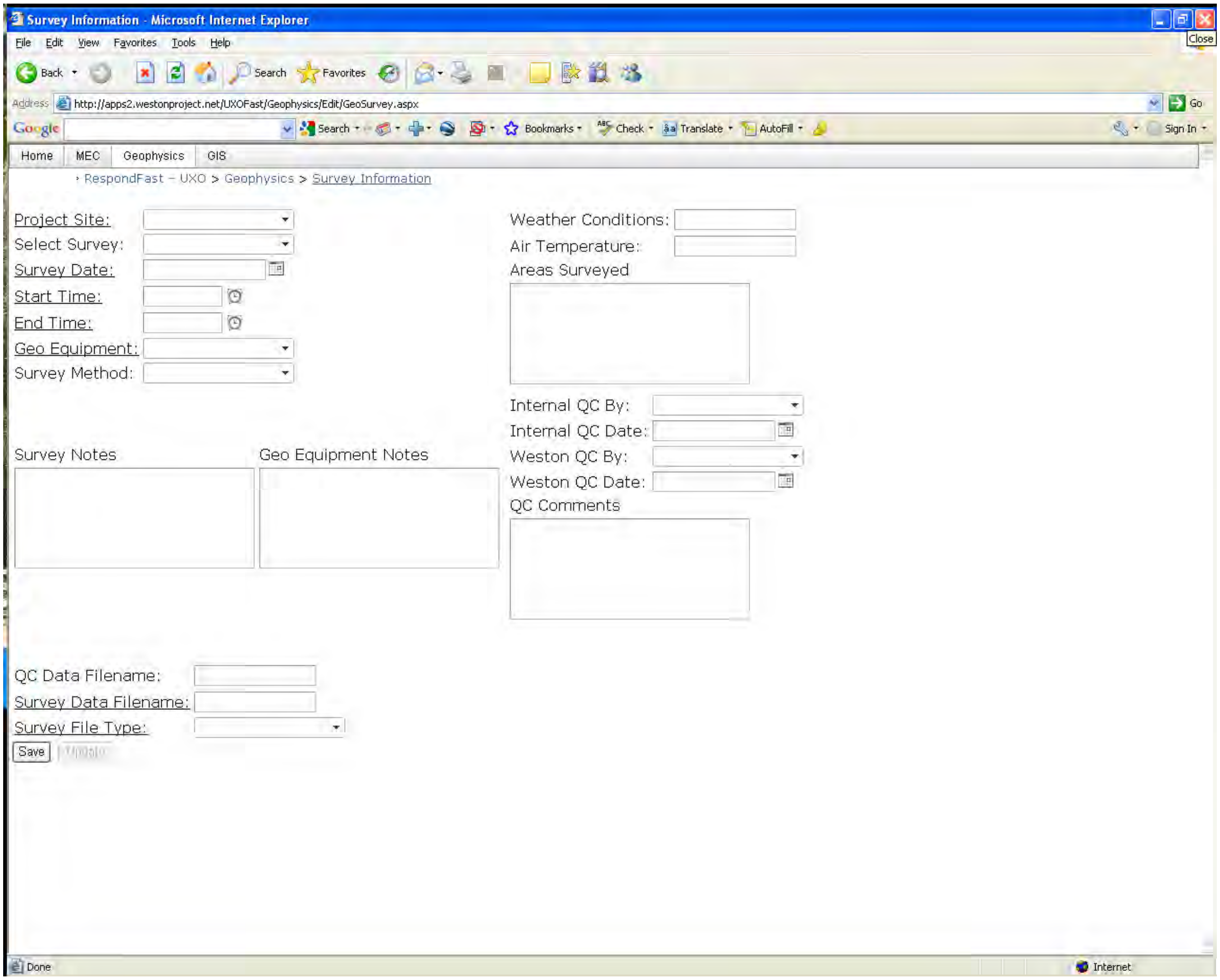
Days Weather

Daily Notes

Daily EM Acreage	Total EM Acreage



Example WESTON's UXOFast Processing and QC Form



Example of WESTON's UXOFast Survey Information Form

Geophysical Dig Sheet and Target History

Project Name		Geophysical Contractor	
Project Location		Project Geophysicist	
Date		Site Geophysicist	
Coordinate System		Field Team	
Survey Area ID		COE Design Center POC	
Sector	Grid	COE Project Engineer	
Field Book ID		COE Geophysicist	

Reacquisition Geophysical Equipment Used	Component	Serial #	Grid Background Value (mV/nT)	Date	Time

Unique Target ID	Original Survey						Reacquisition Survey							Dig Results													Post-Dig UXO QC Results			Post-Dig Geophysical QC		
										Offset							Offset															
	Easting Coord. (ft/m)	Northing Coord. (ft/m)	Channel ID (ie -C1 o r C4 , top sensor, gradient)	Response Amplitude (units*)	Dig Priority (0 is no dig-known anomaly source, 1 is highest dig recommendation, e tc..)	Date	Channel ID (ie -C1 o r C4 , top sensor, gradient)	Response Amplitude (units*)**	Date	Offset Easting Coord. (ft/m)	Offset Northing Coord.(ft/m)	Distance (ft/m)	Direction (N, NE, etc.)	Anomaly type ***	Approx. weight (lbs-oz/kg g)	Comments	Offset Easting Coord. (ft/m)	Offset Northing Coord.(ft/m)	Distance (ft/m)	Direction (N, NE, etc.)	Orientation of Nose (Azimuth deg) **	Inclination of Nose (deg) **	Depth to Top of Item (in/cm)	Digital Photo Filename **	Date	Team Leader Initials	Excavation Hole Cleared?	UXO QC Spec. Initials	Date	Agreement between Dig Results & Geophysical Data ? (G=good , P =poor, U=unacceptable)	Geophysicist QC Initials	Date

APPENDIX K

EXPLOSIVES SITE PLAN AND DEMOLITION SOP

EXPLOSIVES SITE PLAN

DEPARTMENT OF THE ARMY
US ARMY DEFENSE AMMUNITION CENTER
1 C TREE ROAD MCALESTER
OK 74501-9053

REPLY TO
ATTENTION OF

JMAC-EST 25 March 2013

MEMORANDUM FOR US Army Corps of Engineers, Environmental and Munitions Center of Expertise, CEHNC-CX-MM, P.O. Box 1600, Huntsville, AL 35807-4301

SUBJECT: DDESB Approval of Explosives Site Plan, Remedial Investigation (RI), Boat Basin/Visitor Information Center, NASA Wallops Flight Facility, Accomack County, VA.

1. References:

a. Memorandum, CEHNC-CX-EMM, dated 05 March 2013, subject: Explosives Siting Plan (ESP), Remedial Investigation (RI), NASA Wallops Flight Facility Project 7 Boat Basin/ Visitors Information Center, Accomack Co, VA, February 2013.

b. DoD 6055.09-M, Ammunition and Explosives Safety Standards, 29 Feb 08, administratively reissued August 4, 2010.

c. Memorandum, DDESB-PE, dated 21 March 2013, subject: DDESB Approval of Explosives Site Plan, Remedial Investigation of Project 7, NASA Wallops Flight Facility, Accomack County, VA

2. The subject Explosive Safety Plan, Remedial Investigation, transmitted by reference 1.a, has been reviewed in accordance with reference 1.b. Reference 1.c provides Department of Defense Explosives Safety Board (DDESB) final approval. This approval will be made part of the administrative record for the site.

3. The POC is Jorge L. Villafane, JMAC-ESM, DSN 956-8966, commercial (918) 420-8966, email jorge.l.villafane.civ@mail.mil.

Jimmy L. Langley Ph.D., CSHM
Toxic Chemical Agent Team Leader
Explosives Safety Knowledge, MEC
And Chemical Division

JMAC-EST
SUBJECT: DDESB Approval of Explosives Site Plan, Remedial Investigation (RI), Boat Basin/Visitor Information Center, NASA Wallops Flight Facility, Accomack County, VA.

CF (w/encl):
Office of the Director of Army Safety, DACS-SF/Mr. Patton and Mr. Walker, 223 23rd Street, Crystal Plaza 5, Suite 980, Arlington, VA 22202
Office of the Deputy Assistant Secretary of the Army for Environment, Safety, and Occupational Health, Special Assistant for Munitions, DASA-DESOH/Mr. King, 110 Army Pentagon, Washington, DC 20310-0110
U.S. Army Corps of Engineers (CESO/Ms. Roberts), 20 Massachusetts Avenue, NW, Washington, DC 20314-100

DEPARTMENT OF THE ARMY
HUNTSVILLE CENTER, CORPS OF ENGINEERS
P.O. BOX 1600
HUNTSVILLE, ALABAMA 35807-4301

REPLY TO
ATTENTION OF:

CEHNC-CX-EMM

5 March 2013

MEMORANDUM FOR US Army Technical Center for Explosives Safety, Explosives Safety Knowledge, OE and Chemical Division, (JMAC-ESM/ Mr. Jorge Villafane), Building 35, 1C Tree Road, McAlester, OK 74501-9053.

SUBJECT: Explosives Siting Plan (ESP), Remedial Investigation (RI), NASA Wallops Flight Facility Project 7 Boat Basin / Visitors Information Center, Accomack Co, VA, February 2013.

1. References:

a. ER 385-1-95, Safety and Health Concerns for Munitions and Explosives of Concern (MEC) Projects, March 2007.

b. DOD 6055.09-M, Ammunition and Explosives Safety Standards, February 2008.

2. This ESP is submitted to address the RI NASA Wallops Flight Facility Project 7 Boat Basin / Visitors Information Center, Accomack Co, VA.

3. This memorandum constitutes Direct Reporting Unit approval for USACE participation per reference 1a.

4. If you have any questions, please contact Mr. Walt Zange at (256) 895-1586 or Mr. David Becker at (256) 895-1513.

Encl

for SANDRA M. ZEBROWSKI, P.E.
Director, Environmental and Munitions
Center Of Expertise

CF: (electronically w/o encls)

HQUSACE, (CESO-SWD/Ms. Blanca Roberts)
USACE, (CENAB-EN-HI/Mr. Paul Greene/Clint Henker)

DEPARTMENT OF DEFENSE EXPLOSIVES SAFETY BOARD
4800 MARK CENTER DRIVE, SUITE 16E12
ALEXANDRIA, VIRGINIA 22350-3606

DDESB-PE

MAR 21 2013

MEMORANDUM FOR DIRECTOR, U.S. ARMY DEFENSE AMMUNITION CENTER
ATTENTION: JMAC-ESM

SUBJECT: DDESB Approval of Explosives Site Plan, Remedial Investigation of Project 7, NASA Wallops Flight Facility, Accomack County, VA

References: (a) DAC JMAC-ESM Memorandum of 8 March 2013, Subject: Request DDESB Approval, Explosives Site Plan, Remedial Investigation (RI), Boat Basin/Visitor Information Center, NASA Wallops Flight Facility, Accomack County, VA.

(b) Email from Mr. Jorge Villafane (USATCES), to Ms. Kristene Bigej (DDESB), dated 14 March 2013, Subject: RE: NASA Wallops ESP

(c) DoD 6055.09-M, DoD Ammunition and Explosives Safety Standards, date varies by volume

(d) DDESB TP-15, Approved Protective Construction, Revision 3, May 2010

(e) DDESB TP-16, Methodologies for Calculating Primary Fragment Characteristics, Revision 4, 2 August 2012

The Department of Defense Explosives Safety Board (DDESB) Staff has reviewed the subject explosives site plan (ESP) forwarded by reference (a), as modified by reference (b), against the requirements of reference (c). Based on the information provided, approval is granted for removal and treatment of material potentially presenting an explosive hazard (MPPEH) and munitions and explosives of concern (MEC) at NASA Wallops Flight Facility, Accomack County, VA. This approval is based on the following:

a. The efforts addressed in this ESP involve manual unintentional detonation operations, mechanized high input unintentional detonation operations, and intentional detonations supporting munitions response actions within Munitions Response Site (MRS) Project 7: Boat Basin/Visitors Information Center (Project 7).

b. The results of this ESP will be used to prepare an explosives safety submission per reference (c).

c. The munition with the greatest fragmentation distance (MGFD) for the MRS Project 7 is the 30mm HEI PGU-13/B Projectile; the minimum separation distance (MSD) for teams for manual unintentional detonation operations is 22 feet (ft) based on K40 of the MGFD; the MSD for nonessential personnel from manual unintentional detonation operations is 120 ft based on the hazardous fragment distance (HFD) of the MGFD; the MSD for nonessential personnel from high input unintentional detonation operations is 825 ft based on the maximum fragment distance (MFD) of the MGFD; the MSD for aircraft from high input unintentional detonation operations is 825 ft horizontal and 643 ft vertical based on the MFDs of the MGFD; and the MSD for all personnel from intentional detonations is 825 ft based on the MFD-H of the MGFD.

d. The use of sandbags is authorized as an engineering control for intentional detonations involving the MEC identified in reference (a) provided the Army ensures usage per reference (d), paragraph C6.2.7.5.

e. Operators of mechanized equipment will be shielded from hazardous fragments based on an unintentional detonation from mechanized operations involving the MEC identified in reference (a). The use of barricades/shields is authorized as an engineering control to prevent fragment penetration provided the Army ensures usage per reference (e). Additionally, operators will be provided blast overpressure protection of 13 ft based on K24 of the MGFD.

f. The use of hearing protection is authorized as an engineering control for unintentional detonation operations to provide equivalent K24 blast overpressure protection for essential personnel at 10 ft based on K18 of the MGFD. The Army shall ensure hearing protection provides $\geq$ 9 decibel (dB) protection.

g. Demolition materials, per reference (a), will be delivered as needed.

h. Prior to initiation and through completion of on-site explosives operations, all nonessential personnel will be evacuated and prevented from entering any area/facility encumbered by the MSD required for the operation being conducted, or explosives operations will be suspended if nonessential personnel enter the MSD.

i. MPPEH will be inspected and classified as material documented as safe prior to release to the public.

