DRAFT FINAL

MUNITIONS RESPONSE –
QUALITY ASSURANCE PROJECT PLAN

FOR

SUFFOLK COUNTY ARMY AIR FIELD BOMBING AND GUNNERY RANGE MUNITIONS RESPONSE SITE 01 FORMERLY USED DEFENSE SITE

MILITARY MUNITION RESPONSE PROGRAM REMEDIAL INVESTIGATION THROUGH DECISION DOCUMENT SUFFOLK COUNTY, NEW YORK

Contract No.: W912DR-16-D-0021, Delivery Order W912DR20F0374

Prepared for:

US Army Corps of Engineers
BUILDING STRONG

September 2021

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Draft-Final

SUFFOLK COUNTY ARMY AIR FIELD
BOMBING AND GUNNERY RANGE
MUNITIONS RESPONSE SITE 01
FORMERLY USED DEFENSE SITE

MILITARY MUNITION RESPONSE PROGRAM
REMEDIAL INVESTIGATION THROUGH DECISION DOCUMENT
SUFFOLK COUNTY, NEW YORK

Prepared for:

U.S. Army Corps of Engineers

Contract No.: W912DR-16-D-0021,
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Prepared by:

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LIST OF ACRONYMS AND ABBREVIATIONS

°F	degrees Fahrenheit
AAF	Army Air Field
ADR	Automated Data Review
AGC	Advanced Geophysical Classification
APP	Accident Prevention Plan
ASR	Archive Search Report
BGR	Bombing and Gunnery Range
bgs	below ground surface
BIP	blow-in-place
CA	corrective action
CCV	continuing calibration verification
CERCLA	Comprehensive Environmental Response Compensations and Liability Act
CHMM	Certified Hazardous Materials Manager
CIH	Certified Industrial Hygienist
COPC	constituents of potential concern
COPEC	constituents of potential ecological concern
CORS	continually operating reference station
CQA	Certified Quality Auditor
CQM	Corporate Quality Manager
CSEM	Conceptual Site Exposure Model
CSM	conceptual site model
CSP	Certified Safety Professional
DAGCAP	DoD AGC Accreditation Program
DDESB	Department of Defense Explosives Safety Board
DERP	Defense Environmental Restoration Program
DFW	definable features of work
DGM	digital geophysical mapping
DMM	discarded military munitions
DoD	Department of Defense
DoD DV	Department of Defense Data Validation
DQO	data quality objective
DU	decision unit
DUA	Data Usability Assessment
Eco-SSL	ecological soil screening level
EDD	electronic data deliverable
EDR	Environmental Data Resources, Inc.
EM	Engineering Manual
EOD	Explosive Ordnance Disposal
ESP	Explosives Site Plan
FS	Feasibility Study
FUDS	Formerly Used Defense Site
FUDSChem	Formerly Used Defense Sites Chemistry Database
GIS	geographical information system
GPS	global positioning system
HARN	high-accuracy reference network
HAZWOPER	Hazardous Waste Operations and Emergency Response

HD	high density
HE	high explosives
HHRA	human health risk assessment
HPLC	high performance liquid chromatography
HUA	high use area
IAW	in accordance with
ICS	interference check solution
ICV	initial calibration verification
IDL	Instrument Detection Level
IDQTF	Intergovernmental Data Quality Task Force
INPR	Inventory Project Report
IS	Incremental Sampling
ISO	industry standard object
ITS	instrument test strip
IVS	instrument verification strip
LCS	laboratory control sample
LD	low density
LLCCV	low-level calibrations check standard
LOD	limit of detection
LOQ	limit of quantitation
LUA	low use area
MB	method blank
MC	munitions constituents
MD	munitions debris
MDAS	material document as safe
MEC	munitions and explosives of concern
MFD-H	maximum fragmentation distance – horizontal
MM2x2	MetalMapper 2x2
MMRP	Military Munitions Response Program
MPC	measurement performance criteria
MPPEH	munitions potentially presenting an explosive hazard
MQO	method quality objectives
MR-QAPP	Munitions Response Quality Assurance Project Plan
MRS	munitions response site
MSD	minimum separation distance
mV	milliVolt
NA	not applicable
NCR	non-conformance report
NEU	no evidence of use
NFA	no further action
NYSDEC	New York State Department of Environmental Conservation
OESS	Ordnance and Explosives Safety Specialist
OSHA	Occupational Safety and Health Administration
PDF	portable document format
PDT	Project Delivery Team
PG	Professional Geologist
PGp	Professional Geophysicist
PID	Photoionization Detector

PM	Project Manager
PMP	Project Management Professional
PSL	Project Screening Level
QA	quality assurance
QAPP	Quality Assurance Project Plan
QC	quality control
QCSR	Quality Control Status Report
QSM	Quality Systems Manual
RI	Remedial Investigation
RCA	root cause analysis
RMM	Risk Management Methodology
RMS	root mean square
ROE	rights-of-entry
RPD	relative percent difference
RPM	Remedial Project Manager
RRD	range related debris
RSD	relative standard deviation
RSL	Regional Screening Level
RT	retention time
RTS	Robotic Total Station
SD	standard deviation
SHPO	State Historic Preservation Officer
SI	Site Inspection
SLERA	screening-level ecological risk assessment
SOP	Standard Operating Procedure
SPP	Systematic Project Planning
SRA	saturated response area
SSHP	Site Safety and Health Plan
SU	sampling unit
SUXOS	Senior UXO Supervisor
TBD	to be determined
TPC	three phase of control
TM	Technical Manager
TOI	target of interest
UFP-QAPP	Uniform Federal Policy for Quality Assurance Project Plans
USACE	United States Army Corps of Engineers
USEPA	United States Environmental Protection Agency
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
UXO	Unexploded Ordnance
UXOSO/QCS	Unexploded Ordnance Safety Officer/Quality Control Specialist
VRS	Virtual Reference Station
VSP	Visual Sampling Plan
WOE	weight of evidence
WS	worksheet

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INTRODUCTION

This Munitions Response–Quality Assurance Project Plan (MR-QAPP) has been written to provide the project team the planning and implementation procedures to complete the remedial investigation (RI) of munitions and explosives of concern (MEC) and munitions constituents (MC) at the Suffolk County Army Air Field (SCAAF) Bombing and Gunnery Range (BGR) Formerly Used Defense Site (FUDS) Munitions Response Site (MRS)-01. This MR-QAPP documents the systematic planning process steps leading to the detection and identification of MEC and other debris.

This RI is contracted by the U.S. Army Corps of Engineers (USACE), Baltimore District with Project Management coming from the New England District, and is being performed in support of the Army Military Munitions Response Program (MMRP), which has the goal of making munitions response areas and MRSs safe for reuse while protecting human health and the environment in the process. This RI's objectives are to adequately determine the nature and extent of the MEC and MC that are present in the MRS and to determine if unacceptable risks to human health and the environment exist due to the potential presence of MEC or MC.

The munitions response actions detailed in this MR-QAPP will be conducted pursuant to the Comprehensive Environmental Response Compensations and Liability Act (CERCLA), the National Oil and Hazardous Substances Contingency Plan requirements, and Executive Order 12580. CERCLA has no special provisions for dealing with explosive safety. Therefore, the provisions in the Department of Defense Explosives Safety Board, Defense Explosives Safety Regulation 6055.09, Edition 1, 13 January 2019, and USACE's Engineering Manual (EM) 385-1-97 (USACE, 2013) will be followed.

USACE and the United States Environmental Protection Agency (USEPA) require that environmental monitoring and measurement efforts mandated or supported by these organizations participate in a centrally managed quality assurance (QA) program. Any party generating data for this project has the responsibility to implement procedures to ensure that the precision, accuracy, representativeness, and completeness of the data are appropriately determined and documented. QA/Quality Control (QC) procedures have been developed using applicable professional technical standards, USEPA and USACE requirements, government regulations and guidelines, and specific project goals and requirements.

The former SCAAF FUDS is approximately two miles north of Westhampton Beach, New York, and occupies approximately 9,224 acres. The area of investigation for this project, which includes MRS-01, is 4,297 acres in size and located within the FUDS boundary (Appendix A, Figure 1). The site is situated in a relatively flat area and is south of, and partially within, the Central Pine Barrens in Suffolk County. The Atlantic Ocean lies approximately three miles to the south of the former SCAAF.

This MR-QAPP (optimized worksheet format) has been prepared in accordance with (IAW) all relevant and current guidance, including the recently published MR-QAPP Toolkit, Module 1 Update 1 (Intergovernmental Data Quality Task Force [IDQTF], 2020), which consists of a series of worksheets (WS) that contain both general and specific information about the project. This MR-QAPP was also prepared IAW the requirements of the *Uniform Federal Policy for Quality Assurance Project Plans (UFP-QAPP)* (USEPA, 2005); Optimized UFP-QAPP Worksheets

(USEPA, 2012); and EM 200-1-15, *Technical Guidance for Military Munitions Response Actions* (USACE, 2018).

Table 1 provides an MR-QAPP component crosswalk table that shows the Optimized UFP-QAPP Worksheets, their applicability to the MR-QAPP Module 1, and an indication of the applicability of the worksheet to MEC or MC. Appendix H contains a description of any deviations from the MR-QAPP Recommended Minimum Requirements.

Table 1. Crosswalk: Optimized UFP-QAPP Worksheets to MR-QAPP Module 1: RI/FS

Optimized UFP-QAPP Worksheets		MR-QAPP Module 1: RI/FS
1 & 2	Title and Approval Page	Included
3 & 5	Project Organization and QAPP Distribution	Included
4 , 7 & 8	Personnel Qualifications and Sign-off Sheet	Included
6	Communication Pathways and Procedures	Included
9	Project Planning Session Summary	Included
10	Conceptual Site Model	Included
11	Project/Data Quality Objectives	Included
12	Measurement Performance Criteria	Included
13	Secondary Data Uses and Limitations	Included
14 & 16	Project Tasks & Schedule	Included
15	Project Action Limits and Laboratory-Specific Detection/Quantitation Limits	Not applicable for MEC; Included for MC
17	Sampling Design and Rationale	Included – Title changed to “Survey Design and Project Workflow”
18	Sampling Locations and Methods	Included for MC
19 & 30	Sample Containers, Preservation, and Hold Times	Included for MC
20	Field Quality Control (QC)	Worksheet not included for MEC – Field QC procedures for MEC are included on Worksheet #22; Worksheet included for MC
21	Field Standard Operating Procedures (SOPs)	Included
22	Field Equipment Calibration, Maintenance, Testing, and Inspection	Included – Title changed to “Equipment Testing, Inspection, and Quality Control”
23	Analytical SOPs	Included for MC
24	Analytical Instrument Calibration	Included for MC
25	Analytical Instrument and Equipment Maintenance, Testing, and Inspection	Included for MC
26 & 27	Sample Handling, Custody, and Disposal	Included for MC
28	Analytical Quality Control and Corrective Action	Included for MC
29	Project Documents and Records	Included – Title changed to “Data Management, Project Documents and Records”
31, 32 & 33	Assessments and Corrective Action	Included
34	Data Verification and Validation Inputs	Included – Title changed to “Data Verification, Validation, and Usability Inputs”
35	Data Verification Procedures	Included – Title changed to “Data Verification and Validation Procedures”
36	Data Validation Procedures	Included for MC
37	Data Usability Assessment	Included

QAPP WORKSHEET #1 & #2 – TITLE AND APPROVAL PAGE

1. Project Identifying Information

- **a. Site name:** SCAAF BGR MRS-01
  Project name: SCAAF BGR MRS-01 RI through DD
- **b. Site location/number:** Suffolk County, New York
- **c. Lead Organization:** USACE, Baltimore and New England Districts
- **d. Contractor:** Tetra Tech
- **e. Contract number:** W912DR-16-D-0021 **Delivery Order:** W912DR20F0374

2. Lead Organization

- **a.** USACE Project Manager: Julie Rupp, PG

  ____
  Signature Date

- **b.** USACE Technical Manager: Todd Beckwith

  ____
  Signature Date

3. Prime Contractor: Tetra Tech

- **a.** Jennifer Harlan, Project Management Professional (PMP), Project Manager (PM)

  ____
  Signature Date

- **b.** Eugene Mikell, Certified Quality Auditor (CQA), Corporate Quality Manager (CQM):

  ____
  Signature Date

4. State Regulatory Agency: New York State Department of Environmental Conservation (NYSDEC)

- **a.** Heather Bishop

  ____
  Signature Date

5. Plans and Reports from Previous Investigations Relevant to this Project

USACE New York District, 1991. *DERP-FUDS Inventory Project Report (INPR) for Site No. C02NY071300, Suffolk County AAF Bombing and Gunnery Range, West Hampton, NY.*

USACE Rock Island District, 1998. *Final Archives Search Report (ASR) for the Former Suffolk County AAF Bombing and Gunnery Range*. February.