If changes occur during or after completion of this effort that could increase explosive hazards to site workers or the public due to the presence of military munitions at the site, an amendment to this ESP must be submitted to DDESB for review and approval.

The point of contact for this action is Ms. Kristene Bigej, (571) 372-6705, DSN 372-6705, E-mail address: kristene.a.bigej.civ@mail.mil.

THIERRY L. CHIAPELLO
Chairman (Acting)
DDESB

REMEDIAL INVESTIGATION (RI) EXPLOSIVES SITE PLAN (ESP)

FORMERLY USED DEFENSE SITES PROGRAM (FUDS)

NASA WALLOPS FLIGHT FACILITY PROJECT 7: BOAT BASIN / VISITOR INFORMATION CENTER

NASA WALLOPS FLIGHT FACILITY
ACCOMACK COUNTY, VIRGINIA

MARCH 2013

PREPARED

BY

EMDC BALTIMORE DISTRICT, USACE

TABLE OF CONTENTS

Section | Page

1. **Site:** Wallops Flight Facility Project 7
   a. **Name:** Boat Basin / Visitors Information Center
   b. **State:** Virginia

2. **Anticipated Dates:**
   a. **Start:** August 2013

3. **Purpose:**
   A Remedial Investigation (RI) is required for this site at this location based on historic ordnance activities within the site and the Comprehensive Site Evaluation Phase II findings in order to further characterize the following MRS:

   - Boat Basin / Visitor Information Center

   Additional investigation is required to determine the extent of Munitions and Explosives of Concern (MEC) contamination within the Boat Basin / Visitor Information Center.

4. **Site Background and Current Conditions:**
   The MRS is situated on the Atlantic Coast of the Delmarva Peninsula, approximately five miles south of the Maryland/Virginia state boundary, west of Chincoteague Island. Wallops Island and Wallops Mainland are located approximately 7.5 miles south-southeast of the Main Base. The Main Base, which is approximately 2,230 acres, is bordered to the north and west by Little Mosquito Creek. State Route 175 and 798 form the southern and southeastern borders of the Main Base. Currently these facilities are owned and operated by NASA Wallops Flight Facility.

   The Visitor Information Center area is open to the public and used for educational purposes. It is also used as an observation area of scheduled rocket launch operations. The following two sites will be investigated during this RI:

   - Gun Butt N0. 1 was constructed in 1952 and used to test and perfect the used of medium-caliber aviation guns and ammunition. The test range included a firing point and a concrete impact berm filled with sand or soil. Aircraft guns fired ammunition from the firing point into the impact berm approximately 350 feet to the southwest of the firing point.

   - Gun Butt No. 2 was constructed in 1952 and used to test and perfect the used of medium-caliber aviation guns and ammunition. The test range included a firing point and a concrete impact berm filled with sand or soil. Aircraft guns fired ammunition from the firing point into the impact berm approximately 150 feet to the southwest of the firing point.

The Boat Basin Area is a secure area with no access to the public. Access is only given to NASA and environmental study personnel. The following two sites will be investigated during this RI:

- The Pyrotechnics Burn Area is an approximately 20 foot by 25 foot fenced in area formerly used by the Navy to dispose of parachute flares and practice bomb signals, using either gasoline or trinitrotoluene (TNT). The former disposal sites are still visible in specific locations within the fenced area. The date of construction or first use if the Pyrotechnics Burn Area is not known, the fencing remains, and the area is overgrown with vegetation.

- South Bank of Boat Basin. Dredging of the Boat Basin and channel was completed on 26 April 1949 by the Navy in order to establish a boat dock and basin to transport rocket testing materials from the Wallops Main Base to the Wallops Island test facilities. The South Bank of Boat Basin had no known munitions use; however, numerous munitions items have been observed in this area.

a. Historical Use

The Boat Basin, Visitor Information Center MRS encompasses approximately 1.53 acres of land that includes four areas of concern: Pyrotechnics Burn Area, Gun Butt Nos. 1 and 2, and the South Bank Boat Basin. The MRS was used by NAOTS between 1946 and 1959. In June 1959, the U.S. Navy ceased training and flight operation and the WFF, including the MRS, was declared excess and transferred to the newly formed NASA in 1961.

b. Area of Concern: The Boat Basin / Visitor Information Center are the focus of this ESP.

5. Executing Agencies:

a. U.S. Environmental Protection Agency
b. Virginia Department of Environmental Quality
c. NASA Wallops Flight Facility
d. USACE, Norfolk District
e. USACE, Baltimore District

6. **Scope of Investigative Action:**
   a. A manual surface and subsurface investigative action to depth of detection is required for this RI.

   b. The use of earth moving machinery (EMM) may be used to access/investigate underwater surface and subsurface anomalies during intrusive operations for high-input excavations. The equipment operator will be protected by applying the requisite shielding/plating identified on the Fragmentation Calculation Sheets located in Appendix B to the front of the equipment and providing the operator K24 over pressure protection distance. This distance may be reduced to the K18 overpressure distance if hearing protection that provides ≥9 decibels of noise mitigation is provided to the operator. During high-input operations the Minimum Separation Distance (MSD) for unintentional detonations for non-essential personnel will be the Munition with the Greatest Fragmentation Distance (MGFD). Essential personnel shall be protected by shields or barricades designed to defeat hazardous fragmentation from the MGFD and separated from the operation by K24 based on the munition with the greatest net explosive weight quantity distance (NEWQD) that is reasonably expected to be encountered. DDESB-approved overpressure-mitigating engineering controls (EC) may be used to provide an equivalent level of protection.

7. **Safety Criteria:**
   a. The Munition with the Greatest Fragmentation Distance (MGFD) for the Boat Basin/Visitor Information Center is identified in Table 7-1. During the course of this investigation, if MEC with a greater fragmentation distance is encountered, the Minimum Separation Distance (MSD) will be adjusted in accordance with DDESB Technical Paper 16 and the Fragmentation Database, work will continue with an ESP amendment submitted. Quantity Distance (QD) arcs will be adjusted accordingly.

   b. Fragmentation Data Sheet: See Appendix B.

   c. Minimum Separation Distances: See Table 7-1.

   d. Any occupied buildings or public roadways in the MSD areas will be evacuated and/or roadways blocked to prevent non-essential personnel from entering during the conduct of MEC operations. In the event that roadways cannot be blocked or manned aircraft is located on the runways, guards will be posted and work halted if non essential personnel enter the MSD. MEC operations will not resume until non-essential personnel have departed the MSD.

e. Close coordination will be maintained with the airfield operations and flight tower. Aircraft will be directed to maintain a minimum altitude during MEC operations of 120 ft and 200 ft for disposal operations. During "high input" mechanical operations aircraft will maintain a minimum altitude of 634 ft vertical and 825 ft horizontal. Operations will be halted when any aircraft is observed entering or in the Boat Basin/Visitor Information Center area. Airfield operation will be notified and airspace will be verified clear prior to intentional detonation operations. All disposal operations will be conducted using engineering controls as identified in section 8.d.

Table 7-1
Minimum Separation Distances

Munitions Response Site (MRS)	Munition with the Greatest Fragmentation Distance (MGFD)	MSD (ft)			
		Unintentional Detonations		Intentional Detonations	
		Hazardous Fragment Distance (HFD)	Team Separation Distance (K-40)	Without Engineering Controls Max Frag Distance (MFD)	Using Engineering Controls (Sandbags)
Boat Basin / Visitor Information Center	30 MM PGU-13/B, HEI	120	22	825	200
Notes:					

8. Methods of Disposal:

a. The contractor will not maintain any explosives on site. Explosives will be delivered to the project location on an “As Needed” basis. The SUXOS and UXOSO are authorized to determine that movement of certain items is acceptable for the purpose of efficiency of activity being conducted or protection of personnel, property or critical assets. Explosives will be guarded by the contractor until use.

b. The MSD for intentional detonations when conducting munitions disposal operations is identified in Table 7-1 and is depicted for in Appendix A.

c. All recovered MEC and Material Potentially Presenting an Explosive Hazard (MPPEH) identified as Material Documented as Explosive Hazard (MDEH), will be destroyed by the contractor on site, same day found. In the event an unforeseen delay occurs in disposal operations due to a lightning storm or explosive delivery, the contractor will ensure that the item is guarded until the following work day.

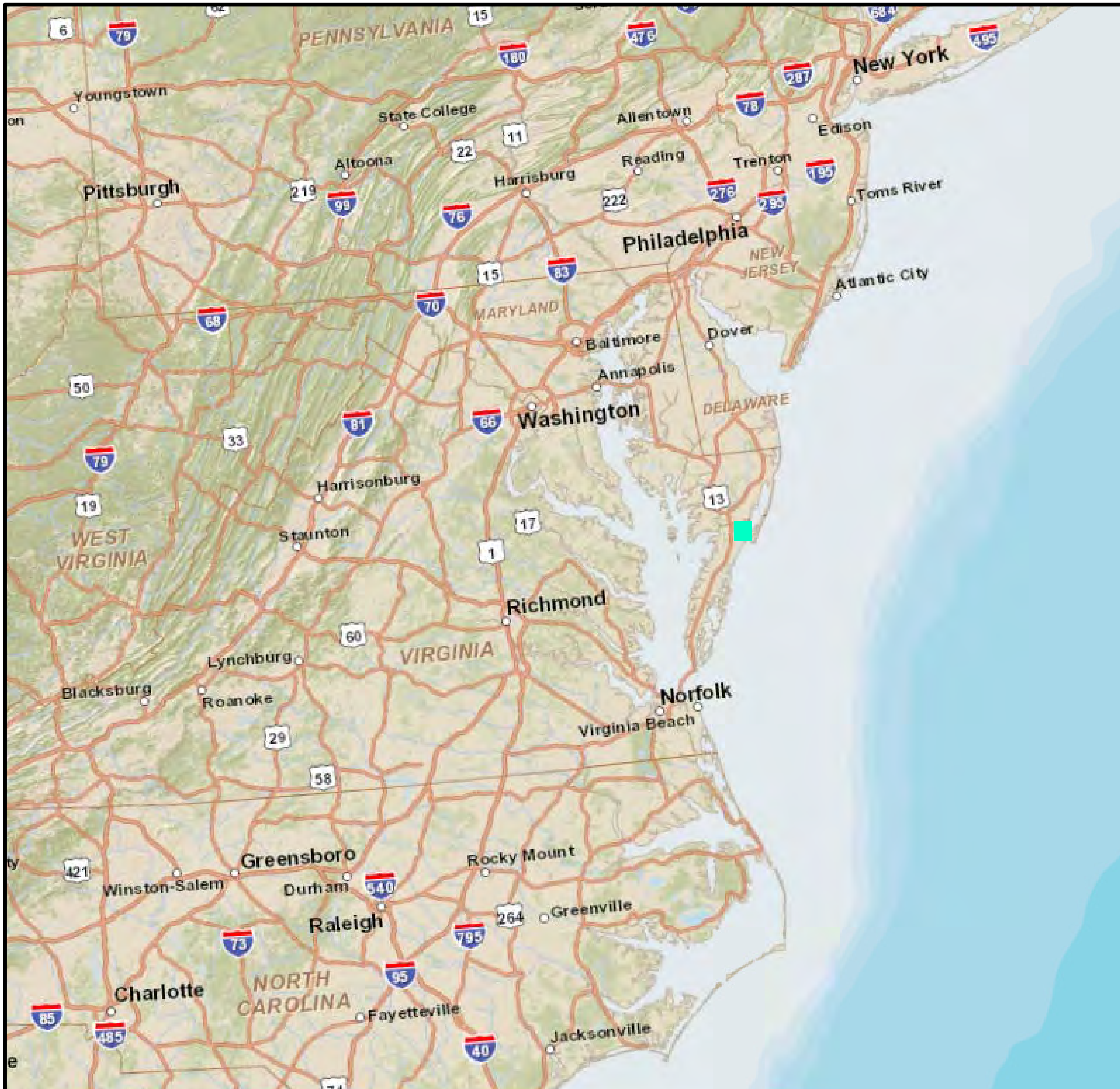
d. Engineering Controls: Sandbags will be used as engineering controls to reduce the intentional detonation MSD. This control will be used IAW HNC-ED-CS-98-7, HNC-ED-CS-S-00-3, HNC safety advisory dated 07 November 2011, and DDESB memo dated 29 November 2010 (Clarification regarding use of sandbags for mitigation of fragmentation and blast effects due to intentional detonation of munitions). This EC may be applied to mitigate fragmentation and blast hazards to the MSD identified in table 7-1. A copy of HNC-ED-CSS-98-7 will be available on site if this EC is applied. Only one MEC item will be destroyed at a time using this technique.

e. MPPEH procedures will be IAW DoDI 4140.62 and EM1110-1-4009

All MPPEH will be assessed and its explosives safety status determined and documented prior to transfer within the DoD or release from DoD control. Prior to release to the public, MPPEH will be documented by authorized and technically qualified personnel as Material Documented as Safe (MDAS) after a 100% inspection and an independent 100% re-inspection to determine that it is safe from an explosives safety perspective.