Alion Science and Technology, 2009. *Final Site Inspection Report for Suffolk AAF Bombing and Gunnery Range, Suffolk County, NY*. December.

QAPP WORKSHEET #3 & #5 – PROJECT ORGANIZATION AND QAPP DISTRIBUTION

Figure 3-1. Geophysical Investigation Organization Chart

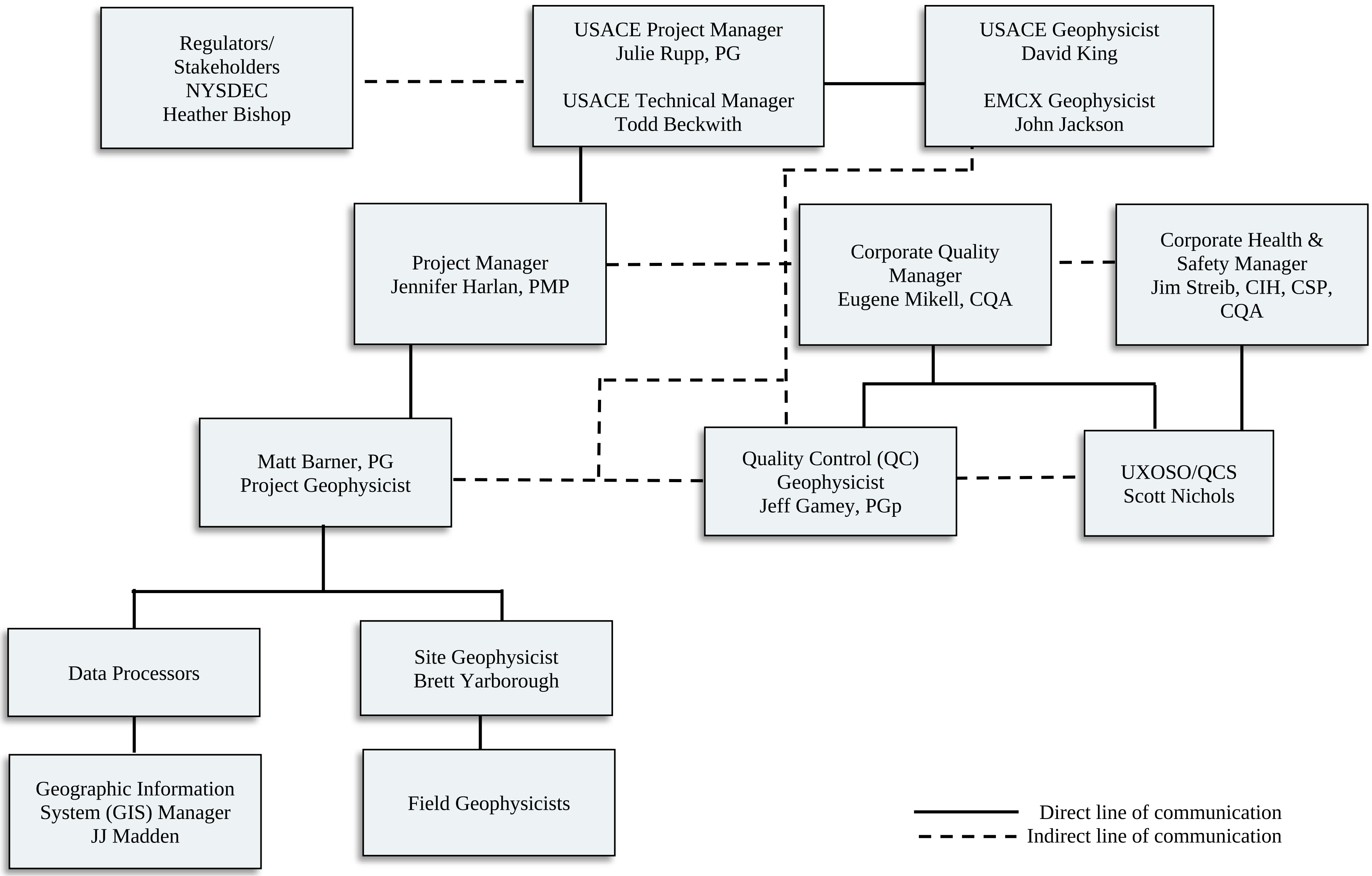


Figure 3-2. MEC Investigation Organization Chart

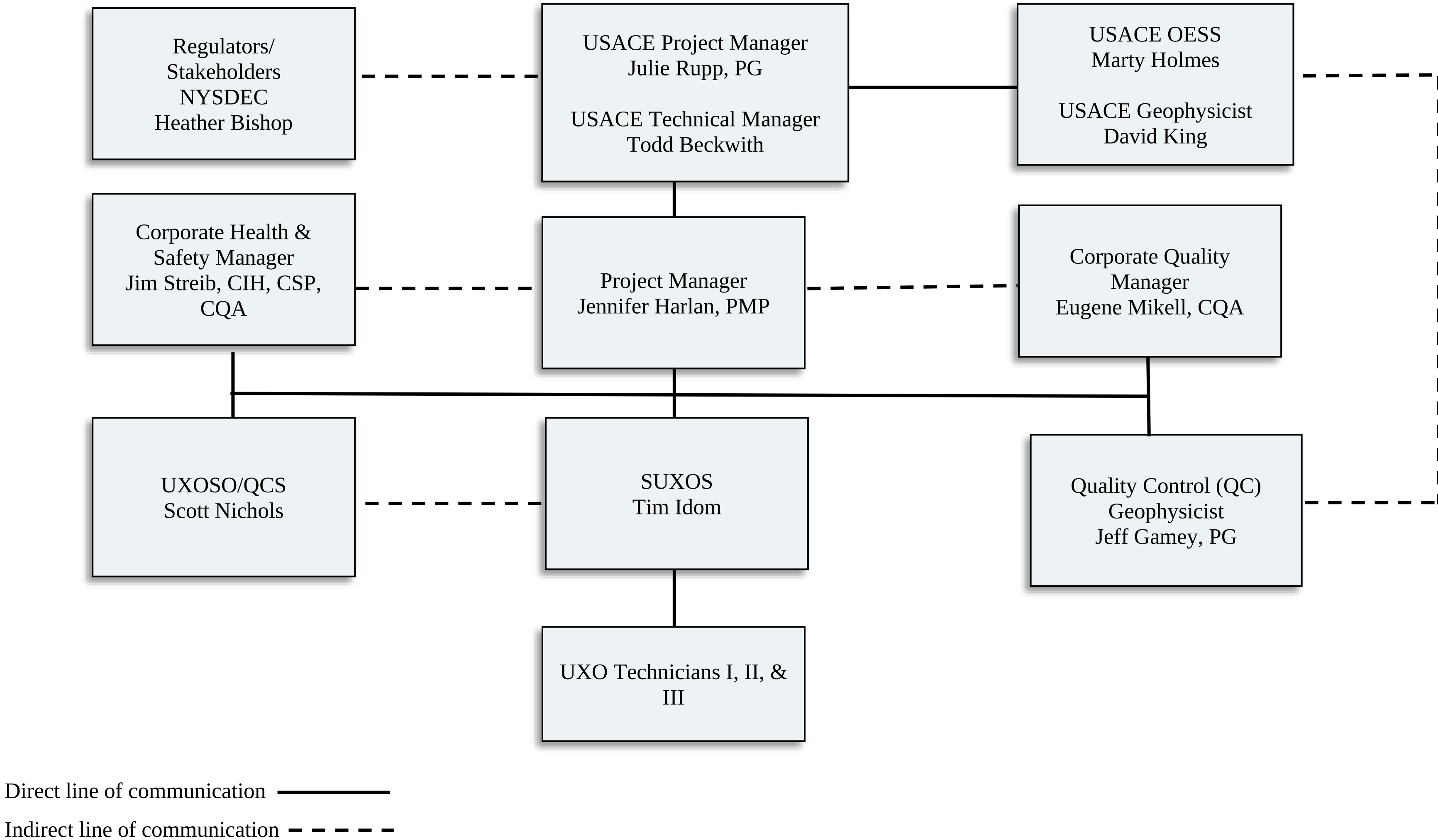
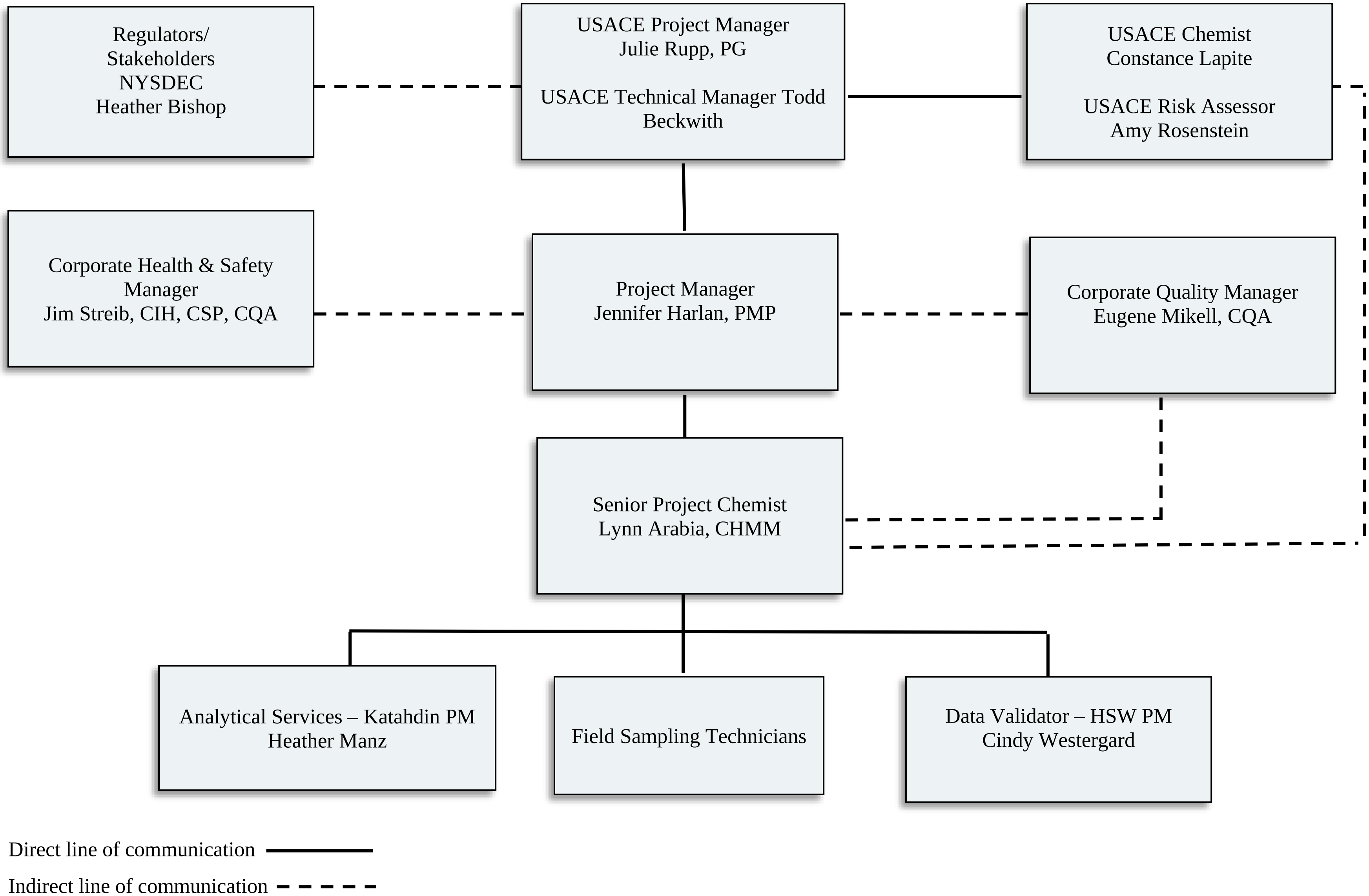