NASA WALLOPS FLIGHT FACILITY
APPENDIX A
MAPS

- Boat Basin / Visitor Information Center
  - Regional MAP
  - Site Map
  - MRS Map



Wallops Island, VA

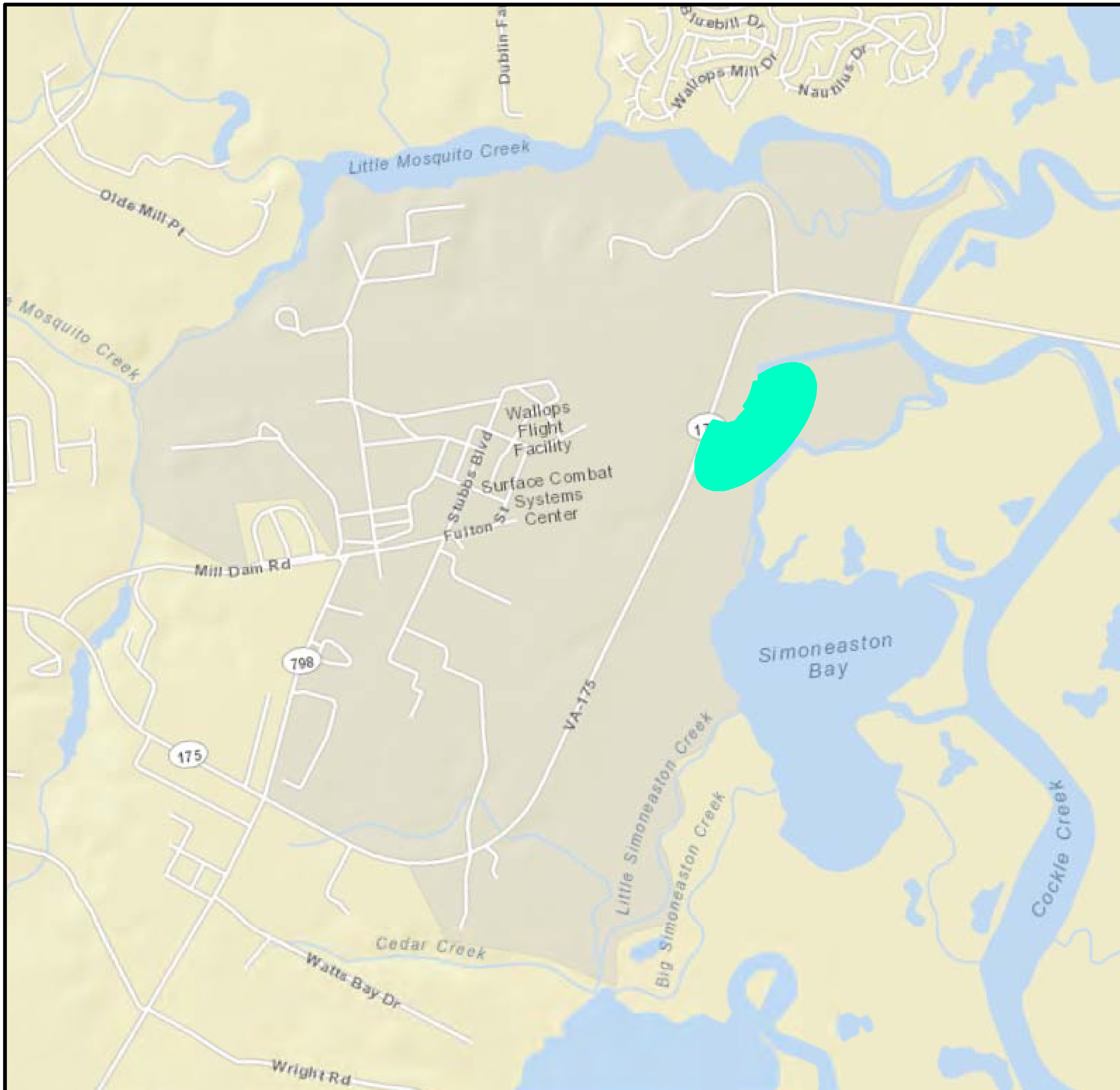
US Army Corps of Engineers

NASA Wallops
Flight Facility
Regional Map

Legend

Site Location

0 200,000 400,000 600,000
Feet



Wallops Island, VA

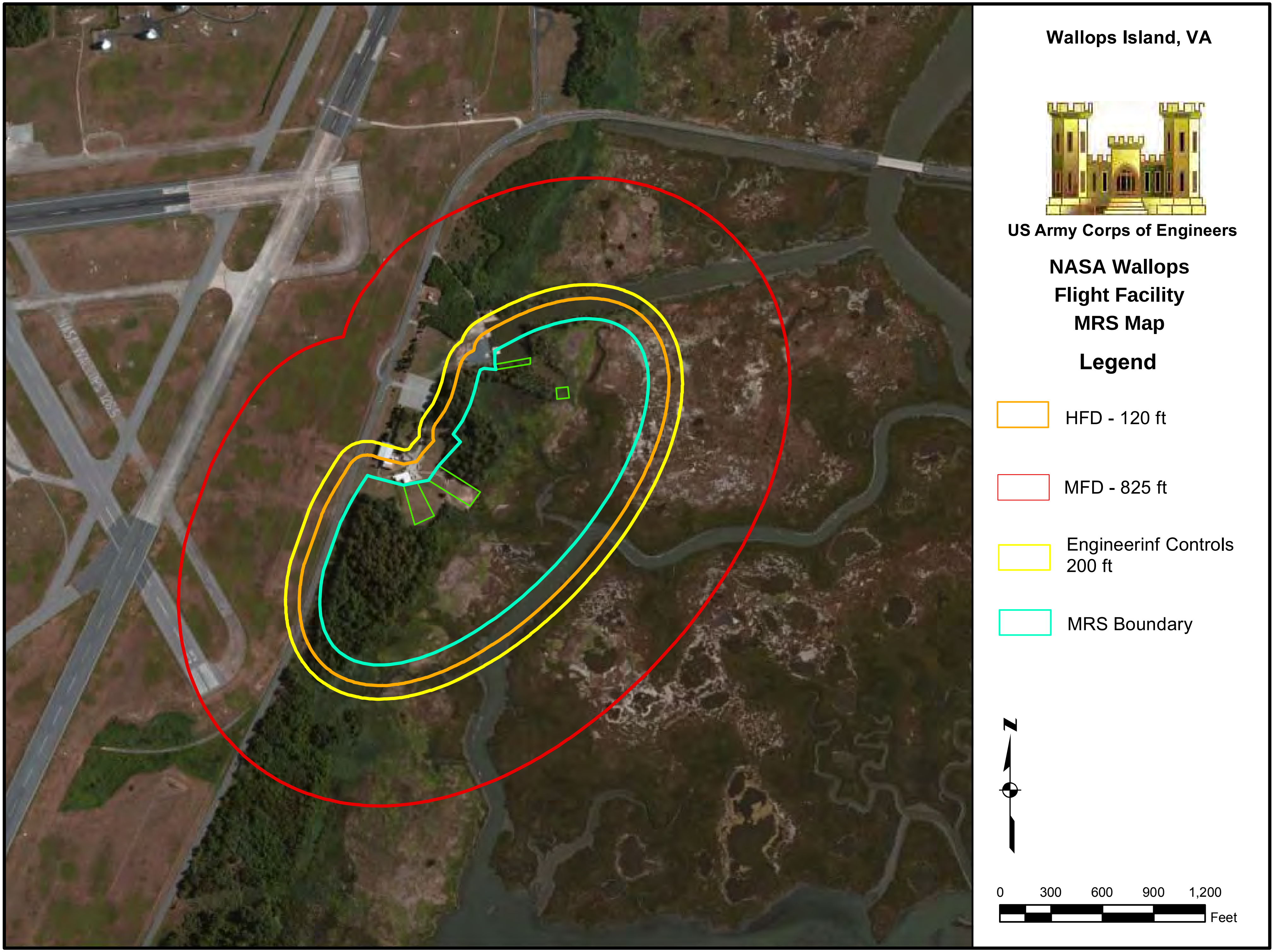
US Army Corps of Engineers

NASA Wallops Flight Facility Site Map

Legend

- Project 7 MRS

0 1,000 2,000 3,000 4,000 Feet


Wallops Island, VA
US Army Corps of Engineers
NASA Wallops
Flight Facility
MRS Map
Legend
HFD - 120 ft
MFD - 825 ft
Engineerinf Controls
200 ft
MRS Boundary
N
0
300
600
900
1,200
Feet

NASA WALLOPS FLIGHT FACILITY
APPENDIX B

FRAGMENTATION DATA REVIEW FORM

Fragmentation Data Review Form

Database Revision Date 4/2/2012

Category:	Surface-Launched HE Rounds
Munition:	30 mm HEI PGU-13/B
Case Material:	Steel, Mild
Fragmentation Method:	Naturally Fragmenting
Secondary Database Category:	Projectile
Munition Case Classification:	Robust

DODIC:	B104
Date Record Created:	9/21/2004
Record Created By:	MC
Last Date Record Updated:	8/31/2009
Individual Last Updated Record:	SDH
Date Record Retired:	

Munition Information and Fragmentation Characteristics

Explosive Type:	RDX
Explosive Weight (lb):	0.12
Diameter (in):	1.1810
Cylindrical Case Weight (lb):	0.66200
Maximum Fragment Weight (Intentional) (lb):	0.0125
Design Fragment Weight (95%) (Unintentional) (lb):	0.0031
Critical Fragment Velocity (fps):	3681

Sandbag and Water Mitigation Options

TNT Equivalent (Impulse):	1.3
TNT Equivalent Weight - Impulse (lbs):	0.156
Kinetic Energy 10^6 (lb-ft²/s²):	0.0849

Single Sandbag Mitigation

Required Wall & Roof Thickness (in)	12
Expected Max. Throw Distance (ft):	25
Minimum Separation Distance (ft):	200

Double Sandbag Mitigation

Required Wall & Roof Thickness (in)	24
Expected Max. Throw Distance (ft):	10
Minimum Separation Distance (ft):	12.5

Water Mitigation

Minimum Separation Distance (ft):	200/200
Water Containment System:	5 gal carboys/ inflatable pool

Note: Use Sandbag and Water Mitigation in accordance with all applicable documents and guidance. If a donor charge larger than 32 grams is utilized, the above mitigation options are no longer applicable. Subject matter experts may be contacted to develop site specific mitigation options.

Theoretical Calculated Fragment Distances

HFD [Hazardous Fragment Distance: distance to no more than 1 hazardous fragment per 600 square feet] (ft):	120
MFD-H [Maximum Fragment Distance, Horizontal] (ft):	825
MFD-V [Maximum Fragment Distance, Vertical] (ft):	643

Overpressure Distances

TNT Equivalent (Pressure):	1.46
TNT Equivalent Weight - Pressure (lbs):	0.175
Unbarricaded Intraline Distance (3.5 psi), K18 Distance:	10
Public Traffic Route Distance (2.3 psi); K24 Distance:	13
Inhabited Building Distance (1.2 psi), K40 Distance:	22
Intentional MSD (0.0655 psi), K328 Distance:	184

Note: Per V5.E3.2.2.1 of DoD 6055.09-M the minimum sited K328 distance may be no smaller than 200 ft.