Figure 3-3. MC Investigation Organization Chart



QAPP WORKSHEET #4, #7, & #8 – PERSONNEL QUALIFICATIONS AND SIGN-OFF SHEET

Table 4-1 USACE PDT

Name	Role	Email
Julia Rupp	New England District Project Manager	Julia.M.Rupp@usace.army.mil
Todd Beckwith	Baltimore District Technical Manager	Todd.T.Beckwith@usace.army.mil
Amy Rosenstein	Risk Assessor	Amy.B.Rosenstein@usace.army.mil
Marty Holmes	Ordnance and Explosives Safety Specialist (OESS)	Marty.A.Holmes@usace.army.mil
Constance Lapite	Chemist	Constance.D.Lapite@usace.army.mil
Olivia Beaulieu	Geologist	Olivia.P.Beaulieu@usace.army.mil
David King	Geophysicist	David.V.King@usace.army.mil
Marcos Paiva	Archeologist	Marcos.A.Paiva@usace.army.mil
Michael Narcisi	Biologist	Michael.J.Narcisi@usace.army.mil
John Jackson	EMCX Geophysicist	John.M.Jackson@usace.army.mil

Table 4-2. Prime Contractor and Subcontractors

Name	Title/Role	Education/Experience Qualifications	Specialized Training	Required Licenses/Certifications/ Authorizations	Signature*/ Date
Jennifer Harlan, PMP Jennifer.harlan@tetratech.com (406) 940-5040	PM	• BS, Biology/Ecology • 11 years managing MMRP and hazardous, toxic, and radioactive waste projects	• MR-QAPP Module 1 Training • OSHA 40-Hour HAZWOPER training • Tt Project Management Training, Level 01 & 02	PMP, #1484360	
Eugene Mikell, CQA eugene.mikell@tetratech.com (865) 816-0388	CQM	• Naval Explosive Ordnance Disposal (EOD) School • 18 years of combined corporate QC and regulatory QA oversight experience • 40 years EOD/unexploded	• HAZWOPER 40-hour • Current 8-hour refresher OSHA Supervisor • ASQ Certified Quality Auditor • Tetra Tech Quality Manager under DoD Advanced Geophysical Classification (AGC) Accreditation Program (DAGCAP)	CQA #0914	

Name	Title/Role	Education/Experience Qualifications	Specialized Training	Required Licenses/Certifications/ Authorizations	Signature*/ Date
		ordnance (UXO) experience	• MR-QAPP Module 1 Training		
Jim Streib, CIH, CSP, CQA Jim.streib@tetratech.com (240) 727-9240	Corporate Health and Safety Manager	• MS, Occupational Safety and Health / Environmental Management • BS, Occupational Safety & Health • AS, Public Health • Over 15 years of environmental construction safety/explosive ordnance experience	• 40-Hour EM 385-1-1 USACE Safety & Health • OSHA 30 Hour Construction Safety • Safety Management Specialist No. SMS-209 • Construction Health and Safety Technician No. CHST-10023 • UXO Level 1 Training • Construction Quality Management for Contractors	• Certified Industrial Hygienist (CIH) # 12059 CP • Certified Safety Professional (CSP) # CSP-34027 • CQA # 68792	
Matthew Barner, PG Matt.barner@tetratech.com (980) 257-6800	Project Geophysicist	• B.S. Geology • M.S. Geology with a geophysics concentration • 20 years of geophysics for environmental remediation and munitions response experience	• 40-Hour OSHA HAZWOPER • 8-Hour OSHA HAZWOPER Refresher, Current • Member of Tetra Tech key AGC personnel • Geosoft UX-Analyze Training • MR-QAPP Module 1 Training	Professional Geologist #2171 (NC) and #2801-001635 (VA)	
Jeff Gamey, PGp, PMP Jeff.gamey@tetratech.com (865) 220-4724	QC Geophysicist	• B.S. Geophysics • Master of Business Administration • 38 years of geophysical experience • 6 years of munitions response experience	• 40-hour HAZWOPER Current 8-hour refresher • First Aid/ Cardiopulmonary Resuscitation • Member of Tetra Tech key AGC personnel	• Professional Geophysicist (PGp) #1054 (CA) • PMP, #1506228	

Name	Title/Role	Education/Experience Qualifications	Specialized Training	Required Licenses/Certifications/ Authorizations	Signature*/ Date
Brett Yarborough brett.yarborough@ tetratech.com (214) 902-1829	Site Geophysicist	• B.S., Geophysical Engineering • 4 years of geophysics for environmental remediation and munitions response experience	• 40-hour HAZWOPER Current 8-hour refresher • Geosoft UX-Analyze Training • First Aid/ CPR • Member of Tetra Tech key AGC personnel		
Tim Idom Tim.Idom@tetratech.com (360) 320-0639	Senior UXO Supervisor (SUXOS)	• Graduate, Naval EOD School • 33 years of MEC-related experience	• HAZWOPER • 8-Hour OSHA Supervisor training • 30-Hour OSHA Construction Safety and Health training • USACE QCM for Contractors • Tetra Tech QC and Safety Training	Qualified SUXOS IAW Department of Defense Explosives Safety Board (DDESB) TP-18	
Hannah Neeley Hannah.neeley@tetratech.com (617) 443-7514	Project Risk Assessor	• MPH (Master of Public Health), Environmental Health • BS, Microbiology and cell science • Over 5 years of risk assessment experience, including hazardous, toxic, and radioactive waste projects and MMRP projects	• HAZWOPER • Certified in Public Health (CPH)	NA	

Name	Title/Role	Education/Experience Qualifications	Specialized Training	Required Licenses/Certifications/ Authorizations	Signature*/ Date
Scott Nichols Scott.nichols@tetratech.com (850) 797-2111	UXO Safety Officer/Quality Control Specialist (UXOSO/QCS)	• Graduate, Naval EOD School • 30 years of MEC-related experience	• HAZWOPER • 8-Hour OSHA Supervisor training • 10-Hour OSHA Construction Safety and Health training • USACE CQM course • Tetra Tech QC and Safety training	Qualified UXO Quality Control Specialist IAW DDESB TP-18	
Lynn Arabia, CHMM Lynn.arabia@tetratech.com Direct: 973-630-8356 Cell: 973-224-4359	Senior Chemist	• BS, Chemistry; • Over 28 years of site investigation, chemical analysis, chemical QA/QC, environmental fate and transport analysis, and data quality/usability	• 40-hour OSHA HAZWOPER • 8-hr OSHA Supervisor • Current 8-hour OSHA refresher • First Aid/CPR • DOT/IATA Hazardous Materials (HM-126F) • Automated Data Review (ADR) Short Course • USACE Soil Sampling and Decision Making Using Incremental Sampling Methodology; ITRC Webinar Series • MR-QAPP Module 1 Training	Certified Hazard Materials Manager (CHMM)	
Heather Manz hmanz@katahdin.com Direct: (207) 874-2400	Project Manager, Katahdin Analytical Services, Inc. [Analytical Laboratory]	• B.S. Earth Science • 13 years of analytical laboratory experience	• Not Applicable (NA)	NA	

Name	Title/Role	Education/Experience Qualifications	Specialized Training	Required Licenses/Certifications/ Authorizations	Signature*/ Date
Cindy Lee Westergard cwestergard@hsweng.com Direct: 813.549.1015 Cell: 813.943.8831	Project Manager, HSW Engineering, Inc. [Data Validator]	• B.A. Chemistry/ Biology; MBA Business • Nearly 30 years data validation experience • Over 30 years on environmental laboratory audits	• Training in ADR.net automated data review software • Created and given training courses in ADaPT automated data review software • NELAP laboratory auditor training	NA	

QAPP WORKSHEET #6 – COMMUNICATION PATHWAYS AND PROCEDURES

Table 6.1. Communication Pathways

Communication Driver	Initiator (name, project title)	Recipient (name, project title)	Procedure (timing, pathway, documentation)
Regulatory agency interface	Julie Rupp, USACE PM	Heather Bishop, NYSDEC	USACE PM provides weekly project update memorandum to the Regulator via email. USACE PM will seek concurrence on QAPP changes and provide notification of quality failure.
Daily field progress reports	Don Schwalback, Tetra Tech SUXOS	Jennifer Harlan, Tetra Tech PM	The SUXOS provides daily progress by email. The Tetra Tech PM provides daily progress reports to the USACE PM via email.
Daily field QC reports	Scott Nichols, Tetra Tech UXOSO/QCS	Jennifer Harlan, Tetra Tech PM, Matthew Barner, Tetra Tech Project Geophysicist; Jeff Gamey, Tetra Tech QC Geophysicist; Eugene Mikell, CQM	The UXOSO/QCS will be notified (email) of any data processing or other quality checks conducted by home office activities. Daily field QC reports are provided to the Tetra Tech PM, Project and QC Geophysicists, and CQM. At the end of each week of fieldwork, Tetra Tech provides daily QC reports to the USACE PM via email.
Weekly digital geophysical mapping (DGM) & AGC QC reports	Jeff Gamey, Tetra Tech QC Geophysicist	Jennifer Harlan, Tetra Tech PM; Matthew Barner, Tetra Tech Project Geophysicist; Eugene Mikell, CQM	Weekly DGM/AGC QC reports are provided to the Tetra Tech PM, Project Geophysicist, and CQM. At end of each week of fieldwork, Tetra Tech PM provides weekly DGM/AGC QC reports to the USACE PM, TM and QA Geophysicist via email. The exception to this reporting procedure includes changes arising from corrective actions in response to geophysical nonconformances. Refer to nonconformance communication driver in this table.
Mishap notification	Scott Nichols, Tetra Tech UXOSO/QCS	Jennifer Harlan, Tetra Tech PM	UXOSO/QCS will notify Tetra Tech PM by phone immediately. Tetra Tech PM will notify the USACE PM by phone within 2 hours.
Stop work due to safety issues	Tim Idom, Tetra Tech SUXOS	Jennifer Harlan, Tetra Tech PM	As soon as possible following discovery, the SUXOS informs Tetra Tech PM by phone of critical safety issues and generates a follow-up Stop Work Memorandum. Tetra Tech PM notifies the USACE PM by phone as soon

Communication Driver	Initiator (name, project title)	Recipient (name, project title)	Procedure (timing, pathway, documentation)
			as possible. NOTE: All team members have the authority to Stop Work for safety concerns.
Quality assurance stand-down (missed validation seed)	Todd Beckwith, USACE Technical Manager (TM)	Jennifer Harlan, Tetra Tech PM	USACE TM notifies Tetra Tech PM by email. Tetra Tech PM notifies CQM, who in turn notifies DAGCAP, the contractor's accrediting body, Tetra Tech Project and QC Geophysicists, SUXOS, and UXOSO/QCS.
Minor QAPP changes during project execution, such as deviations from planned work tasks or schedule in QAPP due to unforeseen site conditions, safety hazards or access restrictions.	Jennifer Harlan, Tetra Tech PM, Jeff Gamey, Tetra Tech Project Geophysicist, or Tim Idom, Tetra Tech SUXOS	Jennifer Harlan, Tetra Tech PM; Matthew Barner, Tetra Tech QC Geophysicist; Scott Nichols, UXOSO/QCS; Eugene Mikell, CQM	Minor QAPP changes will be noted on the Daily progress reports and forwarded to the listed recipients at the end of each day. Additionally, the USACE PM will be verbally notified of any changes and a follow-up email will be sent.
Major QAPP changes during project execution such as named key project personnel, task sequence, geophysical system type, SOPs, changes to investigation area boundary or size and changes necessitating updates to data quality objective decision rules, measurement performance criteria and failure responses	Jennifer Harlan, Tetra Tech PM	Julie Rupp, USACE PM; Todd Beckwith, USACE TM Eugene Mikell, CQM	Within 24 hours of discovery of the need for a change, Tetra Tech PM submits field change request form to Tetra Tech CQM and USACE PM and TM for approval. The USACE PM/TM will coordinate review/approval of the FCR with the appropriate USACE project team members and provides approval to the Tetra Tech PM. Following approval, USACE PM informs the Regulator via email. The exception to this reporting procedure includes changes arising from corrective actions in response to QA/QC nonconformances. Refer to quality assurance stand down and QC nonconformance communication drivers in this table. Note: AGC SOPs are subject to updates as required by changes in technology, software, and mandatory annual reviews. Changes to the AGC SOPs will not require an FCR.

Communication Driver	Initiator (name, project title)	Recipient (name, project title)	Procedure (timing, pathway, documentation)
Resume work following a stop work or QA stand-down	Todd Beckwith, USACE TM	Jennifer Harlan, Tetra Tech PM	The USACE TM will provide the Tetra Tech PM with written notice of approval before work may resume.
Geophysical QC nonconformance	Jeff Gamey, Tetra Tech QC Geophysicist, Scott Nichols, Tetra Tech UXOSO/QCS	Jennifer Harlan, Tetra Tech PM; Eugene Mikell, CQM; Matthew Barner, Tetra Tech Project Geophysicist	The Tetra Tech QC Geophysicist will generate an non-conformance report (NCR) and transmit it to the Tetra Tech PM, Project Geophysicist, and CQM. The Tetra Tech PM forwards the NCR to the USACE PM, TM, and QA Geophysicist. Upon response action completion IAW this QAPP, the Tetra Tech Project Geophysicist will forward the revised NCR and proposed corrective action (CA) to the Tetra Tech PM, QC Geophysicist, and CQM. Upon acceptance by all three, the Tetra Tech PM forwards the documents to the USACE PM, TM, and QA Geophysicist for review and concurrence. Note: If the Project Delivery Team (PDT) agrees, the Project and QC Geophysicist may conduct technical discussions without other PDT members.
Updates to MC-related QAPP Worksheets	TBD, Field Sampling Technician Tetra Tech Senior Chemist, Lynn Arabia	Jennifer Harlan, Tetra Tech PM Eugene Mikell, CQM	Minor QAPP deviations will be noted on the Daily progress reports and forwarded to the Tetra Tech PM at the end of each day. CQM will discuss with the PM, and initiate documented changes to the QAPP (e.g., procedure changes, additional sample locations, modified analytical suites) as Amendments or field change requests.
Reporting of Laboratory Data Quality Issues	Heather Manz, Katahdin PM	Tetra Tech Senior Chemist, Lynn Arabia	All quality issues with field sample analysis reported (phone or email) to the Project Senior Chemist who will subsequently discuss with Tetra Tech PM and CQM within one business day of discovery.
Reporting of Data Quality Issues during Validation	Cindy Lee Westergard, HSW PM	Tetra Tech Senior Chemist, Lynn Arabia	Quality issues regarding usability (or lack thereof) of data reported (phone or email) to the Project Senior Chemist who will subsequently discuss with Tetra Tech PM and CQM within one business day of discovery.

Communication Driver	Initiator (name, project title)	Recipient (name, project title)	Procedure (timing, pathway, documentation)
Communication of firewalled information	Scott Nichols, Tetra Tech UXOSO/QCS; Jeff Gamey, Tetra Tech QC Geophysicist	Eugene Mikell, Tetra Tech CQM David King, USACE QA Geophysicist	The UXOSO/QCS and Tetra Tech QC Geophysicist are responsible for firewalled communications with the project team regarding blind seed information. The Tetra Tech QC Geophysicist is responsible for the communication of firewalled information to the USACE QA Geophysicist.

QAPP WORKSHEET #9 – PROJECT PLANNING SESSION SUMMARY

Date of planning session: September 10, 2020

Location: Web meeting/Conference call

Purpose: Geophysical Discussion

Participants:

Name	Organization	Role	Email
Julia Rupp	USACE	New England District Project Manager	Julia.M.Rupp@usace.army.mil
Todd Beckwith	USACE	Baltimore District Technical Manager	Todd.T.Beckwith@usace.army.mil
John Jackson	EMCX	Geophysicist	John.M.Jackson@usace.army.mil
David King	USACE	Geophysicist	David.V.King@usace.army.mil
Jennifer Harlan	Tetra Tech	Project Manager	Jennifer.Harlan@tetratech.com
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Consensus/Notes: USACE Project Delivery Team (PDT) and Tetra Tech discussion on geophysical approach, and agreement on Visual Sampling Plan (VSP) inputs and transect spacing.

Date of planning session: October 1, 2020

Location: Web meeting/Conference call

Purpose: MC/Data Quality Objective (DQO) Discussion

Participants:

Name	Organization	Role	Email
Julia Rupp	USACE	New England District Project Manager	Julia.M.Rupp@usace.army.mil
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Consensus/Notes: USACE PDT and Tetra Tech discussion on MC sampling approach and DQOs.

Date of planning session: October 6, 2020

Location: Web meeting/Conference call

Purpose: Geophysical Discussion – residential area

Participants:

Name	Organization	Role	Email
Julia Rupp	USACE	New England District Project Manager	Julia.M.Rupp@usace.army.mil
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Consensus/Notes: USACE PDT and Tetra Tech discussion on geophysical approach at the residential areas, and agreement on transect spacing.

Date of planning session: November 16, 2020

Location: Web meeting/Conference call

Purpose: Systematic Project Planning (SPP) #1

Participants:

Name	Organization	Role	Email
Julia Rupp	USACE	New England District Project Manager	Julia.M.Rupp@usace.army.mil
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The SPP presentation covered the goals and objectives of MR-QAPP planning sessions #1 through #4 and included the following discussion points:

- Introduction of USACE Project Team, Tetra Tech, and Stakeholders
- Process Overview for FUDS
- Requirements and Guidance Summary
- Systematic Project Planning (SPP) Meeting 1 Activities
    - SCAAF BGR MRS Site Details
    - Preliminary Conceptual Site Model (CSM)
    - DQOs 1 – 7
    - MEC Technical Approach
    - MC Sampling Design
- Definable Features of Work (DFW) for RI Fieldwork
- Potential Constraints/Coordination Issues
- Project Schedule
- Safety Reminder, Closing Remarks, and Questions

All meeting minutes can be found in Appendix B.

QAPP WORKSHEET #10 – CONCEPTUAL SITE MODEL (CSM)

Facility Profile:

Site location, size, and ownership:

The former SCAAF FUDS is approximately two miles north of Westhampton Beach, New York, and occupies approximately 9,224 acres. The area of investigation for this project is 4,297 acres, includes MRS-01, and is located within the FUDS boundary (Figure A-1). The site is situated in a relatively flat area and is south of, and partially within, the Central Pine Barrens in Suffolk County. The Atlantic Ocean lies approximately three miles to the south of the former SCAAF.

Currently, New York State and Suffolk County own most of the property. The northern portion of the FUDS is located within the Long Island Central Pine Barrens Groundwater Conservation area under the stewardship of the Central Pine Barrens Joint Planning and Policy Commission. Residential areas are primarily to the east and south in the MRS, and light industrial use and sand/gravel quarrying are conducted on the west side of the MRS.

Site History:

The SCAAF BGR was activated in 1943 for bombing, strafing, and rocket fire training exercises for fighter pilots using the P-47 Thunderbolt aircraft. Most of the training exercises appear to have been .50 caliber machine guns, practice bombs, and practice rockets. However, from May 1943 through January 1944, 100-lb and 500-lb high explosive (HE) bombs, incendiary bombs, and 4.5-in HE rockets were reportedly used on the numerous targets located throughout the MRS. The training exercises lasted less than one year, resulting in the destruction of the majority of the targets and structures. Military use of the SCAAF site ceased in 1946. Figure A-2 provides a layout of MRS-01 and historical target locations. The Army Geospatial Center conducted research on historic photographs and found a series of 1947 aerials that they developed into a mosaic showing the target details to show what was there on the site at the end of operations (Figures A-3 and A-4).

As part of training range development, the land comprising the bombing and gunnery range FUDS was cleared and developed into four separate ranges: a bombing range, a strafing range, and two 1,500 by 3,000 feet scoring ranges. Construction of targets and facilities in the range areas consisted of 23 strafing targets, 25 bombing targets, 12 target pits, two (2) range houses, and two (2) range towers. Bombing and strafing targets included elaborately constructed wooden trains, tanks, trucks, ammo storage buildings, planes, submarines, and houses. Ship silhouette targets—with features outlined on the earth in white stone—were also constructed. Except for two target silhouettes constructed of painted boulders, a destroyer, and an aircraft carrier, no military structures remain at MRS-01.

Munitions known or suspected to be present:

Small arms (.50 cal)
AN-M20 or AN-M18 100lb bomb, explosive burster tube
AN-M30 100lb bomb HE
AN-M64 & AN-M64A1 500lb bomb HE
AN-M50 4lb incendiary bomb
AN-M54 4lb incendiary bomb [smallest target of interest (TOI)]
AN-M69 6lb incendiary bomb

White Phosphorus bombs
M38A2 100lb practice bomb
M47A4 100lb smoke bomb
M8 4.5” barrage rocket HE
2.25” practice rocket & nose cones
M1 3lb black powder spotting charges
M77 10lb smoke or incendiary bomb
10lb bombs

Previous Investigations:

An INPR for MRS-01 was completed in 1991 by the USACE New York District. The report documented the acreage, site visit findings, and local interviews. The INPR determined the site was eligible for the Defense Environmental Restoration Program (DERP) under FUDS.

The 1998 ASR prepared by USACE Rock Island District detailed the historical nature of MRS-01. The ASR referenced available records, interviews, site inspections and analyses, which confirmed the presence of MEC or munitions debris (MD) on private, public, and residential properties within the property boundaries.

During the 2009 Site Inspection (SI), analog and visual observations of approximately 5.8 acres of the MRS were performed. No MEC was discovered, but MD including .50 caliber shell casings and bullets, debris from one M38A2 100-lb practice bomb, and 2.25-inch practice rocket bodies and nose cones were found. Several subsurface anomalies were noted but not investigated as part of the SI. The SI concluded that there is a reasonable probability that MEC or MD may be present within the MRS. Note that the final MRS boundary in the SI Report varies from this RI, as the SI and ASR figures did not accurately depict the locations of targets and MRS boundary. USACE reviewed additional historical photographs and aerial images to develop the RI MRS boundary, as shown in Figure A-2.

Limited soil and groundwater samples were collected during the SI to evaluate MC onsite. Samples were analyzed for explosives and select metals (aluminum, antimony, barium, copper, iron, lead, and nickel). In surface soils, the presence of antimony, barium, copper, iron, lead, and nickel above their respective background values (Alion, 2009) resulted in the determination of a complete pathway for humans and biota. Antimony and iron were identified as chemicals of potential concern (COPCs) in surface soil; however, based on a Weight of Evidence (WOE) evaluation, surface soil was not determined to represent an unacceptable risk to human receptors. The WOE evaluation for antimony was based on the following: none of the site antimony concentrations exceeded the unadjusted antimony EPA regional screening level, the detection of antimony was infrequent and the conservative HHRA screening level explosive to antimony in surface soil. For iron, the WOE evaluation was based on the fact that only 1 value slightly exceeded the HHRA residential screening level (5,940 mg/kg concentration versus 5,500 mg/kg screening criteria) and the conservative HHRA screening level (Alion, 2009). In subsurface soil, the maximum detected concentrations for all metals sampled were below the HHRA screening levels; therefore, no COPCs were identified for subsurface soil (Alion, 2009).

In surface soil, antimony, copper, and lead were detected at concentrations exceeding both background and their respective ecological screening levels and were identified as chemicals of potential ecological concern (COPECs). The background evaluation included a comparison of the site maximum detected concentration to the maximum detected background concentration as well as a comparison of the site mean concentration to the background mean concentration for the constituents being evaluated. The background data set included five surface soil background samples and no subsurface soil background samples. Background surface soil data was used for comparison to subsurface soil site data due to similar geologic conditions in surface soil and subsurface soil. It should be noted that a more rigorous background evaluation will be conducted during the RI (i.e., statistical hypothesis testing with larger data sets). A WOE evaluation for these three COPCs indicated that exposure to surface soil may represent a potential risk to biota that warranted further evaluation to confirm the findings of the 2009 SI (Alion, 2009).