Minimum Thickness to Prevent Perforation

	Intentional	Unintentional
4000 psi Concrete (Prevent Spall):	2.58	1.47
Mild Steel:	0.50	0.29
Hard Steel:	0.41	0.24
Aluminum:	1.08	0.64
LEXAN:	3.81	2.70
Plexi-glass:	2.40	1.52
Bullet Resist Glass:	1.89	1.14

Item Notes

DEMOLITION SOP

STANDARD OPERATING PROCEDURE
DEMOLITION/DISPOSAL OPERATIONS

1. PURPOSE

The purpose of this Standard Operating Procedure (SOP) is to provide the minimum procedures and safety and health requirements applicable to conducting demolition/disposal operations of munitions and explosives of concern (MEC) at the Wallops Flight Facility (WFF) Boat Basin, Visitors Information Center MRS.

2. SCOPE

This SOP applies to all Weston Solutions, Inc. (WESTON) site personnel, including contractor and subcontractor personnel, involved in conducting MEC demolition/disposal operations. This SOP is not intended to contain all of the requirements needed to ensure complete compliance, and should be used in conjunction with approved project plans and applicable referenced regulations. Consult the documents listed in Section 18 of this SOP for additional compliance issues.

3. RESPONSIBILITIES

3.1 PROJECT MANAGER

The Project Manager (PM) will be responsible for ensuring the availability of the resources needed to implement this SOP, and will also ensure that this SOP is incorporated into plans, procedures, and training for sites where this SOP will be implemented.

3.2 SENIOR UXO SUPERVISOR

The Senior UXO Supervisor (SUXOS) will be responsible for assuring that adequate safety measures and housekeeping are performed during site operations, including demolition activities, and will visit site demolition locations, as deemed necessary, to ensure that demolition operations are carried out in a safe, clean, efficient, and economic manner. The demolition activities will then be conducted under the direct control of the SUXOS, who will be responsible for supervising demolition operations within the area.

The SUXOS will be responsible for training on-site UXO personnel on the nature of the materials handled, the hazards involved, and the precautions necessary. The SUXOS will also ensure that the Daily Summary Report, MEC Accountability Log, WESTON Demolition Shot Records, and inventory records are properly filled out and accurately depict the demolition events and demolition material consumption for each day's operations. The SUXOS will be present during demolition operations or designate a competent, qualified person to be in charge during any absences.

3.3 UXO SAFETY OFFICER

The UXO Safety Officer (UXOSO) for the site is responsible for ensuring that all demolition operations are being conducted in a safe manner, and is required to be present during MEC demolition operations. The UXOSO will ensure the compliance of the demolition team with the above referenced documents that are applicable to the particular task being performed. The UXOSO will be responsible for notifying the WESTON PM, United States Army Corps of Engineers (USACE) PM, and local emergency responders in the event of an accident requiring medical attention or the possibility of lost time. The emergency response plan will be used, and first aid, notification, and evacuation will be accomplished as required. The accident site will then be shut down and the scene preserved/secured for the accident investigation team.

3.4 UXO QUALITY CONTROL SPECIALIST

The UXO Quality Control Specialist (UXOQCS) is responsible for ensuring the completeness of demolition operations records and for weekly inspection of the MEC Accountability Log, the Daily Summary Report, the WESTON Demolition Shot Record, and the inventory of MEC and demolition material. The UXOQCS, assisted by demolition team personnel, will inspect each demolition pit and an area of appropriate radius after each demolition shot, in accordance with the approved explosive siting plan, to ensure that there are no kick-outs, hazardous MEC components, or other hazardous items. In addition, the pit may be checked with a magnetometer, and large metal fragments and any hazardous debris will be removed on a per use basis and stored in sealed containers at the Gorge or designated project lay down area. Any MEC or material potentially presenting an explosive hazard (MPPEH) discovered during the QC check will be properly disposed of using the demolition procedures presented in Section 3 of the Work Plan. Extreme caution must be exercised when handling MEC/MPPEH that has been exposed to the forces of detonation. Personnel must adhere to acceptable safe practices and procedures when determining the condition of munitions and fuzes that have not been consumed in the disposal process.

4. GENERAL OPERATIONAL AND SAFETY PROCEDURE

Personnel, including contractor and subcontractor personnel, involved in operations on MEC-contaminated sites will be familiar with the potential safety and health hazards associated with the conduct of demolition/disposal operations, and with the work practices and control techniques used to reduce or eliminate these hazards.

During demolition operations, the general safety provisions listed below will be followed by demolition personnel at all times. Noncompliance with the general safety provisions listed below will result in disciplinary action, which may include termination of employment.

Safety regulations applicable to demolition activities and demolition and MEC materials involved will be complied with.

- Demolition of any kind is prohibited without an approved Explosives Site Plan (ESP).
- If items are deemed unsafe-to-move, EOD will be notified and advised of the demolitions procedures to be performed.

- If a recovered item cannot be identified by the UXO Team or if the filler is unknown, the UXO Team will not perform the demolition operations. Also, if the minimum separation distances for a known item encompasses critical infrastructure (buildings and utilities) and the item cannot be moved away from the critical infrastructure, the UXO Team will not perform the demolition operations. These circumstances will require EOD support. Notify the USACE OESS.
- The quantity of MEC to be destroyed will be determined by the fragmentation and K-Factor distance calculations, as specified in the approved ESP.
- In the event of an electrical storm, dust storm, or other hazardous meteorological conditions, immediate action will be taken to cease demolition operations and to evacuate the area.
- In the event of a fire, which does not include explosives or energetic materials, put out the fire using the firefighting equipment located at the site? If unable to do so, notify the fire department and evacuate the area. If injuries are involved, remove the victims from danger, administer first aid, and seek medical attention.
- The UXOSO is responsible for reporting all injuries and accidents that occur.
- Personnel will not tamper with any safety devices or protective equipment.
- Any defect or unusual condition noted that is not covered by this SOP will be reported immediately to the SUXOS or UXOSO for evaluation and/or correction.
- Methods of demolition will be conducted in accordance with this SOP and approved changes or revisions thereafter.
- Adequate fire protection and first aid equipment will be provided at all times.
- Personnel engaged in the destruction of MEC will wear clothing made of natural fiber, close-weave clothes, such as cotton. Synthetic material such as nylon is not authorized unless treated with anti-static material.
- Care will be taken to restrict exposure to the smallest number of personnel, for the shortest time, to the least amount of hazard, consistent with safe and efficient operations.
- Work locations will be maintained in a neat and orderly condition.
- Hand tools will be maintained in a good state of repair.
- Each heavy equipment and/or vehicle operator will have a valid operator's permit or license for the equipment being operated.
- Equipment and other lifting devices designed and used for lifting will have the load rating and date of next inspection marked on them. The load rating will not be exceeded and the equipment will not be used without a current inspection date.
- Leather or leather-palmed gloves will be worn when handling wooden boxes, munitions, or MEC.
- Eye protection will be worn when handling wooden boxes, munitions, or MEC.
- Lifting and carrying require care. Improper methods cause unnecessary strains. Observe the following preliminaries before attempting to lift or carry:
  - When lifting, keep your arms and back as straight as possible, bend your knees and lift with your leg muscles.
  - Be sure to have good footing and a firm hold on the object, and lift with a smooth, even motion.

- The demolition area will be provided with two forms of communication, capable of contacting appropriate personnel or agencies (i.e., medical response, Quick Response Force (QRF).
- Exhaust systems will be kept in good mechanical repair at all times.
  - Lighting systems will be an integral part of the vehicle.
  - One Class 10B:C rated, portable fire extinguisher will, if possible, be mounted on the vehicle outside of the cab on the driver's side, and one Class 10B:C fire extinguisher will be mounted inside the cab.
  - Wheels of carriers must be chocked and brakes set during loading and unloading.
  - No demolition material or MEC will be loaded into or unloaded from motor vehicles while their motors are running.
- Motor vehicles and MHE used to transport demolition material and MEC will be inspected prior to use to determine that:
  - Fire extinguishers are filled and in good working order.
  - Electrical wiring is in good condition and properly attached.
  - Vehicles transporting energetics will have the transport area-beds lined with a non-metallic material.
  - Vehicles transporting energetics will have a clean transport area-bed free of debris or combustibles.
  - Fuel tank and piping are secure and not leaking.
  - Brakes, steering, and safety equipment are in good condition.
  - The exhaust system is not exposed to accumulations of grease, oil, gasoline, or other fuels, and has ample clearance from fuel lines and other combustible materials.
- Employees are required to wear leather, or rubber, gloves when handling demolition materials. The type of glove worn is dependent on the type of demolition material.
- Vehicles transporting energetics will stay on explosive truck routes at all times. If this is not possible, the local police will be notified and will need to approve alternate routes prior to use.
- Unless otherwise directed or authorized by the approved ESP, demolition shots will be tamped with an appropriate amount of earth/dirt.
- An observer will be stationed at a location where there is a good view of the air and surface approaches to the demolition area, before material is detonated. It will be the responsibility of the observer to order the SUXOS to suspend firing if any aircraft, vehicles, or personnel are sighted approaching the general demolition area.
- Two-way radios (to include cell phones) will not be operated in close proximity of the demolition area during the priming process and while the pit is primed. Radio transmissions will be kept at a minimum of 50 ft from the explosives.
- No demolition operation will be left unattended during the active portion of the operation (i.e., once any explosives or MEC are brought to the demolition area).
- A minimum radius (approximately 50 feet) around the demolition pit will be cleared of dry grass, leaves, and other extraneous combustible materials.

- No demolition activities will be conducted if there is less than a 2,000 ft ceiling or if the wind velocity is in excess of 20 mph.
- Demolition shots must be fired during daylight hours (minimum time for sunrise and sunset is determined by the firing procedure used (i.e., electric, non-electric, shock tube 30/60/60).
- Notification of the local authorities will be made in accordance with the site requirements.
- No more than two persons will ride in a truck transporting demolition material or MEC, and no person will be allowed to ride in the trailer/bed.
- Vehicles will not be refueled when carrying demolition material or MEC, and must be 100 ft from magazines or trailers containing such items before refueling.
- Explosive vehicles will be cleaned of visible explosive and other contamination, before releasing the vehicles for other tasks.
- After handling demolition material or MEC and prior to conducting any other task, personnel will wash their faces and hands.

5. SPECIAL REQUIREMENTS FOR DEMOLITION ACTIVITIES

The following safety and operational requirements will be met during demolition operations. Any deviations from this procedure will be allowed only after receipt of written approval from USACE and WFF. Failure to adhere to the requirements and procedures listed in the paragraphs below could result in serious injury or death; therefore, complete compliance with these requirements and procedures will be strictly enforced. Any deviations from the approved ESP will require a request for approval and a change to the ESP prior to implementation. The change will be submitted through appropriate channels—the Weston Project Manager, USACE PM, and the WFF Safety Office.

6. GENERAL REQUIREMENTS

The general demolition requirements listed below will be followed at all times:

- The USACE “Procedures for Demolition of Multiple Rounds (Consolidated Shots) on Munitions and Explosives of Concern (MEC) Sites,” will be followed when destroying multiple munitions by detonation on site. This document will be available on-site during site operations. Department of Defense Explosives Safety Board (DDESB) TP 16 and/or the Demolition Tables will be used to calculate the required buried model and protective works.
- White phosphorus (WP) and propellant will be disposed of only in an approved manner and following the guidance for maximum temperature exposure (90 degrees Fahrenheit). Note there is no designated area for the disposal or use of WP on the Boat Basin, Visitors Information Center MRS or WFF. If suspected WP is encountered, arrangements will be made through WFF Range Control and the WFF Safety Office to designate and document a WP demolition area.
- Material awaiting destruction will be stored at not less than intra-line distance, based on the largest quantity involved, from adjacent explosive materials and from explosives being destroyed. The material will be protected against accidental ignition or explosion from fragments, grass fires, burning embers, or detonating impulses originating in materials being destroyed.

- Requirements may be found in the explosives siting plan (ESP). TP 16 and or the Demolition Tables will be used to calculate the required buried module and protective works. The components should be placed on their sides or in a position to expose the largest area to the influence of the demolition material. The demolition material should be placed in direct contact with the item to be detonated and held in place by tape or earth packed over the material.
- Detonations will be counted to ensure detonation of the pit. After each series of detonations, a search will be made of the surrounding area for explosive hazards. Items such as lumps of explosives or unfuzed ammunition may be picked up and prepared for the next shot. Fuzed ammunition, or items that may have internally damaged components, will be detonated in place, if possible.
- Prevailing weather condition information can be obtained from the local weather service, or other acceptable source and the data logged in the Demolition Shot Log before each shot or round of shots.
- All shots will be dual primed with an electrical/remote firing device (RFD) whenever possible.
- Whenever possible, during the excavation of the demolition pits, the ground should be contoured so that runoff water will be channeled away from the pits. If demolition operations are discontinued for more than 2 weeks, the pits should be backfilled until operations resume.
- Upon completion of the project, disturbed demolition areas will be thoroughly inspected for MEC. Depending upon contract requirements, the site may have to be backfilled and leveled. If necessary, this will be coordinated with the contractor representative.
- An individual who will be excavating on a demolition area will be trained in UXO avoidance to ensure a reduced risk of encountering UXO or residue from previous demolition operations.
- Before and after each shot, the WESTON Demolition Shot Record will be filled out by the SUXOS with all applicable information. This record will be kept with the MEC Accountability Log and will reflect each shot.