Of the analytes detected in groundwater during the SI, aluminum, iron, and lead exceeded their associated human health screening criteria. Aluminum did not exceed background levels and therefore, was indicated not to pose additional risks based on former U.S. Department of Defense (DoD) activities. Based on a WOE evaluation, the SI stated exposures to iron and lead are not expected to produce unacceptable risks to human receptors, based on the conservatism in the HHRA screening levels and only slight exceedances of the screening levels for both iron and lead (Alion, 2009). Figure A-5 provides an overview of the previous sampling locations that exceeded human health or ecological screening criteria.

<u>Physical Profile:</u>

<u>Topography and vegetation:</u>

The MRS has elevations that range from approximately 33 feet to 75 feet above mean sea level at the central portion of the former range. The surface topography is generally flat with subtle rolling terrain with an overall slope of 0.5 percent (Alion, 2009). Slight valleys are noted across the project area, situated in a north-to-south manner where streams intermittently flow. The range is located on a glacial outwash plain south of the Ronkonkoma moraine, which forms the long east-to-west trending ridge visible from the Gabreski Airport. These sand and gravel deposits are approximately 100 to 200 feet thick at the site and increase in thickness to the south (USACE, 1998).

The site photographs in the ASR and SI indicate that the MRS is moderate to heavily vegetated. Prevalent tree species include shrubby scrub oak (*Quercus ilicifolia*), pitch pine (*Pinus rigida*), white pine (*Pinus strobus*), and to a lesser extent, red maple (*Acer rubrum*). Other small tree, plant, and shrub species found near the project site include black huckleberry (*Gaylussacia baccata*), blueberry (*Vaccinium pallidum* and *V. angustifolium*), sheep laurel (*Kalmia latifolia*), wintergreen (*Gaultheria procumbens*), and poison ivy (*Toxicodendron radicans*) (Alion, 2009).

<u>Geologic Setting:</u>

The geologic unit mapped beneath the surficial glacial deposits is the Upper Glacial Aquifer, characterized by glacial deposits including till and sand and gravel lenses. The Gardiners Clay, which pinches out to the north of the site, underlies the Upper Glacial Aquifer. This unit, located at depths greater than 155 feet below ground surface (bgs), consists of a 40-foot-thick layer of green and gray clay, silt, and clayey or silty sand, with some clayey gravel. This unit has a low bulk hydraulic conductivity and tends to confine water in the underlying aquifer (Alion, 2009).

Underlying the Gardiners Clay deposits are the Magothy Formation and the Raritan Formation (consisting of a clay layer underlain by the Lloyd Sand Member). The Lloyd Sand Member has a moderate overall hydraulic conductivity, and consists of sand and gravel interbeds with occasional lenses of clay and silt. The Lloyd Sand Member beds are encountered at a depth of approximately

400 ft bgs and are approximately parallel to the bedrock surface below. Bedrock in and around the project area is encountered at an approximate depth of 400-1,600 ft bgs. The bedrock consists of Precambrian or Cambro-Ordivician Walloomsac schist, gneiss, granite, or Inwood marble (Alion, 2009).

Surface soils at MRS-01 either belong to the Riverhead-Plymouth-Carver Association or the Plymouth-Carver Association, the latter comprising approximately 75-80% of the soils. These soil associations are similar with only subtle variations between the separate units. Soils are characterized as deep, excessively well-drained, fine- to coarse-textured loamy sands over thick layers of stratified coarse sand and gravel. These soils, derived from glacial deposits, have very low moisture capacity making them unsuitable for agricultural purposes. The remaining surface soils are comprised of Haven sandy loam and cut and fill material brought in for developed areas in the southern portion of the project area (Alion, 2009).

Hydrogeology:

Surface water: There are no permanent surface water bodies on MRS-01. However, in the event of substantial rainfall, water would flow from north to south across the project area, following the slight valleys that have naturally formed over time (USACE, 1998).

Aquifers: Three aquifers and two aquitards are present below MRS-01. Overlying the bedrock is the Lloyd Aquifer located 400 to 1,000 ft bgs (USACE, 1998). The Lloyd Aquifer correlates to the Lloyd sand member of the Raritan Formation. Overlying the Lloyd is the Raritan clay member, an aquiclude present beneath and south of Gabreski Airport. Overlying the Raritan clay is the Magothy Aquifer, a water-bearing unit that correlates to the Magothy Formation (USACE, 1998). The Magothy Aquifer is located 150 to 400 ft bgs (USACE, 1998).

Overlying the Magothy is the Gardiners clay, an aquiclude present beneath and south of the airport. Overlying the Gardiners clay at the airport and overlying the Magothy north of the airport is the Upper Glacial Aquifer, a predominately sand and gravel unit deposited during the Wisconsin glaciation (USACE, 1998). The Upper Glacial Aquifer is located from ground surface to 150 ft bgs. A majority of the groundwater in the project area is obtained for drinking water from the upper glacial aquifer; the rest is obtained from the Magothy and Lloyd (deep) aquifers (USACE, 1998).

Groundwater: According to data from the United States Geological Survey (USGS), depth to groundwater ranges from less than 11 feet to 100 feet below land surface within MRS-01. However, the average depth across the project area is 40 feet to 60 feet below land surface. The differences in groundwater depth could be the result of wells being screened in different aquifers. Based on hydrological data gathered during the 2009 SI field event, the depth to groundwater varied from 15 ft bgs to at least 45 ft bgs. Approximately 90% of the FUDS lies within the Long Island Central Pine Barrens Groundwater Conservation area (Alion, 2009). Groundwater flows in a southerly direction.

Per an October 2020 Environmental Data Resources, Inc. (EDR) Report procured by Tetra Tech, nine wells within the MRS-01 boundaries range in depth between 36 and 1,123 ft bgs with a majority being 86 ft bgs deep. Groundwater levels were measured in seven of these nine wells, and depth to water ranged from 41 to 60 ft bgs (or 17 to 30 feet above mean sea level). There are 43 wells within a one-mile search radius from MRS-01 with well depths ranging from 27 to 839 ft bgs.

Groundwater levels ranged between 32 and 142 ft bgs (8 and 28 feet above mean sea level). A summary of the EDR is presented in Appendix I.

Wetlands: According to the Fish and Wildlife Service's National Wetlands Mapper, the only wetlands at MRS-01 are lower perennial riverine. These are characterized as having a low gradient, with no tidal influence, and a substrate consisting of sand and mud. The locations of these riverine wetlands are consistent with the previous surface water and topography discussions. According to local stakeholders, the area does not generally support sustained standing water throughout the year.

Climate:

Long Island, New York falls somewhere between a humid subtropical and humid continental climate. The summers are warm and humid, while the winters are cool to sometimes cold. According to climate data from Gabreski Airport, average summer temperatures are in the 60s to 70s°F, with July as the hottest month, reaching into the 80s. Winter temperatures are in the 30s on average.

Precipitation is well- distributed throughout the year. On average, March and April receive the most rainfall at 4.62" per month, whereas February sees the least precipitation at 2.9" on average. The project area can expect approximately 47" of precipitation per year. Average wind speeds are around 8 miles per hour during the summer and 12-14 miles per hour during the winter. Long Island is susceptible to convective thunderstorms, tropical depressions, and sometimes hurricanes.

Endangered species, sensitive habitats, and cultural resources:

Per US Fish and Wildlife Service (USFWS) consultation, the only endangered species/sensitive habitat to address includes the Northern Long-Eared Bat. NYSDEC indicated that the property is not situated within the New York Coastal Zone. Furthermore, according to the USFWS Information for Planning and Consultation database, there are no critical habitats at MRS-01. Based on communications with Suffolk County and Pine Barrens Commission personnel in April 2020, protected plant species such as the dwarf pine are widespread. An updated consultation with the NY Natural Heritage division is ongoing.

According to the New York State Cultural Resource Information System, there are no known cultural sites at MRS-01. Furthermore, the New York State Historic Preservation Office (SHPO) has verified that there are no identified archeological resources in MRS-01. USACE will confirm this information through background research and further coordination with SHPO. A current project description of RI planned activities will be provided to SHPO along with a determination of effect upon cultural resources. Although there are no known resources, the state is interested in any possible archeological resources discovered due to the site's former military activity. If remediation is expected to alter, destroy, or otherwise impact any structures or facilities associated with the former base, the SHPO must be contacted immediately, and measures to avoid, minimize or mitigate for these impacts developed before project remediation. If impacts occur during remediation, a notification process will need to be developed to address inadvertent or unanticipated discoveries and provide SHPO an opportunity to comment.

Areas that are inaccessible to the investigation:

Rights of entry (ROEs) are being coordinated with the property owners by USACE. Based on the results of this coordination, some areas of the MRS may not be accessible during the investigation due to a lack of ROEs.

Vegetation clearance will be needed for transects, mini-grids, and general access. General vegetation removal procedures will include

- Not removing trees 4 inches or greater in diameter
- Stumps and roots will be left in place to protect the soil and foster regeneration
- Brush material will be chipped and left in place
- Appropriate precautions will be taken to ensure site activities do not cause a wildfire

Release Profile:

As shown by the grey dots with blue buffer zones surrounding them on Figure A-2, there were 23 strafing targets, 25 bombing targets, and 12 target pits, two (2) range houses, and two (2) range towers. Bombing and strafing targets included elaborately constructed wooden trains, tanks, trucks, ammo storage buildings, planes, submarines, and houses. Ship silhouette targets with features outlined on the earth in white stone were also constructed.

As no intrusive investigations have previously been conducted within MRS-01, the horizontal and vertical distribution of munitions and MC is unknown. While most of the land is undeveloped, there have been roads, houses, quarries, and other industrial buildings built within MRS-01 that may have had the potential to redistribute MEC.

Land Use and Exposure Profile:

Current/Future Land Use

- Mostly undeveloped with light industrial, commercial, and residential land
- A large portion of the site is part of the Central Pine Barrens Groundwater Conservation District
- Land use not expected to change substantially

Land use and the associated receptors vary across different portions of the Site. The evaluation of risk will be specific to the exposure pathways potentially present within a HUA/LUA based on the current and reasonably anticipated future land use in that area and the exposure unit (EU) for each receptor.