7. ELECTRIC DETONATOR USE

The following requirements are necessary when using electric detonators and blasting circuits:

- Electric detonators and electric blasting circuits may be energized to dangerous levels from outside sources such as static electricity, induced electric currents, and radio communication equipment. Safety precautions will be taken to reduce the possibility of a premature detonation of the electric detonator and the explosive charges. Radios will not be operated during the priming process or while the pit is primed.
- When uncoiling or straightening the detonator leg wires, keep the explosive end of the detonator pointing away from the body and away from other personnel. When straightening the leg wires, do not hold the detonator itself; rather, hold the detonator leg wires approximately 1 inch from the detonator body. Straighten the leg wires by hand; do not throw or wave the wires through the air to loosen them.

- Prior to use, the detonators will be tested for continuity. To conduct the test, place the detonators in a pre-bored hole in the ground or place them under a sand bag, and walk facing away from the detonators and stretch the wires to their full length, being sure not to pull the detonators from the hole or sand bag. With the leg wires stretched to their fullest length, test the continuity of the detonators one at a time by un-shunting the leg wires and attaching them to the galvanometer and checking for continuity. After the test, re-shunt the wires by twisting the two ends together. Repeat this process for each detonator until all detonators have been tested. This process will be accomplished at least 50 ft from and downwind of any MEC or demolition materials and out of the demolition personnel and vehicle traffic flow pattern. In addition, all personnel on the demolition area will be alerted prior to the test being conducted.

NOTE: When testing the detonator, prior to connecting the detonator to the firing circuit, the leg wires of the detonator must be shunted by twisting the bare ends of the wires together immediately after testing. The wires will remain short circuited until time to connect them to the firing line or RFD receiver.

- At the power source end of the blasting circuit, the ends of the wires will be shorted or twisted together (shunted) at all times, except when actually testing the circuit or firing the charge. The connection between the detonator and the circuit firing wires must not be made, unless the power ends of the firing wires are shorted and grounded or the firing panel is off and locked.
- The firing line will be checked using pre-arranged hand signals. If the demolition pit is not visible from the firing point, two-way radios will be used. If radios are used, communication will be accomplished a minimum of 50 ft from the demolition pit and detonators. The firing line will be checked for electrical continuity in both the open and closed positions, and will be closed/shunted after the check is completed.
- MEC to be detonated will be placed in the demolition pit and the demolition material placed/attached in such a manner as to ensure the total detonation of the MEC. Once the MEC and demolition material are in place and the shot has been tamped, the detonators will be connected to the det cord. Prior to handling any detonators that are connected to the firing line or RFD, personnel will ensure that they are grounded. The detonators will then be carried to the demolition pit with the end of the detonators pointed away from the individual. The detonators will then be connected to the detonation cord, NON-EL, etc., ensuring that the detonator is not covered with tamping material to allow for ease of recovery/investigation in the event of a misfire.
- Prior to making connections to the blasting machine or RFD transmitter, the firing circuit will be tested for electrical continuity and ohms resistance, or transmitting power (as applicable), to ensure the blasting machine or RFD transmitter (distance) has the capacity to initiate the shot.
- The individual assigned to make the connections at the blasting machine or panel will not complete the circuit at the blasting machine or panel, and will not give the signal for detonation, until satisfied that all personnel in the vicinity have been evacuated to a safe distance. When in use, the blasting machine, or its actuating device, will be in the blaster's

possession at all times. When using the panel, the switch must be locked in the open position until ready to fire, and the single key must be in the blaster's possession.

- Prior to initiating a demolition shot(s), a warning will be given. The type and duration of such warning will be determined by the prevailing conditions at the demolition area. At a minimum, this should be an audible signal using a siren, air horn, or megaphone, which is sounded for duration of 1 minute, 5 minutes prior to the shot and again 1 minute prior to the shot.

8. NON-EL USE (SHOCK TUBE)

The following requirements are necessary when using NON-EL (shock tube) systems:

- After cutting a piece of shock tube, either immediately tie a tight overhand knot in one or both cut ends or splice one exposed end and tie the other.
- Always use a sharp knife or razor blade to cut shock tube to prevent the tube from being pinched or otherwise obstructed.
- Always cut shock tube squarely across and make sure the cut is clean.
- Use only the splicing tubes provided by the manufacturer to make splices.
- Every splice in the shock tube reduces the reliability of the priming system; therefore, keep the number of splices to a minimum.
- Always dispose of short, cut-off pieces in accordance with local laws as they relate to flammable material.

The shock tube system is a thin plastic tube of extruded polymer with a layer of pentaerythritol tetranitrate (PETN) coated on its interior surface. The PETN propagates a shock wave, which is normally contained within the plastic tubing. The shock tube offers the controlled instantaneous action of electric initiation without the risk of premature initiation of the detonator by radio transmissions, high-tension power lines, or static electricity discharge. The NON-EL system uses detonators in the bunch blocks and in the detonator assembly, which will be handled in accordance with approved procedures.

The shock tube initiating system is highly reliable because all of the components are sealed and, unlike standard non-electric priming components, cannot be easily degraded by moisture. Cutting the shock tube makes the open end vulnerable to moisture and foreign contamination; therefore, care must be taken to prevent moisture and foreign matter from getting into the exposed ends of the shock tubes.

8.1 SHOCK TUBE DEMOLITION PROCEDURES

> **WARNING**
> Although the detonation along the shock tube is normally contained within the plastic tubing, burns may occur if the shock tube is held.

8.1.1 Shock Tube Assembly

- Spool out the desired length of shock tube from the firing point to the demolition site and cut it off with a sharp knife or razor blade. Weight down the loose end of the trunk line.
- Immediately seal the shock tube remaining on the spool by tying a tight overhand knot on the cut-off end or use a push-over sealer.
- Using a sharp knife or razor, cut the sealed end off the detonator assembly.
- Push one of the shock tube ends to be spliced firmly into one of the pre-cut splicing tubes provided by the manufacturer at least ¼ inch. Push the other shock tube end firmly into the other end of the splicing tube at least ¼ inch. Secure splice with tape if needed.

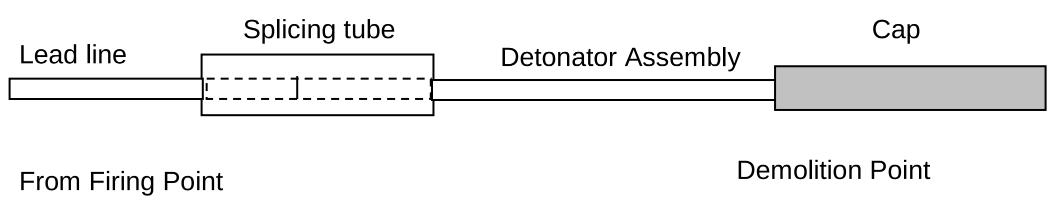


Figure 1

8.1.2 Firing Assembly Setup

1. If there are multiple items to be destroyed using bunch block(s) supplied by the manufacturer, lay out lead lines at the demolition site to the shot(s) and secure the bunch block with a sandbag, or some other item which will keep it from moving.

NOTE: No more than six leads may be used from any one bunch block.

2. If the detonator assembly has not been attached yet, use the splicing tube to splice the detonator assembly to the shock tube branch line as explained in the splicing instructions above.
3. If this is a non-tamped shot, place the detonator assembly into the demolition material. If the shot is to be tamped, prepare the demolition material with a detonating cord lead long enough to stick out of the tamping at least 1 ft.

4. Tape the detonator assembly with the cap to the detonating cord lead as shown in Figure 2.

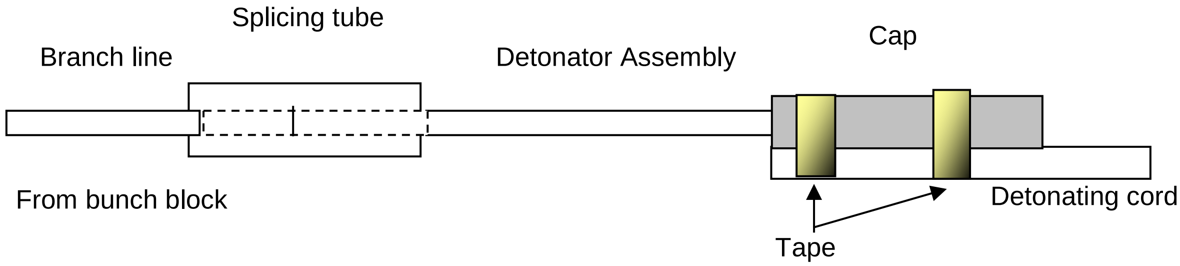


Figure 2

5. Return to the firing position.
6. Cut off the sealed end of the shock tube and proceed to the directions listed in Step 7. If you are using a previously cut piece of shock tube, use a sharp knife or razor blade to cut approximately 18 inches from the previously cut end, whether or not it was knotted in accordance with the above guidance.
7. Insert a primer into the firing device and connect the shock tube lead line to the firing device ensuring that the shock tube is properly seated in the firing device.
8. Take cover.
9. Signal **"fire in the hole"** three times and initiate charge.
10. Observe a 5-minute wait time after the detonation.
11. Remain in designated safe area until Demolition Supervisor announces **"All Clear."**

9. DETONATING CORD USE

The following procedures are required when using detonating cord (det cord):

- The det cord should be cut using approved crimpers, and only the amount required should be removed from inventory.
- The det cord should be cut outside the magazine.
- For ease of inventory control, remove the det cord only in 1 ft increments.
- The det cord should not be placed in clothing pockets or around the neck, arm, or waist, and should be transported to the demolition location in either an approved “day box,” original container, or a cloth satchel, depending upon the magazine location and proximity to the demolition area.
- The det cord should be placed at least 50 ft away from the detonators and the demolition materials until the det cord is ready to use. To ensure consistent safe handling, each classification of demolition material will be separated by at least 25 ft until ready to use.
- When the det cord is ready to be connected to the demolition materials or the detonator, the det cord will be secured to the item. The cord is then strung out of the hole and secured in place with soil, or filled sandbags, leaving a minimum of 6 ft of det cord exposed outside the hole.

- Once the hole is filled, make a loop in the det cord large enough to accommodate the detonator, place the detonator in the loop, and secure it with tape. The detonator's explosive end will face down the det cord toward the demolition material or parallel to the main line.
- Always ensure that there is a minimum of 6 ft of det cord extending out of the hole to make it easier to attach and inspect the detonator and replace it should a misfire occur.
- If the det cord detonators are electric, they will be checked, tied in to the firing line, and shunted prior to being taped to the loop. If the det cord detonators are non-electric, the time/safety fuse will be prepared with the igniter in place prior to taping the detonators to the det cord loop. If the det cord detonators are NON-EL, tape the detonators into the loop as described above.
- In the event that a time/safety fuse is used, an igniter is not available, and a field expedient initiation system is used (i.e., matches), do not split the safety fuse until the detonator is taped into the det cord loop.

10. TIME/SAFETY FUSE USE

The following procedures are required when using a time/safety fuse:

- Prior to each daily use, the burn rate for the time/safety fuse must be tested to ensure the accurate determination of the length of time/safety fuse needed to achieve the minimum burn time of 5 minutes needed to conduct demolition operations.
- To ensure both ends of the time/safety fuse are moisture free, use approved crimpers to cut 6 inches off the end of the time/safety fuse roll, and place the 6-inch piece in the time/safety fuse container.
- If quantity allows, accurately measure and cut off a 6-ft-long piece of the time/safety fuse from the roll.
- Take the 6-ft section out of the magazine, and attach a fuse igniter.
- In a safe location, removed from demolition materials and MEC, ignite the time/safety fuse, measure the burn time from the point of initiation to the "spit" at the end, and record the burn time in the SUXOS's Log.
- To measure the burn time, use a watch with a second hand or chronograph.
- To calculate the burn rate in seconds per foot, divide the total burn time (in seconds) by the length (in feet) of the test fuse.
- When using a time/safety fuse for demolition operations, the minimum amount of fuse to be used for each shot will be the amount needed to permit a minimum burn time of 5 minutes.