Current/Future Receptors

- Residents – EU = 0.25 acres or existing residential parcel size
- Recreational Users – EU = 2 acres
- Commercial/Industrial Workers – EU = 2 acres or existing commercial/industrial parcel size
- Municipal Workers – EU = 2 acres or existing commercial/industrial parcel size
- Construction Workers – EU = 2 acres or existing commercial/industrial parcel size
- Trespassers – EU = 2 acres or existing parcel size
- Ecological Receptors – EU = varies according to species

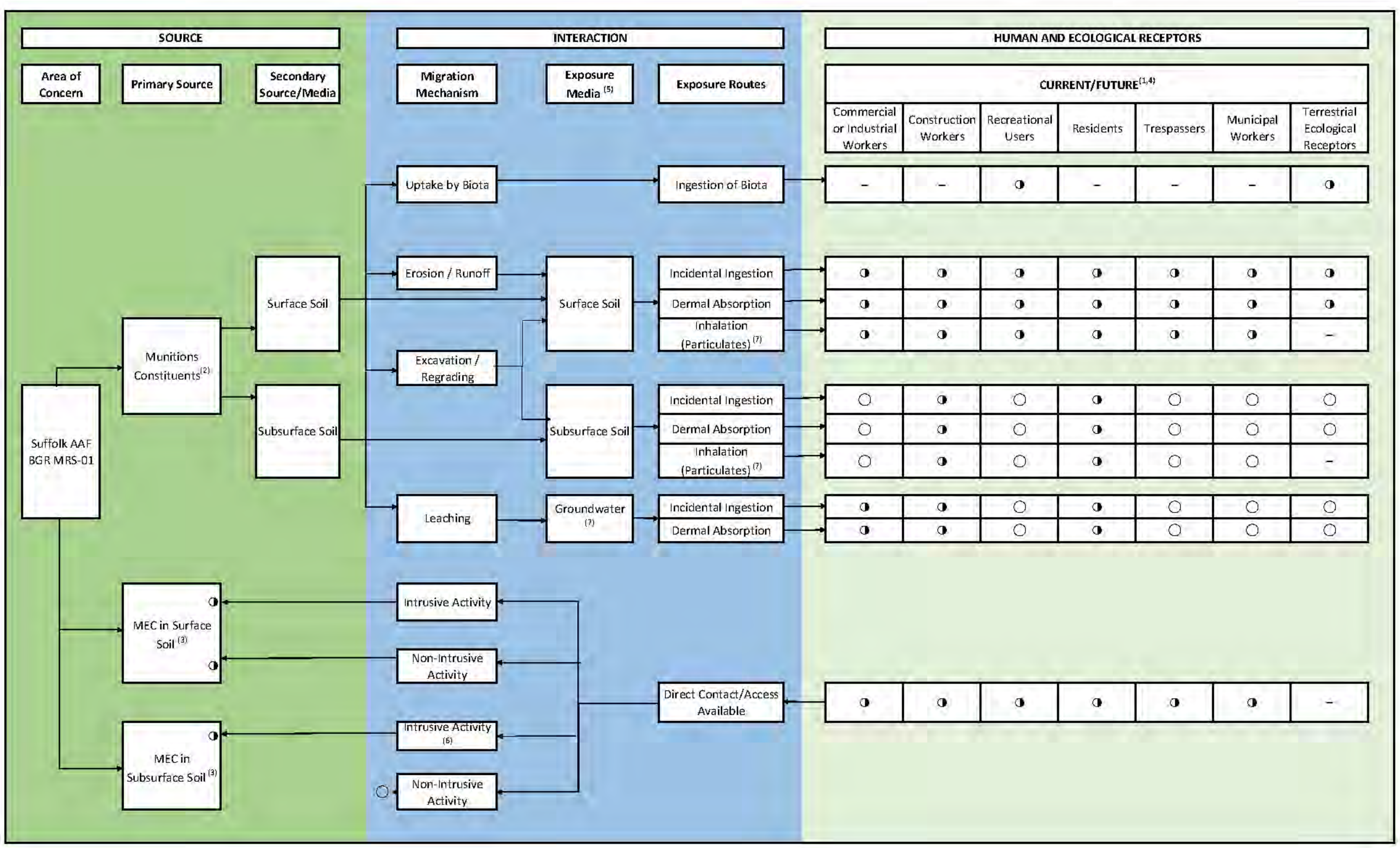
Exposure Pathways

- MEC Exposure Pathways
  - Current/Future Human Receptors: Direct contact at the surface and subsurface with MEC
    - Considered potentially complete pathway – receptors are present and have access to MEC if present

- MC Exposure Pathways
  - Current/Future Human Receptors: Incidental ingestion, inhalation of particulates, and dermal absorption of surface and subsurface soil. Incidental ingestion and dermal absorption of groundwater
    - There are no drinking water wells within the MRS.
    - Considered potentially complete pathway – The pathway is potentially complete if a MC source is identified in the surface and/or subsurface soil in areas with MEC or large quantities of MD.
  - Ecological Receptors: Incidental and dietary ingestion or direct contact/absorption/uptake of surface soils. Incidental ingestion, dermal absorption, and indirect exposure by ingestion of biota that has been exposed to MC

The Conceptual Site Exposure Model (CSEM) is included as Figure 10-1.

Figure 10-1. Preliminary CSEM.



● Complete Exposure Pathway
◑ Potentially Complete Exposure Pathway
○ Incomplete Exposure Pathway
– Receptor or Exposure Pathway Not Present – Historical information indicates this receptor is not present within the MRS or the exposure from this pathway is inapplicable or insignificant for this receptor.

NOTES

(1) CSEM based on previous investigation results.
(2) The SI indicated that explosives and select metals are present in surface or subsurface at the site.
(3) Results of the previous field activities indicate that MD were identified on the surface soil and metallic anomalies were present in the subsurface soil; the RI is needed to determine if MEC and MD are present in this MRS.
(4) Not all receptors may be applicable throughout all areas within the MRS (e.g., residential, commercial, and Central Pine Barrens Area)
(5) Current site information does not suggest surface water/sediment within MRS, therefore this is considered an incomplete pathway. Should surface water/sediment be observed during the field investigation, the PDT will discuss sampling of these media.
(6) This pathway is incomplete if the intrusive activity does not reach the depth of MEC present
(7) None of the analytes of interest are volatile.

QAPP WORKSHEET #11A – PROJECT/DATA QUALITY OBJECTIVES - MEC

Data Quality Objective (DQO) Steps and Description	DQO Step Activity
1) State the Problem	Human receptors may come into contact with MEC hazards; therefore, there is the potential for an explosive safety risk. Also, the extent of MC within the MRS is undefined and may be associated with human health or ecological risks.
2) Identify the Goal of the Project	Previous investigations have found MEC and MD; however, the extent of MEC is unknown. During the 2009 SI, limited soil and groundwater samples were collected and analyzed for MC. A potential ecological risk from select metals in surface soil was identified, however the exposure pathway for ecological risks from exposure to subsurface soil was considered incomplete. No unacceptable risk was identified for subsurface soil or groundwater based on the limited data collected. Further Investigation is needed to: • Confirm locations of targets • Delineate High Density (HD) and Low Density (LD) areas for characterization • Conduct detailed characterization to determine if anomaly sources are munitions-related or not and to establish boundaries for high use areas (HUAs), low use areas (LUAs), and no evidence of use (NEU) areas • Characterize the type, nature, and distribution (horizontal and vertical) of munitions within each HUA and LUA • Determine if findings are consistent or inconsistent with the preliminary CSM, revisit DQOs, and, if necessary, collect additional MEC data to ensure all RI data needs are met • Collect MC data within each HUA (including areas with significant quantities of small arms) in sufficient quantity to determine the horizontal and vertical extent and from each Decision Unit (DU) within the HUA and to evaluate risk • Evaluate human health and ecological risk for MEC and/or MC • Support determinations of areas with NEU • Collect data to support a Feasibility Study (FS), if necessary **MEC** *<u>Principal study questions:</u>* • What are the nature and extent (i.e., horizontal and vertical distribution) of explosive hazards throughout MRS-01? • What current and potential future threats may be posed to human health by MEC remaining at the site? • What are alternative actions for mitigating current and potential threats (if identified) posed by MEC remaining at the site? *<u>Alternative outcomes:</u>* • The area is an HUA. • The area is an LUA. • The area shows NEU. *<u>How the data will be used in solving the problem:</u>* Results of the RI will be used to determine that there is no unacceptable risk, or there is an unacceptable risk. If an unacceptable risk exists, remedial alternatives will be evaluated to mitigate the unacceptable risk in the FS.
3) Identify Information Inputs	Information needed to establish the nature and extent of MEC and MC and characterize the potential hazard:

<table>
<tr><th>Data Quality Objective (DQO) Steps and Description</th><th>DQO Step Activity</th></tr>
<tr><td></td><td><u>MEC</u>
Expected background anomaly density
Average HD area density above background
The horizontal and vertical boundaries of HUAs
Background geophysical sensor response
Geophysical target detection threshold
The anticipated depth of reliable detection for munitions known to be present
Geophysical target locations
Geophysical sensor survey path and footprint coverage
Derived geophysical anomaly density relative to expected density
Site-specific classification library
Predicted geophysical anomaly sources
Nature of intrusively investigated anomaly sources
Types of munitions on the site and identified munitions not in current CSM
Information needed to establish exposure potential for both MEC and MC
Current/future land use, receptors, and exposure scenarios
Information needed to support the FS, if necessary
Data to establish the effectiveness of various alternatives
Anticipated detection technology performance
Impacts of various alternatives on risk
Data to support costing of various alternatives</td></tr>
<tr><td>4) Define the Boundaries of the Project</td><td><u>Target population:</u> The target population includes munitions reportedly used during historical military training as well as munitions known or suspected onsite through the discovery of MEC or MD, which serves as an indicator of potential MEC hazards and potential MC contamination. Table 11-1 lists munitions that are known or suspected to be present at MRS-01.

<u>Spatial and temporal boundaries:</u>
The area of investigation comprises 4,297 acres; its lateral extent is shown on Figure A-2.
Portions of the MRS excluded from the investigation include state and local highways and surface streets, associated rights-of-way, industrial sites, quarry, and properties for which right of entry (ROE) access agreement is not granted.
The vertical boundary is the depth of detection with geophysical sensors. The depth of detection is a function of site-specific background response and sensor-specific noise levels relative to measured signal amplitude associated with buried munitions. The vertical boundary will be established and evaluated based on data gathered onsite for the RI. [Example theoretical dynamic detection depths using the MM2x2 with a sensor height of 31 centimeters [12 inches], assumed root mean square (RMS) noise of 0.1 mV/A and monostatic Z-component picking threshold of 0.5 mV/A are 27 centimeters [11 inches] for a small Schedule 80 Industry Standard Object (ISO), 57 centimeters [22 inches] for a medium Schedule 80 ISO and 90 centimeters [35 inches] for a large Schedule 40 ISO, with surrogates in a horizontal, inline position beneath the sensor. Example detection depth at this threshold for a small Schedule 80 ISO oriented vertically beneath the sensor is 43 centimeters [17 inches]].</td></tr>
</table>

Data Quality Objective (DQO) Steps and Description	DQO Step Activity
	• No onsite work will be performed between June 1 and July 31st due to Northern Long-Eared Bat restrictions • No onsite work will be performed during the summer tourist season (Memorial Day through Labor Day) Access: • ROE required for each parcel • Moderate to heavy vegetation that will require vegetation clearance along transects, mini-grids, and access points o Trees greater than 4 inches in diameter at chest height will not be removed o Stumps and roots will be left in place to protect the soil and foster regeneration o Brush material will be chipped and left in place o NY Natural Heritage Consultation and coordination with Pine Barrens Commission in progress, which may impact vegetation removal requirements
5) Develop the Project Data Collection and Analysis Approach	**MEC** The data collection and analysis approach for the RI at MRS-01 will be performed in three work phases: • Preliminary MRS Characterization (Phase 1) • HD/LD Characterization (Phase 2) • Intrusive Investigations and MC Sampling (Phase 3). Additional investigation details are contained in Worksheet #17. **Preliminary MRS Characterization (Phase 1)** • Transect spacing based on traversal and detection of an air-launched bomb ≤100-lb aerial bomb (i.e., AN-M54 4-lb incendiary bomb), with the exception of the residential area in the southeast corner of the MRS. The nominal transect spacing in this neighborhood will be 750 ft. • Table 11-2 presents inputs used for VSP. • Table 11-3 presents VSP outputs, and Figure 11-1 presents a graphical depiction of these results. • Planned transect spacing of 500 feet is less than the suggested spacing of 1,200 feet in VSP outputs in order to provide added coverage of the MRS and minimize the need for additional, interleaved transects to appropriately delineate the boundaries of HD areas. Additionally: o This approach increases probability of gathering a sufficient amount of transect data in the event gaps along individual transects arise from lack of approved ROEs or deviation from planned transect alignment is necessary to avoid a safety hazard or obstruction. o This reduced spacing also intended to facilitate informed decision-making with regards to rules established in this DQO step for identification of HD/LD areas and further characterization of each as HUA, LUA or NEU, as appropriate. • Phase 1 DGM transects will be collected using the Geonics, Ltd. EM61-MK2 sensor. • Visual Sampling Plan (VSP) will be used to perform geostatistical analysis of transect data to inform Phase 2 mini-grid placement. Parameters of interest: • Background EM61-MK2 response • Geophysical survey line path

Data Quality Objective (DQO) Steps and Description	DQO Step Activity

	• Locations of geophysical anomalies meeting the established EM61-MK2 target selection criteria
	• Background geophysical anomaly density and target area density above background
	Assumptions:
	• Predicted EM61-MK2 background density and critical density assumptions are presented in Table 11-2 as inputs into VSP.
	Type of inference:
	Areas having an anomaly density ≥ critical density will be identified as HD areas. Areas having an anomaly density < critical density will be identified as LD areas. Further designations (i.e., HUA, LUA, NEU) will depend on the information contained in the CSM and obtained during subsequent investigations.
	Decision rules:
	• If an area has an anomaly density ≥ critical density, it will be considered an HD area.
	• If an area has an anomaly density < critical density, it will be considered an LD area.
	• If data gathered during the preliminary MRS characterization are inconsistent with the CSM or suggest the CSM is incomplete, the PDT will convene to discuss whether changes to the sampling design are necessary.
	• In the residential neighborhood in the southeastern portion of the MRS (where transects are more widely spaced than the remainder of the MRS), if a lack of ROEs results in gaps totaling ≥700 continuous feet (or two or more individual sections of ≥350 continuous feet) along a single transect, the PDT will convene prior to the start of fieldwork to discuss forgoing the collection of the impacted transect(s) in the residential area and performing geophysical surveys using mini-grids in lieu of the transect(s).
	• If within the remainder of the MRS, a lack of ROEs results in a gap totaling ≥700 continuous feet along a single transect, the following sub-rules will apply:
	  o If adjacent ROEs permit the transect alignment to traverse around the gap without deviating >100 feet from the planned transect alignment, the transect will be collected along the route deviation around the parcel with no ROE.
	  o If ROEs do not permit a deviation ≤100 feet from the planned transect alignment, the transect gap will be addressed in the Preliminary MRS Characterization Memorandum and Data Usability Assessment (DUA).
	  o If a transect gap is associated with an area intentionally excluded from RI data collection, the gap (or collection of gaps) will be addressed in the Preliminary MRS Characterization Memorandum and Data Usability Assessment.
	• Note: a 700-foot linear data gap threshold is used as part of these decision rules because it closely approximates the radius of an air-launched aerial target area of concern for ≤100-lb bombs in VSP (i.e., 714 feet).
	• If the Phase 1 transect survey identifies no HD areas other than locations coincident with existing site infrastructure and development which post-dates historic military operations, the PDT will convene to discuss the CSM and appropriateness of the Phase 1 sampling design.
	• If the Phase 1 transect survey identified saturated response areas (SRAs), the path forward on how to address them in subsequent phases will be discussed in

Data Quality Objective (DQO) Steps and Description	DQO Step Activity
	the Preliminary MRS Characterization Memorandum and Preliminary DUA. SRA locations will be incorporated into the master project GIS. **HD/LD Characterization (Phase 2)** • Metal Mapper 2x2 (MM2x2) dynamic survey of mini-grids (0.11 acres each) • Dynamic survey line spacing of 1.6 feet within each mini-grid • Mini-grid placement throughout HD areas based on Phase 1 DGM results • MM2x2 dynamic survey of select Phase 1 DGM transect segments, which span portions of apparent LD and HD areas, also bisecting likely buffer zones • Cued interrogation of derived target locations in 50% of the mini-grids with the MM2x2 AGC sensor • Classification of sources as Targets of Interest (TOIs), non-TOIs or Inconclusive (i.e., Cannot Analyze) for each interrogated target location Parameters of interest: • Dynamic MM2x2 background response • Derived MM2x2 target locations meeting the target selection criteria for the dynamic MM2x2 survey along transect segments repeated from Phase 1 DGM as well as in Phase 2 mini-grids • MM2x2 dynamic survey footprint coverage in mini-grids • Goodness of fit between derived model response and observed cued data from interrogated locations in mini-grids • Model polarizabilities • Decision statistic for each source model solution relative to the project-specific dig/no dig threshold • Number and location of sources part of population clusters • TOI outer diameter estimate from classification process for all derived source model solutions for each classified TOI Assumptions: • Weight of evidence approach using data gathered through Phase 1 and review of available information will be the basis for placement of any mini-grids in LD areas. • Sources matching to TOI (beyond those associated with QA/QC seeds) indicate high probability of HD area comprising an HUA. • In accordance with Department of the Army guidance memorandum dated May 6, 2021, AGC may be used as the basis to reduce the minimum separation distance (MSD) during intrusive activities in areas with greatest impact to local community, provided applicable measurement quality objectives (MQOs) have been met. • The PDT will assess potential adverse impacts to local community as part of the decision process for which grids undergo cued interrogation, in order to utilize AGC to fullest potential in minimizing MSDs where impacts to community would be greatest and also to meet the RI objectives. • Intrusive investigation of anomaly sources will confirm classification results, including TOI outer diameter predictions, for those target locations undergoing cued interrogation as well as facilitate an evaluation of achieved clutter rejection rate and outer diameter prediction performance to support development of an FS. • Intrusive investigation of targets not undergoing cued interrogation will also facilitate development FS alternatives which may not include cued surveys or AGC altogether.

Data Quality Objective (DQO) Steps and Description	DQO Step Activity

	• Comparison of transect densities from dynamic MM2x2 and EM61-MK2 surveys will inform development of the FS alternatives, which may include DGM, AGC or a combination thereof.
	Type of inference:
	Within an HD area, the presence of MEC or MD would indicate the presence of an HUA. Moving away from the portion of the HD areas with the highest geophysical anomaly density, the point at which the anomaly density reduces to the background density will mark the location of the HUA boundary. To accommodate uncertainty associated with establishing HUA boundaries, buffer zones will be delineated. The size and configuration of the buffer zone will depend on the CSM, the geophysical anomaly distribution within the HUA, and the eventual results of classification and intrusive investigations of geophysical anomaly sources. Within an LD area, indications of historic munitions use and/or delineation of a buffer zone within the LD areas would indicate a presumed LUA.
	Decision rules:
	• If it is determined in the field a planned mini-grid location contains a manmade obstruction which would result in a loss of ≥25% of planned mini-grid coverage or has the potential to result in MM2x2 response saturation across ≥25% of the mini-grid, the location of the mini-grid will be adjusted within the parcel boundary to avoid the obstruction.
	• If the placement and orientation of a mini-grid cannot be adjusted in the field to avoid manmade obstructions or sources of interference and still achieve >75% coverage of the mini-grid, the mini-grid will be re-distributed to an adjacent parcel with an approved ROE; if no adjacent parcel with an approved ROE exists, the mini-grid will be re-distributed to another parcel within the same HD area with an approved ROE and without a mini-grid already sited on it.
	• If the Phase 2 dynamic surveys of the mini-grids identify SRAs, the path forward on how to address them in subsequent phases will be discussed with the PDT and discussed in the updated DUA. SRA locations will be incorporated into the master project GIS.
	• If the preliminary MRS characterization and current weight of evidence indicates characterization of an LD area as LUA or NEU would be strengthened by placement of a mini-grid, the Preliminary Characterization Memorandum will present the rationale for inclusion of mini-grids in LD areas; establishment of mini-grids in LD areas will not be an in-the-field decision. Examples of possible lines of evidence may include, but are not limited to, the following:
	  o Localized transect segment exhibiting high geophysical anomaly density but with a lateral extent which does not warrant designation as a HD area.
	  o No HD areas coincident with the locations of documented former bombing targets in the CSM.
	  o Observed evidence of suspected discarded military munitions (DMM) during RI field activities.
	• The Preliminary MRS Characterization Memorandum may be amended after the start of Phase 2 operations and after collection of dynamic MM2x2 transect data across select portions of transects completed during Phase 1. These changes may include re-positioning of mini-grids in LD areas for the following reasons:
	  o Localized MM2x2 transect segment high geophysical anomaly density not observed in DGM results from same transect section.

Data Quality Objective (DQO) Steps and Description	DQO Step Activity
	- Localized discrepancies between surveyed MM2x2 transect segments, where MM2x2 results depict potentially larger buffer zone than indicated in DGM data. **Intrusive Investigation (Phase 3)** - For all mini-grids, dig 100% of derived targets (or sources) from the dynamic MM2x2 mini-grid surveys. - Anomaly resolution for each dig location. - Exception to this phase of work will be based on limiting impacts to the community, as agreed to with the PDT during review of HD/LD area designations and planned cued interrogation locations. - AGC may be used to reduce MSDs when digging target locations having undergone cued interrogation and classification, and where applicable MQOs in Worksheet #22 have been met. - MEC/material potentially presenting an explosive hazard (MPPEH) will be handled IAW the approved Explosives Site Plan (ESP). <u>Parameters of interest:</u> - Nature, quantity, position, and depth of geophysical anomaly sources for each investigated geophysical target (or source) location. - Source designation as TOI, non-TOI or Cannot Analyze - TOI outer diameter estimation for all derived models for each source location - Ground truth (e.g., QA and QC seeds) - Ongoing evaluation of outer diameter prediction performance during intrusive investigation of classified sources and review of ground truth. <u>Decision rules:</u> - The explosive hazard posed by MEC will be evaluated by performing a baseline MEC risk assessment IAW the Risk Management Methodology (RMM) (USACE, 2017). If an HUA is present that has different source characteristics (i.e., type of munitions or amount of munitions) or a potentially different land use than the rest of the MRS, these factors will score differently using the RMM. Therefore, a separate RMM for the HUA and the remainder of the MRS will be scored. - If during USACE QA review of classified results and/or during intrusive investigation of sources, it is determined the outer diameter predictions for sources classified as TOIs on the dig list are not correct, the MSDs will revert to the munition with the greatest fragmentation distance in the DDESB-approved ESP, in accordance with the Department of the Army guidance memorandum dated May 6, 2021. - If source locations on the dig list are classified as Cannot Analyze, the MSDs will revert to the munition with the greatest fragmentation distance for intrusive investigation of those locations but not the remainder of the dig list. - If MEC or MD are identified within an HD area, the area will be designated an HUA. - If MEC or MD are identified within the HD area, but the CSM contains no evidence of historic munition use at that location, the PDT will convene to discuss whether sufficient data have been collected to support the achievement of the data quality objectives and to adequately refine the CSM. - If no MEC or MD are found within the HD area, the PDT will revisit the CSM and historic use of the area to assess whether sufficient data were gathered and evidence exists to designate the HD area as an NEU.

Data Quality Objective (DQO) Steps and Description	DQO Step Activity
	• If evidence of munitions use exists in an LD area, the area will be characterized as an LUA. • If no evidence of munitions use exists in an LD area, the PDT will convene to discuss how the entirety of evidence gathered during the RI, as well as existing information on the site prior to the RI, may support designation of the LD area as an NEU. This same approach will be taken to address buffer zones and whether portions of buffer zones characterized by high geophysical anomaly densities are more appropriately designated as an NEU or LUA. • If multiple HUAs are identified in the MRS, the PDT will convene to assess whether the remainder of the MRS not characterized as HUAs should be characterized as an LUA or whether there is sufficient evidence to sub-divide this portion of the MRS into sectors which may support a combination of LUA and NEU designations.
6) Specify Project-Specific Measurement Performance Criteria (MPC)	Project-specific MPCs are presented in Worksheet #12.
7) Develop the Detailed Plan for Obtaining Data	The RI design is summarized below and detailed in Worksheet #17 and accompanying SOPs (Worksheet #21). The RI design is broken down into DFWs. The chemical constituent design is supported by Worksheets #19 & #30, #20, #24, #25, #26 & #27, and #28. **MEC** • Site controls will be established by a New York-registered professional land surveyor (PLS) • Observations recorded during RI tasks will be used as part of the weight of evidence decision-making basis to support the characterization of the nature and extent of MEC within MRS-01. • DGM transect surveys will identify HD areas and inform placement of follow-up mini-grids, along with evidence presented in field observations. • Surface clearance will be performed across each planned mini-grid. • Blind seeding will be performed in advance of the mini-grid dynamic surveys. • Dynamic MM2x2 surveys will be completed across 100% of the mini-grids to support further characterization of HD and LD areas. • QC Geophysicist will confirm successful detection and inclusion of blind QC seeds prior to submittal of dynamic data packages to USACE QA Geophysicist • USACE QA Geophysicist will confirm successful detection and inclusion of blind validation seeds on cued survey target list prior to finalization of cued target list. • Cued MM2x2 surveys will be completed in 50% of the mini-grids to classify anomaly sources as TOI, non-TOI, or Inconclusive. • 100% of the derived target locations from mini-grids undergoing no cued surveying will be intrusively investigated. • 100% of derived source locations from mini-grids undergoing cued surveys and classification will be intrusively investigated. • QC Geophysicist will confirm successful classification of QC seeds as TOIs prior to submittal of cued data packages to USACE QA Geophysicist • USACE QA Geophysicist will confirm successful classification of validation seeds as TOIs prior to finalization of dig list for Phase 3.