11. DEMOLITION INSPECTION SCHEDULE

The schedule for the demolition inspection will be followed when demolition operations are being conducted. This inspection will be conducted by the UXOSO or UXOQCS and will be documented in the Site Safety or QC Log. If any deficiencies are noted, demolition operations will be suspended and the deficiency will be reported to the SUXOS. Once the deficiencies are corrected, demolition operations may be resumed.

12. METEOROLOGICAL CONDITIONS

To control the effects of demolition operations and to ensure the safety of site personnel, the following meteorological limitations and requirements will apply to demolition operations:

- Demolition operations will not be conducted during electrical storms or thunderstorms.
- No demolition operations will be conducted if the surface wind speed is greater than 20 miles per hour.
- Demolition operations will not be conducted during periods of visibility of less than 1 mile caused by, but not limited to, dense fog, blowing snow, rain, sand storms, or dust storms.
- Demolition will not be carried out on extremely overcast days with more than 80% cloud cover, with a ceiling of less than 2,000 ft.
- Demolition operations will not be initiated until an appropriate time after sunrise, and will be secured at an appropriate time prior to sunset (see Section 4).

13. PRE-DEMOLITION/DISPOSAL PROCEDURES

13.1 PRE-DEMO/DISPOSAL OPERATIONAL BRIEFING

WESTON'S philosophy is that a successful operation is dependent upon a thorough briefing, covering all phases of the task, which is presented to all affected personnel. The SUXOS will brief personnel involved in demolition operations in the following areas:

- Type of MEC being destroyed.
- Type, placement, and quantity of demolition material being used.
- Method of initiation (electric, non-electric, or NON-EL).
- Means of transporting and packaging MEC.
- Route to the disposal site.
- Equipment being used (i.e., galvanometer, blasting machine, firing wire).
- Misfire procedures.
- Post-shot clean-up of demolition area.

13.2 PRE-DEMO/DISPOSAL SAFETY BRIEFING

The WESTON SUXOS, Team Leader, or UXOSO will conduct a safety brief for personnel involved in demolition operations in the following areas:

- Care and handling of explosive materials.
- Personal hygiene.
- Two man rule and approved exceptions.
- Personnel roles and responsibilities.
- Potential trip/fall hazards.
- Horseplay on the demolition area.

- Staying alert for any explosive hazards in the demolition area.
- Calling a safety stop for hazardous conditions.
- Location of emergency shelter, if available.
- Parking area for vehicles (vehicles must be positioned for immediate departure, with the keys in the ignition).
- Location of emergency vehicle.
- Wind direction (to assess potential toxic fumes).
- Locations of first aid kit and fire extinguisher.
- Route to nearest hospital or emergency aid station.
- Type of communications in the event of an emergency.
- Storage location of demolition materials and MEC awaiting disposal.
- Demolition schedule.

13.3 TASK ASSIGNMENTS

Individuals with assigned tasks will report the completion of the task to the SUXOS. The types of tasks that may be required are:

- Contact local military authorities and fire response personnel, and get air clearance, as required.
- Contact hospital/emergency response/medevac personnel, if applicable.
- Secure all access roads to the demolition area.
- Visually check demolition area for any unauthorized personnel.
- Check firing wire for continuity and shunt.
- Prepare designated pits as required.
- Check continuity of detonators.
- Check time/safety fuse and its burn rate.
- Designate a custodian of the blasting machine, RFD, fuse igniters, or NON-EL initiator.
- Secure detonators in a safe location.
- Place MEC in pit, and place charge in desired location.

13.4 PREPARING EXPLOSIVE CHARGE FOR INITIATION

To prepare the explosive charge for initiation, the procedures listed below will be followed:

- Ensure firing wire is shunted.
- Connect detonator to the firing wire.
- Isolate or insulate all connections.
- Prime the demolition charge.
- Place demolition charge on MEC.

- Depart to firing point (if using non-electric firing system, obtain head count, pull igniters, and depart to designated safe area).
- Obtain a head count.
- Give the 1 minute warning signal, using a bullhorn or siren, 5 minutes prior to detonation, and again at 1 minute prior to detonation.
- Check the firing circuit.
- Take cover.

  Signal "**fire in the hole**" three times (or an equivalent warning).

- If using electric firing system, connect firing wires to blasting machine, and initiate charge.
- Remove firing wires from blasting machine and shunt or turn off RFD transmitter.
- Remain in designated safe area until SUXOS announces **"All Clear."** This will occur after a post-shot waiting period of 5 minutes and the SUXOS has inspected the pit(s).

14. POST DEMOLITION/DISPOSAL PROCEDURES

Do not approach a smoking hole or allow personnel out of the designated safe area until cleared to do so, and follow the procedures listed below:

- After the **"All Clear"** signal, check pit for low orders or kick-outs.
- Examine pit, and remove any large fragmentation, as needed.
- Back fill hole, as necessary.
- Police all equipment.
- Notify military authorities, fire department, etc., that the operation is complete.

15. MISFIRE PROCEDURES

A thorough check of all equipment, firing wire, and detonators will prevent most misfires. However, if a misfire does occur, the procedures outlined below will be followed.

15.1 ELECTRIC MISFIRES

To prevent electric misfires, one technician will be responsible for all electrical wiring in the circuit. If a misfire does occur, it must be cleared with extreme caution, and the responsible technician will investigate and correct the situation, using the steps outlined below:

- Check firing line and blasting machine connections, and make a second initiation attempt.
- If unsuccessful, disconnect and connect to another blasting machine (if available), and attempt to initiate a charge.
- If unsuccessful, commence a 30-minute wait period.

- After the maximum delay predicted for any part of the shot has passed, the designated technician will proceed down range to inspect the firing system, and a safety observer must watch from a protected area.
- Disconnect and shunt the detonator wires, connect a new detonator to the firing circuit, check the replacement detonator for continuity, and prime the charge without disturbing the original detonator.
- Follow normal procedures for effecting initiation of the charge.

15.2 NON-ELECTRIC MISFIRES

Working on a non-electric misfire is the most hazardous of all operations. Occasionally, despite all painstaking efforts, a misfire will occur. Investigation and corrective action should be undertaken only by the technician who placed the charge, using the following procedure:

- If the charge fails to detonate at the determined time, initiate a 60-minute wait period plus the time of the safety fuse, i.e., 5-minute safety fuse plus 60 minutes for a total of 65 minutes.
- After the wait period has expired, a designated technician will proceed down range to inspect the firing system. A safety observer must watch from a protected area.
- Prime the shot with a new non-electric firing system, and install a new fuse igniter.
- Follow normal procedures for initiation of the charge.

15.3 NON-EL MISFIRE

The use of a shock tube for blast initiation can result in misfires, which require the following actions:

- If the charge fails to detonate, it could be the result of the shock tube not firing. Visually inspect the shock tube. If it is not discolored (i.e., slightly black), it has not fired.
- If it has not fired, cut a 1 ft piece off the end of the tube, re-insert the tube into the firing device, and attempt to fire again.
- If the device still does not fire, wait 60 minutes and proceed down range to replace the shock tube in accordance with the instructions outlined below.
- If the tube is slightly black, then a "Black Tube" misfire has occurred, and the shock tube will have to be replaced, after observing a 60-minute wait time. When replacing the shock tube, be sure to remove the tube with the detonator in place. Without removing the detonator from the end of the tube, dispose of by demolition.

15.4 DETONATING CORD MISFIRE

WESTON uses det cord to tie in multiple demolition shots, and to ensure that electric detonators are not buried. Since det cord initiation will be either electrical or non-electrical, the procedures presented in Sections 15.1, 15.2, or 15.3, as appropriate to the type of detonator used, will be used to clear a det cord misfire. In addition, the following will be conducted:

- If there is no problem with the initiating system, wait the prescribed amount of time, and inspect the connection between the initiator and the cord to ensure that it is properly connected. If the connection was faulty, attach a new initiator, and follow the appropriate procedures for the type of initiator.

- If the initiator detonated but the cord did not, inspect the cord to determine if the problem is with the det cord and not time fuze. Also, check to ensure that there is PETN in the cord at the connection to the initiator.
- It may be necessary to uncover the det cord and replace it. This must be accomplished carefully, to ensure that the demolition charge and the MEC item are not disturbed.

16. RECORD-KEEPING REQUIREMENT

To document the demolition operation procedures and the completeness of the demolition of MEC, the following recordkeeping requirements will be met:

- WESTON (as directed) will obtain and maintain all required permits.
- The SUXOS will ensure that logs are completed accurately, and the SUXOS and UXOQCS will monitor the entries in the log for completeness, accuracy, and compliance with meteorological conditions.
- The SUXOS will enter the appropriate data on the Ordnance Accountability Log and the Demolition Shot Record, to reflect the MEC destroyed, and will complete the appropriate information on the Explosives Accountability Log (the Magazine Data Card), which indicates the demolition materials used to destroy the MEC.
- The quantities of MEC recovered must match the quantities of MEC destroyed or disposed.
- WESTON will retain a permanent file of demolition records, including permits, magazine data cards, training and inspection records, waste manifests if applicable, and operating logs.
- Copies of the ATF License and required permits must be made available on site.

17. SAFETY AND PERSONAL PROTECTIVE EQUIPMENT REQUIREMENTS

The following safety measures and personal protective equipment (PPE) will be used in preventing or reducing exposure to the hazards associated with MEC demolition/disposal operations. These requirements will be implemented unless superseded by site-specific requirements stated in the SSHP.

- Hard hats are required only when working around heavy equipment or when an overhead or head impact hazard exists.
- Composite toe/shank boots in accordance with EM 385-1-1 are required during surface/subsurface location of anomalies.
- Safety glasses will be required whenever an eye hazard exists, for example, when working around flying dirt/debris and using hand tools. Safety glasses will provide protection from impact hazards and, if necessary, ultraviolet radiation (i.e., sunlight).
- Positive means will be required to secure the PPE and prevent it from falling and causing an accidental detonation.
- Reflective vests will be worn when in proximity to roads or construction equipment (e.g., excavators)

18. REGULATORY GUIDANCE AND REFERENCES

Applicable sections and paragraphs in the documents listed below will be used as references for the conduct of UXO demolition/disposal operations:

- WESTON Corporate Safety and Health Program.
- OSHA General Industry Standards, 29 CFR 1910.
- OSHA Construction Standards, 29 CFR 1926.
- DDESB TP-16, Methodology for Calculation of Fragmentation Characteristics.
- HNC-ED-CS-S-98-7, Use of Sandbags for Mitigation of Fragmentation and Blast Effects Due to Intentional Detonation of Munitions.
- DoD 4160.21-M, Defense Reutilization and Marketing Manual.
- DoD Manual 6055.09-M, DoD Ammunition and Explosives Safety Standards.
- AR 385-64, U.S. Army Explosives Safety Program.
- AR 385-10, Army Safety Program.
- DA PAM 385-64, U.S. Army Explosives Safety Program.
- TM 9-1300-200, Ammunition General.
- TM 9-1300-214, Military Explosives.
- Applicable TM 60 Series Publications.
- AR 190-11, Physical Security of Arms, Ammunition, and Explosives.
- ATF 5400.7, Alcohol, Tobacco, and Firearms Explosives Laws and Regulations.
- DOT, 49 CFR, Parts 100 to 199, Transportation (applicable sections).
- EPA, 40 CFR Parts 260 to 299, Protection of Environment (applicable sections).
- AR 385-40 w/ USACE Supplement 1, Accident Reporting & Records.
- USACE EM 385-1-1, Safety and Health Requirements Manual.
- USACE 385-1-91, Explosives Safety and Health Requirements.
- AMC Regulation 385-100.

APPENDIX L

HUMAN HEALTH AND ECOLOGICAL RISK ASSESSMENT METHODOLOGY

APPENDIX L
HUMAN HEALTH AND ECOLOGICAL RISK ASSESSMENT METHODOLOGY

This project includes conducting human health and ecological risk assessments for the Boat Basin, Visitors Information Center to determine whether respective site contaminants pose a current or potential risk to human health and the environment in the absence of any remedial action.

L.1 HUMAN HEALTH RISK ASSESSMENT

A baseline human health risk assessment (BHHRA) will be conducted to assess potential health impacts to humans considering both the current and future uses at the Boat Basin, Visitors Information Center. The BHHRA will be conducted in accordance with guidance provided in USACE's Risk Assessment Handbook, Volume I: Human Health Evaluation (1999) and the USEPA RAGS, as well as other appropriate USEPA and VDEQ guidelines for risk assessment. The objectives of the BHHRA are to estimate potential risk to people contacting site-related chemicals of potential concern (COPCs) under scenarios of current and plausible future land uses provide an analysis of risks and help determine the need for remedial action(s) at the site, and identify specific media and areas associated with unacceptable risk as applicable. The BHHRA will consist of five main sections: Hazard Identification, Toxicity Assessment, Exposure Assessment, Risk Characterization, and Uncertainty Analysis.

L.1.1 Hazard Identification

The hazard identification will involve the review of available site data, the evaluation of data usability and data validation, establishment of guidelines for data reduction, the evaluation of data for use in the risk assessment, and selection of COPCs. The following guidelines for data reduction will be used to produce the data summaries for each medium of concern for the BHHRA:

- If a chemical was reported in both a field sample and a method or field blank, it will be considered to be a positive identification if the chemical is present in the field sample at a concentration greater than 10 times (for common laboratory contaminants), or 5 times (for all other substances) the maximum concentration reported in the blank for that data set. Common laboratory contaminants include acetone, methylene chloride, methyl ethyl ketone (2-butanone), and phthalate esters.

- If a chemical is not positively identified in any sample for a given medium, because it was reported as a non-detect (indicated by a "U" qualifier), or because it was rejected by the data validator (indicated by an "R" qualifier), it will not be addressed for that medium. No data containing an "R" flag will be used in the BHHRA.

- Data with "J" qualifiers will be assumed to be positive identifications. "J" values are estimated chemical concentrations reported below the minimum confident quantitation limit or the sample quantitation limit (SQL). All data with "J" qualifiers will be assumed to be positive identifications for that medium and the corresponding reported concentrations were used.

- Duplicate samples from the same sampling location will be considered as one data point. If a sample duplicate(s) was collected and analyzed, the average of the reported concentrations was used for subsequent calculations unless there was a greater than 50% difference in soil and sediment concentrations and a 30% difference in water concentrations, in which case the higher of the two concentrations was used. In the case of a detected sample and a non-detect duplicate, the detected concentration was carried through subsequent calculations.

For all sample locations where soils were sampled at multiple depths for a single location, the results from the various depths will be treated as individual data points in summarizing the data.

COPCs will be identified by comparing the maximum detected chemical concentration for each chemical by medium. In general, the list of chemical COPCs to be evaluated in the BHHRA includes those that are the following:

- Positively detected in at least one sample in a given medium, including (a) chemicals with no qualifiers attached (excluding samples with unusually high detection limits) and (b) chemicals with qualifiers attached that indicate known identities but unknown or estimated concentrations (e.g., J-qualified data).

- A chemical will be excluded as a COPC for a medium if it was not detected in any samples from that medium.

- Not normally considered as being toxic to humans. Calcium, magnesium, potassium, and sodium are considered to be essential nutrients and are toxic only at very high doses. These chemicals will not be retained as COPCs.

- Chemicals detected in media at concentrations in excess of levels risk-based concentrations (RBCs) which are associated with a cancer risk of 1E-06 (one-in-one-million) and a systemic HQ of 1. The USEPA has now incorporated all USEPA Region IX, III and VI human health screening values into the national screening database found at: http://epa-prgs.ornl.gov/chemicals/index.shtml. These regional screening levels (RSL) will be used for chemical comparison.

- Soil COPCs will be identified by comparing the maximum detected concentration of each chemical with the residential RSL. For COPC screening purposes, noncarcinogenic RSLs will be adjusted to correspond to a target hazard quotient (THQ) of 0.1 rather than 1. This will be done to ensure that chemicals with additive effects are not prematurely eliminated during screening. Where RSLs are available for carcinogenic and noncarcinogenic endpoints and both ingestion and inhalation exposure routes, the lower (i.e., most stringent) value will be used for the screening comparison. Chromium will be screened against the total chromium RSL (1:6 ratio Cr VI : Cr III).

- In order to identify groundwater COPCs, the maximum detected concentrations will be compared to the tapwater RSLs (Target Risk [TR] – 1.0E-06; THQ – 0.1).

- Currently, there are no RSLs for sediment exposure. Therefore, in order to select sediment COPCs, the maximum detected concentrations in sediment will be compared to the residential soil RSLs multiplied by a factor of 10 (TR – 1.0E-05; THQ – 1.0). VDEQ guidance states, "VRP Tier II screening values for sediment were obtained by multiplying residential soil RSL values by a factor of 10 to account for decreased exposure to sediments. For non-carcinogens, however, the target hazard quotient has been adjusted to 0.1 (the RSL has been divided by 10) so that additive toxicity will not result in a hazard index (HI) greater than one for multiple contaminants."

- Similarly, there are no RSLs for surface water exposure. Therefore, in order to select surface water COPCs, the maximum detected concentrations in surface water will be compared to the minimum value from the VDEQ Surface Water Quality Standard (Human Health, Public Water Supply) or the tap water RSLs multiplied by a factor of 10 (TR – 1.0E-05; THQ – 1.0).

- If a risk-based screening level cannot be obtained or calculated for a chemical, that chemical will be carried forward and discussed qualitatively in the uncertainty analysis. However, when a chemical does not have a screening value available, a suitable surrogate will be attempted to be identified and used in the COPC selection process.

- EPA has not assigned verified or provisional toxicity values (i.e., cancer slope factors [CSFs] and reference doses [RfDs]) to lead because the toxicity data available to date are inadequate for evaluation by current methodology. Therefore, lead risk will not be evaluated using the conventional risk assessment approach. EPA's Integrated Exposure Uptake Biokinetic model (IEUBK) (EPA, 2004) will be used to characterize lead risk to children aged 1 to 6 years. The Adult Lead Model (EPA, 2003) will be used to characterize lead risk to unborn infants based on environmental exposure of the mother to lead-contaminated media.

Upon identification of the COPCs, summary tables will be prepared by medium and will present the following information:

- List of COPCs.
- Arithmetic mean concentration of data.
- Median concentration of data.
- Distribution of data (normal, lognormal, neither).
- 95 percent upper confidence limit (95% UCL) of the arithmetic mean.
- Exposure point concentration (EPC).

L.1.2 Toxicity Assessment

This section of the BHHRA will present a discussion of carcinogenic and noncarcinogenic toxicity characteristics of the COPCs and summarize the carcinogenic and noncarcinogenic toxicity criteria to be used in the risk characterization step. The toxicity criteria will be obtained using the following hierarchy:

- Tier 1 – USEPA's Integrated Risk Information System (IRIS) computerized database found at www.epa.gov/iris.
- Tier 2 – USEPA's Provisional Peer Reviewed Toxicity Values (PPRTVs) developed by the Office of Research and Development/National Center for Environmental Assessment (NCEA)/Superfund Health Risk Technical Support Center (STSC).
- Tier 3 – Other Toxicity Values (can include, for example, NCEA values as presented on the EPA RSLs Table, the Agency for Toxic Substances and Disease Registry (ATSDR) Minimal Risk Levels (MRLs), and toxicity values developed by state agencies such as California EPA.

Only chronic RfDs will be used in estimating non-carcinogenic HIs. However, chronic RfDs and reference concentrations (RfCs) will be conservatively used to evaluate all exposure pathways.

Toxicity criteria have not been developed for the dermal exposure route. Dermal RfDs will be derived for each chemical by multiplying the value used as the oral RfD by an appropriate gastrointestinal absorption values (ABS_{GI}). The ABS_{GI} is also known as the oral to dermal adjustment factor. Chemical-specific ABS_{GI} factors will be obtained from Exhibit 4-1 of USEPA RAGS Part E (USEPA, 2004). For organic chemicals in which chemical-specific ABS_{GI} factors are not available, the ABS_{GI} factor will be assumed to be 100%, indicating that organic chemicals are generally well absorbed [i.e., >50% across the gastrointestinal (GI) tract]. Similarly, for inorganics in which chemical-specific ABS_{GI} factors are not available, the ABS_{GI} factor will also assumed to be 100%.

Summary tables will be included that present the toxicity values for each of the COPCs and will include the source, the USEPA weight-of-evidence (for carcinogens), the route of administration, and the critical noncarcinogenic health effect.

When toxicity criteria are not available for some of the chemicals detected at the site, a surrogate (substitute) chemical will be selected to evaluate the potential impacts of a COPC lacking toxicity criteria. For instance, thallic sulfate will be used as a surrogate chemical for thallium; vanadium pentoxide will be used as a surrogate chemical for vanadium; chlordane will be used as a surrogate chemical for alpha- and gamma-chlordane; endosulfan will be used for endosulfan I, endosulfan II, and endosulfan sulfate; endrin will be used as a surrogate chemical for endrin aldehyde and endrin ketone; and pyrene will used as a surrogate chemical for acenaphthylene, benzo(g,h,i)perylene, and phenanthrene. Use of surrogate toxicity data will be documented in the BHHRA text.

L.1.3 Exposure Assessment

The objective of the exposure assessment is to estimate the nature, extent, and magnitude of potential exposure of human receptors to COPCs considering the current and reasonably anticipated future uses of the site. The exposure assessment will include an evaluation of the likelihood of such exposures occurring and will provide the basis for development of acceptable exposure concentrations. The RME scenario will be evaluated for each receptor group. The exposure assessment will involve several key steps:

- Evaluation of the exposure setting will include describing the local land and water uses and identifying the potentially exposed human populations.
- Development of the CSM will include identifying the source(s) of contamination, the transport and release mechanisms, the exposure media, the exposure routes, and the potentially exposed populations (both current and future).
- EPCs will be calculated for the COPC, the exposure scenario, and medium. EPCs are the concentrations to which a receptor may come in contact with at an area. The EPC will be either the 95% UCL of the mean or the maximum detected concentration, whichever is lower. The 95% UCLs will be calculated following the most recent USEPA guidance and USEPA's ProUCL statistical software program (Version 4 or the latest version, at the time of submittal). Note that ProUCL Version 4 restricts the use of ProUCL for samples of size at least 5. For data sets of size at least 5, no decision statistics will be computed

when not more than one detected observation is present in the data set. The maximum detected concentration will be used as the EPC for sample sizes smaller than 5 or for data sets with only one detected observation.

- Algorithms for calculating the exposure doses through exposure pathways to receptors will be presented in the risk assessment and will be consistent with USEPA and USACE risk assessment guidance and recommendations from USEPA Region III.

- Exposure parameters with which to calculate the exposure doses will be identified for each scenario and exposure routes. Guidance documents such as the following will be used to identify exposure parameters:

  - RAGS Volume I, Human Health Evaluation Manual, Part A, Interim Final (USEPA, 1989).

  - The Exposure Factors Handbook (USEPA, 1997a).

  - Supplemental Guidance for Developing Soil Screening Levels For Superfund Sites (USEPA, 2002).

  - Human Health Toxicity Values in Superfund Risk Assessments (USEPA, 2003b).

  - RAGS Vol. I, Human Health Evaluation Manual, Part E, Supplemental Guidance for Dermal Risk Assessment (USEPA, 2004).

  - RAGS Vol. I, Human Health Evaluation Manual, Part F, Supplemental Guidance for Inhalation Risk Assessment (USEPA, 2009a).

  - Specific guidance from USEPA Region III and USACE.

  - Site-specific information and professional judgment.

- Exposure doses for both carcinogenic and noncarcinogenic effects will be calculated and presented in tabular format.

L.1.4 Risk Characterization

Carcinogenic risk and noncarcinogenic health effects in susceptible populations will be determined by combining chemical-specific toxicity criteria with quantitative information from the exposure assessment. These comparisons will determine whether site contamination may affect human health.

The objective of the risk characterization is to evaluate the carcinogenic risks and adverse noncarcinogenic health effects occurring as a result of exposure to COPCs. The potential for cancer risks and noncarcinogenic health effects of COPCs will be evaluated separately because of differences in the processes by which these health effects are believed to occur. Cancer risks will be calculated for those COPCs with evidence of carcinogenicity and for which cancer toxicity values are available. Noncarcinogenic health effects will be evaluated for the COPCs, for which noncarcinogenic toxicity values are available.

Cancer risks will be calculated for carcinogens through applicable exposure routes (i.e., oral or dermal). Potential cancer risks will be calculated by multiplying the estimated lifetime average daily dose (LADD) that is calculated for a COPC through an exposure route by the exposure route-specific CSF, as follows:

$$\text{Cancer Risk} = \text{LADD} \times \text{CSF}$$

Where:

LADD = Lifetime average daily intake (dose) of the carcinogen averaged over a 70-year lifetime [milligram per kilogram per day (mg/kg-day)].

CSF = COPC- and route-specific cancer slope factor $(\text{mg/kg-day})^{-1}$.

The excess cancer risk for a receptor exposed via the inhalation pathway can be estimated with the following equation:

$$\text{Cancer Risk} = \text{EC} \times \text{IUR}$$

Where:

EC = Exposure concentration ($\mu g/m^3$).

IUR = COPC-specific inhalation unit risk $(\mu g/m^3)^{-1}$.

The total lifetime excess cancer risk for the scenarios and receptors will be estimated by summing the cancer risks calculated for COPCs through applicable exposure routes.

The potential for noncarcinogenic health effects as a result of exposure to a single COPC through a single exposure pathway is referred to as the HQ. HQs for the ingestion and dermal pathways will be calculated using the following equation:

$$HQ = ADD/RfD$$

Where:

HQ	=	Hazard quotient.
ADD	=	Average daily dose for the COPC averaged over the exposure duration (mg/kg-day).
RfD	=	COPC- and route-specific reference dose (mg/kg-day).

The HQ for the inhalation pathway can be calculated with the following general equation:

$$HQ = EC/\text{Toxicity value} \times 1{,}000\ \mu g/mg.$$

Where:

HQ	=	Hazard quotient.
EC	=	Exposure concentration ($\mu g/m^3$).
RfC	=	COPC-specific inhalation reference concentration (mg/m^3).

HQs will be summed to calculate a total HI for pathways and receptors. If the HI is less than or equal to one, it is believed that there will not be significant potential for noncarcinogenic health effects to that receptor. If the HI exceeds one, there may be a risk of noncarcinogenic health effects. In that case, the HQs calculated for the COPCs, which reflect different chemical-specific toxic effects, may not be additive. Therefore, HIs will be segregated according to target organ.

Statistical comparisons with the appropriate background data sets will be performed using the background data and methodologies presented in the NASA background report (Background Soils and Groundwater Investigation Report for the Main Base, PHIL-17051, May 2004). For data sets that have less than 10 samples, simple comparisons will be performed and include a comparison of the site and background maximum detected concentrations and arithmetic means. While a comparison to background concentrations is not a criterion for eliminating media from evaluation, it will be conducted to provide information for management decisions.

L.1.5 Identification of Limitations/Uncertainties

The section will identify critical assumptions and uncertainties. The goal of the uncertainty analysis in a risk assessment is to provide to the appropriate decision makers (i.e., risk managers) information about the key assumptions, their inherent uncertainty and variability, and the impact of this uncertainty and variability on the estimates of risk. The primary sources of uncertainty in this risk assessment will be identified and the potential impacts to the risks (over- or under-estimate) will be described.

Potentially Exposed Populations

The current activities at the Boat Basin, Visitors Information Center include visitors to the boat basin and Visitors Information Center and work performed by maintenance personnel. No residential housing exists nearby; therefore, it is unlikely that residential exposure to chemicals of potential concern occurs at the site. Receptors to be evaluated in the risk assessment could include maintenance workers, visitors, and recreational trespassers (adults and children) that could be exposed to surface soil at the site. Additional personnel and areas of the site that could introduce risk will be evaluated. Future uses of the site are expected to include the current uses.

There is the potential for construction to take place at the Boat Basin, Visitors Information Center. Construction workers would potentially be exposed to both surface and subsurface soils and groundwater during excavation activities. Both residential and commercial/industrial development could be considered as potential future scenarios.

Potential human exposure pathways for soil, groundwater, surface water, and sediment exist at the site. Surface soil exposure pathways at the site could include incidental ingestion and dermal absorption for current and future commercial/industrial workers, current and future recreational users, future adult and child residents, and future construction workers. Fugitive dust and volatile emissions exposure may also be of concern to construction workers during development/excavation activities. Subsurface soil exposure pathways could be evaluated for the same receptors previously mentioned for surface soil, based on the assumption that subsurface soil may be excavated to the ground surface as a result of construction activities.

The aquifer under the site could be evaluated as a potable water source for residential use. Potential current and future exposures to surface water and sediment could be evaluated for recreational users.

Based on the above information, the following exposure pathways and routes could be included in the human health risk assessment of the Boat Basin, Visitors Information Center:

Surface Soil:

- Current/future incidental ingestion and dermal absorption of surface soil by maintenance workers;
- Current/future incidental ingestion and dermal absorption of surface soil by recreational users;
- Future incidental ingestion and dermal absorption of surface soil by residents;
- Future inhalation of fugitive dust and volatile emissions by construction workers during excavation activities (from surface soil); and
- Future incidental ingestion and dermal absorption of surface soil by construction workers during excavation activities.

Subsurface Soil:

- Future incidental ingestion and dermal absorption of subsurface soil by maintenance workers;
- Future incidental ingestion and dermal absorption of subsurface soil by recreational users;
- Future incidental ingestion and dermal absorption of subsurface soil by residents;
- Future inhalation of fugitive dust and volatile emissions by construction workers during excavation activities (from subsurface soil); and
- Future incidental ingestion and dermal absorption of subsurface soil by construction workers during excavation activities.

Groundwater:

- Future incidental ingestion, inhalation and dermal absorption of groundwater by construction workers during excavation/construction activities;
- Future ingestion of drinking water by commercial/industrial workers;
- Future ingestion of drinking water by adult and child residents; and
- Future inhalation and dermal absorption of water by adult and child residents during showering.

Surface Water:

- Current and future incidental ingestion and dermal absorption by preadolescents playing in the stream and ponding area(s).

Sediment:

- Current and future incidental ingestion and dermal absorption by preadolescents playing in the stream and ponding area(s).

L.2 SCREENING LEVEL ECOLOGICAL RISK ASSESSMENT

The ecological risk assessment (ERA) for Boat Basin will follow guidance provided in USEPA's *Ecological Risk Assessment Guidance for Superfund, Process for Designing and Conducting Ecological Risk Assessments* [USEPA/540-R-97-006] (USEPA, 1997b) and USACE's *Environmental Quality Risk Assessment Handbook, Volume II, Environmental Evaluation*. The general approach for conducting an ERA under this guidance follows the federal eight-step guidance document *Framework for Ecological Risk Assessment* (USEPA, 1992a) process as discussed below.

- STEP 1: Screening-level problem formulation and ecological effects evaluation.
- STEP 2: Screening-level exposure estimate and risk calculation.
- STEP 3: Baseline risk assessment problem formulation.
- STEP 4: Study design and data quality objective process.
- STEP 5: Field verification of sampling design.
- STEP 6: Site investigation and analysis phase.
- STEP 7: Risk characterization.
- STEP 8: Risk management.

In addition, the SLERA will follow applicable guidance from the Biological Technical Assistance Group (BTAG) of USEPA Region III, which has posted suggested screening benchmarks on its website.

The scope of work (SOW) covered by the RI Work Plan is to implement a SLERA that covers Steps 1, 2, and 3a of the federal eight-step process. The objective of the SLERA is to conservatively evaluate if there is a potential for ecological risks at the site and to determine whether or not there is a need to go forward with a baseline ecological risk assessment (BERA).

SLERA Steps 1 through 3a are described in the following paragraphs.

Step 1 - Screening Level Problem Formulation and Ecological Effects Evaluation

For the screening-level problem formulation, the developed ecological CSM will be refined for the sites and will address the following five issues:

- Characterization of the environmental setting and known or suspected contaminants.
- Fate and transport mechanisms that might exist at the site.
- Mechanisms of ecotoxicity associated with chemical and likely categories of receptors that could be affected.
- Complete exposure pathways.
- Selection of appropriate endpoints to screen for ecological risks.

The basis for ecological conceptual site model will be the CSM developed for the RI with additional information on potential ecological receptors present that may pose complete exposure pathways for environmental contamination.

Step 2 - Screening-Level Exposure Estimate and Risk Calculation

Step 2 will consist of evaluating soil, sediment, and surface water data against ecological screening benchmarks. In Step 2, chemical exposure levels to screen for potential ecological risks will be estimated. For all complete exposure pathways, the maximum detected site-related chemical concentration will be used as the exposure point concentration used to compare with ecological benchmarks. Results of the screening will be used to identify COPECs.

All bioaccumulative compounds will be assessed in the food chain exposure evaluation. Compounds listed on Table 4-2 in Bioaccumulative Testing and Interpretation for the Purpose of Sediment Quality Assessment, Status and Needs (EPA-823-R-00-001, February 2000) will be carried through to the food chain exposure evaluation.

The Region III BTAG Screening Benchmarks will be used to screen soil and sediment for ecological risks. If the BTAG tables do not provide a value for a compound detected, the following benchmarks taken from the USEPA Region III website will be used to screen soil and sediment for ecological risks:

- Oak Ridge National Laboratory (ORNL) Screening Benchmarks (appropriate safety factors must be applied to values not based on "no effects" data).

The ORNL Screening Benchmarks include the following:

- ORNL. Efroymson, R.A., M.E. Will, and G.W. Suter II. Toxicological Benchmarks for Contaminants of Potential Concern for Effects on Soil and Litter Invertebrates and Heterotrophic Process: 1997 Revision. ORNL. ES/ER/TM-126/R2. November. http://www.hsrd.ornl.gov/ecorisk/tm126r21.pdf

- ORNL. Efroymson, R.A., M.E. Will, G.W. Suter II, and A.C. Wooten. Toxicological Benchmarks for Contaminants of Potential Concern for Effects on Terrestrial Plants: 1997 Revision. ORNL. ES/ER/TM-85/R3. November. http://www.hsrd.ornl.gov/ecorisk/tm85r3.pdf

The following includes a list of sources that will be used to obtain sediment screening benchmarks:

- USEPA Region III BTAG Freshwater Sediment Screening Benchmarks, August 2006. http://www.epa.gov/reg3hwmd/risk/eco/btag/sbv/fwsed/screenbench.htm

- Interim sediment quality guideline (ISQG). Canadian Council of Ministers of the Environment (CCME). 2002. Canadian Sediment Quality Guidelines for the Protection of Aquatic Life Summary Tables.

- Probable effect level (PEL). CCME. 2002. Canadian Sediment Quality Guidelines for the Protection of Aquatic Life Summary Tables.

The ISQG and PEL values will only be used in the absence of a BTAG freshwater sediment value.

The following includes a list of sources that will be used to obtain surface water screening benchmarks:

- USEPA Region III BTAG Freshwater Screening Benchmarks, July 2006. http://www.epa.gov/reg3hwmd/risk/eco/btag/sbv/fw/screenbench.htm

- VDEQ Water Quality for Freshwater Acute and Chronic Aquatic Life Standards, October 2008. http://www.deq.state.va.us/wqs/documents/WQS_eff_10_22_08.pdf

The most stringent value from the aforementioned sources will be used as the screening benchmark.

Step 3a - Refinement of COPECs

Based on EPA guidance (EPA 2001, 1998, 1997a), EPA Step 3a provides for iteration of risk estimates by applying additional site-specific information to further refine the COPECs to those requiring remedial evaluation and/or additional evaluation via a BERA. The Step 3A (refinement of COPECs) incorporates elements of baseline risk (EPA Step 3) and is the final outcome of this SLERA, which represents a scientific management decision point. In most cases, the Step 3A refined risk estimate provides the basis for defining potential Site risk drivers with the overall goal of identifying and prioritizing additional data needs (i.e., BERA and/or early remedial action decisions for the site).

L.2.1 Scientific/Management Decision Point (SMDP)

A summary will be written of the SLERA, including the range of chemical concentrations detected, the number of chemicals exceeding their benchmarks, the degree of the exceedance of the benchmark (or benchmarks), the appropriateness of the benchmarks themselves, and the refinement of COPECs. The results will be evaluated to ensure that the information provided assists the risk manager in making one of the following decisions:

- That there is adequate information to conclude that ecological risks are negligible and, therefore, no need for remediation on the basis of ecological risk.
- That the information is not adequate to make a decision at this point, and the ecological risk assessment process will continue to Step 3 (a BERA).
- That the information points to a potential for adverse ecological effects, and a more thorough assessment is warranted.

The USEPA 1999 guidance, *Ecological Risk Assessment and Risk Management Principles for Superfund Sites,* will be consulted to assist in this aspect. The SLERA will incorporate background data from each medium, but consistent with USEPA Region III policy, the background data will not be used to eliminate COPECs. Instead, all constituents will be evaluated against ecological screening guidelines to determine total site risk. Comparisons with the background data will provide useful comparisons to determine whether overall site risks are primarily associated with DoD related contamination, or other sources, since in making risk management decisions, DoD funding cannot be used to address contamination that is unrelated to former DoD activities.

The result of the SLERA will be a deliverable that identifies COPECs for different media discussed. The SLERA will also include a description of available ecological habitat at the site, an evaluation of exposure pathways, and identification of potential receptors. The SMDP to be addressed at the end of the SLERA will be whether or not sufficient risk attributable to former DoD activities (as opposed to non-point sources or other regional contamination) is identified to warrant proceeding with a BERA.

After the completion of Step 3a, the risk managers at USEPA and VDEQ will be consulted to determine whether the SLERA is sufficient to conclude there are no risks, or if a more detailed BERA must be completed (Steps 3-7), or that there is potential for adverse ecological effects and a more detailed ecological risk assessment is needed that will incorporate more site-specific information.

This RI Work Plan assumes that a SLERA will be conducted for the Boat Basin RI. If a BERA is deemed necessary, an amended work plan will be submitted at a later date.