Data Quality Objective (DQO) Steps and Description	DQO Step Activity
	• USACE QA Geophysicist will assess predicted outer diameter against validation seed ground truth as part of consideration for implementation of flexible MSDs.

QAPP WORKSHEET #11B – PROJECT/DATA QUALITY OBJECTIVES - MC

Data Quality Objective (DQO) Steps and Description	DQO Step Activity
1) State the Problem	Human receptors may come into contact with MEC hazards; therefore, there is the potential for an explosive safety risk. Also, the extent of MC within the MRS is undefined and may be associated with human health or ecological risks.
2) Identify the Goal of the Project	Previous investigations have found MEC and MD; however, the extent of MEC is unknown. During the 2009 SI, limited soil and groundwater samples were collected and analyzed for MC. A potential ecological risk from select metals in surface soil was identified, however the exposure pathway for ecological risks from exposure to subsurface soil was considered incomplete. No unacceptable risk was identified for subsurface soil or groundwater based on the limited data collected. Further Investigation is needed to: • Confirm locations of targets • Delineate High Density (HD) and Low Density (LD) areas for characterization • Conduct detailed characterization to determine if anomaly sources are munitions-related or not and to establish boundaries for high use areas (HUAs), low use areas (LUAs), and no evidence of use (NEU) areas • Characterize the type, nature, and distribution (horizontal and vertical) of munitions within each HUA and LUA • Determine if findings are consistent or inconsistent with the preliminary CSM, revisit DQOs, and, if necessary, collect additional MEC data to ensure all RI data needs are met • Collect MC data within each HUA (including areas with significant quantities of small arms) in sufficient quantity to determine the horizontal and vertical extent and from each Decision Unit (DU) within the HUA and to evaluate risk • Evaluate human health and ecological risk for MEC and/or MC • Support determinations of areas with NEU • Collect data to support a Feasibility Study (FS), if necessary **MC** *<u>Principal study questions:</u>* • What are the nature and extent (i.e., horizontal and vertical distribution) of and potential exposures to MC at MRS-01? • What current and potential future threats may be posed to human health and the environment by MC remaining at the site? • What are alternative actions for mitigating current and potential threats (if identified) posed by MC remaining at the site?

<table>
<tr><th>Data Quality Objective (DQO) Steps and Description</th><th>DQO Step Activity</th></tr>
<tr><td></td><td><u>Alternative outcomes</u>:
• Concentrations indicate an acceptable risk to human and/or ecological receptors.
• Concentrations indicate an unacceptable risk to human and/or ecological receptors.
<u>How the data will be used in solving the problem:</u>
The results of soil sampling and groundwater sampling, if conducted, will be used to assess the potential risk to human and ecological receptors and to develop alternatives for remediation in a pending FS or alternatively to recommend “no further action” for these media.</td></tr>
<tr><td>3) Identify Information Inputs</td><td>Information needed to establish the nature and extent of MEC and MC and characterize the potential hazard:
<u>MC</u>
• Analytical data for MC associated with MEC, MD, and/or small arms ammunition
• Type of media impacted, if any, beyond soil
• Other sources of contamination in the area
• Public and private drinking water sources

Information needed to establish exposure potential for both MEC and MC
• Current/future land use, receptors, and exposure scenarios

Information needed to support the FS, if necessary
• Data to establish the effectiveness of various alternatives
  o Anticipated detection technology performance
  o Impacts of various alternatives on risk
• Data to support costing of various alternatives</td></tr>
<tr><td>4) Define the Boundaries of the Project</td><td><u>Target population:</u> The target population includes munitions reportedly used during historical military training as well as munitions known or suspected onsite through the discovery of MEC or MD, which serves as an indicator of potential MEC hazards and potential MC contamination. Table 11-1 lists munitions that are known or suspected to be present at MRS-01.

<u>Spatial and temporal boundaries (See Table 11A for general information):</u>
• The area of investigation comprises 4,297 acres; its lateral extent is shown on Figure A-2.
• DU horizontal boundaries will include:
  o Residential Areas:
    ▪ If parcel is 0.25 acres or less, the parcel boundary will be the DU with one sampling unit (SU).
    ▪ If parcels are between 0.25 and 1 acres, the parcel boundary will be a DU with SUs of up to 0.25 acres each. SUs will cover 100% of the DU.
    ▪ If parcels are larger than 1 acre, parcel boundary will be DU. SUs will be 0.25 acres and will not cover 100% of the DU.
  o Central Pine Barrens Areas:
    ▪ If HUAs are less than 2 acres, HUA will be the DU with SUs of up to 0.25 acres each. SUs will cover 100% of the DU.
    ▪ If HUAs are larger than 2 acres, HUA will be divided into 2-acre DUs. A stratified sampling approach may be performed tied to the associated anomaly density distribution within the DU with the</td></tr>
</table>

Data Quality Objective (DQO) Steps and Description	DQO Step Activity
	specified number of SUs TBD. SUs will be 0.25 acres and will not cover 100% of the DU. o Industrial Areas: ▪ If parcel is less than 2 acres, DU will correspond to parcel boundary; subdivide into up to 0.25-acre SUs. SUs will cover 100% of the DU. ▪ If parcel is larger than 2 acres, a stratified sampling approach may be performed tied to the associated anomaly density distribution within the DU with the specified number of SUs TBD. SUs will be 0.25 acres and not cover 100% of the DU. Access (See Table 11A)
5) Develop the Project Data Collection and Analysis Approach	The data collection and analysis approach for the RI at MRS-01 will be performed in three work phases: • Preliminary MRS Characterization (Phase 1) • HD/LD Characterization (Phase 2) • Intrusive Investigations and MC Sampling (Phase 3). **MC Sampling (Phase 3)** Sampling locations will be based on geophysical and intrusive investigation results, and field activities will be conducted IAW NYSDEC guidance. All soil samples will be incremental samples (IS). Samples will only be collected from areas that show a munitions source from the geophysical and intrusive investigation results. As such, if a munitions source is not found, no samples will be collected. The known target areas may be sampled (even if the geophysical survey/intrusive investigation does not show a current source) provided that there are no field observations that would negate collection of soil samples (e.g., redevelopment, roadways). Based on the results of the soil samples, groundwater sampling may be conducted. Parameters of interest: Concentrations of MC related to the types of munitions present at MRS-01 will be analyzed in the site soil for site characterization at locations based on the results of the geophysical and intrusive investigation results. Surface and/or subsurface soil will be analyzed for: o Select MC metals [aluminum, antimony, barium, copper, iron, lead, and nickel] (Method 6010D/6020A) o Explosives/propellants (Method 8330B) o pH (Method 9045D) Assumptions: • List of metals based on composition of munitions (e.g., various types of bombs, projectiles, small arms) recovered during previous investigations or historically used at the site; see Worksheet #10. • Soil pH being obtained for calculation of site-specific ecological soil screening values for select metals (such as aluminum and iron). • Sampling locations to be determined (TBD) based on the results of the geophysical survey results and intrusive investigation findings. • If identified, an HUA will be covered by one (or more as necessary depending on size and area) DU for MC sampling. The DUs will be equal in size to the EU of the receptor most likely to be present in that area (residential area, industrial area, Central Pine Barrens area) or an existing parcel size. However, the risk assessment will evaluate a potential unlimited use and unrestricted exposure (UU/UE) scenario for a hypothetical future resident in all areas and the EU for a resident is assumed to be approximately 0.25 acres. Therefore, each SU within a DU will be approximately 0.25 acres in size (as will be the background SUs).

Data Quality Objective (DQO) Steps and Description	DQO Step Activity

	Each DU will be sampled by dividing it into SUs approximately 0.25 acres in size. If a DU is approximately 0.25 acres in size or smaller, it will be covered by one SU of 0.25 acres in size and sampled in triplicate. If a DU is larger than 0.25 acres, it will be subdivided into SUs approximately 0.25 acres in size. If a DU is subdivided into two 0.25-acre SUs, both SUs will be sampled in triplicate to calculate a weighted 95% UCL. If a SU is subdivided into three or more 0.25-acre SUs, a single IS sample will be collected from each SU to calculate a 95% UCL across the DU. In these cases, a replicate sample will not be required. SUs of different sizes are not anticipated. If SUs of considerably different sizes are warranted, triplicate samples will be collected from each SU to be able to calculate a weighted average across the DU.
	• Of the nearly 200 residential parcels, almost all are less than 0.3 acres with 0.25 acres or less of lawn. The few existing parcels that are greater than 0.3 acres, typically are wooded, with approximately 0.25 acres of lawn. Note, the 14-acre USCG housing parcel is composed of individual homes with approximately 0.25 acre or less fenced yards, each of which would be a separate SU. EUs for existing residential properties will be the size of the existing property. For parcels of 0.25-0.3 acres, the SU=DU=EU, and the 95% UCL of the mean will be estimated just for that area. For residential parcels greater than 0.25-0.3 acres, the parcel will be subdivided in equal SUs of approximately 0.25 acres, the entire parcel will be the DU/EU, and the 95% UCL of the mean will be estimated over the entire parcel by pooling and area-weighting the results of the SUs (as detailed in Step 7). This approach assumes that a residential receptor spends equal amount of time in all outdoor areas of his/her property.
	• For non-residential receptors (e.g., commercial/industrial, municipal, recreational, trespasser or ecological receptors) whose EU is larger than 0.25 acres, the EU (or existing property size) will equal the DU, and the DU will be subdivided by SUs of approximately 0.25-acres to calculate a 95 % UCL based on the appropriate EU size (as detailed in Step 7).
	• Replicate sampling for the soil investigation to be performed as follows:
	  ▪ If one or two SUs are within a DU, the SU(s) will be collected in triplicate.
	  ▪ If three or more SUs are within a DU, single IS samples will be collected from each SU. Triplicate samples will not be collected.
	
	Soil pH samples will be obtained as discrete grabs. Ten (10) samples will be analyzed per DU for pH, and the locations will be randomly selected within the SU. A statistical mean of the DU pH will be calculated.
	
	Performance of a groundwater investigation will be based on geophysical survey results, soil sampling results, and knowledge of the area's groundwater. If possible, we will utilize existing monitoring wells identified in the EDR Report (Appendix I) with coordination and approval from USGS.
	
	Otherwise, temporary 2-inch pre-packed monitoring wells will be installed. All groundwater samples will be collected using low-flow methodologies. Replicates for groundwater sampling (if performed) will be conducted as one duplicate for up to every 10 samples (~10%). If soil samples have no MC-related analytes and/or an investigation is not deemed necessary for the RI, no wells will be installed, and no groundwater samples will be collected. Groundwater will be analyzed for:
	o Select MC metals [aluminum, antimony, barium, copper, iron, lead, and nickel] (Methods 6010D/6020A)

Data Quality Objective (DQO) Steps and Description	DQO Step Activity
	o Explosives/propellants (Method 8330B) <u>Decision rules:</u> • If no munitions related items are found during the geophysical and intrusive investigations, no MC sampling will be conducted (with the potential exception of target areas). • If a known target area (as per the 1947 aerial photograph) is not identified as an HUA, and provided there are no field observations that would negate the collection of soil samples (e.g., redevelopment, roadways, etc.), a 0.25-acre DU with one SU will be placed at the center of the target area and a surface soil sample will be collected. • During the investigation, analytical results of soil and groundwater (if performed) analyses will be screened against the Project Screening Levels (PSLs) as outlined in WS #15. These initial screening levels may not be appropriate for use in subsequent steps of the project (e.g., RI report). • For metals in soil, COPCs will be identified based on comparing the 95% UCL of the mean of each detected constituent in an EU/DU to the PSL and performing a statistical background analysis. If the 95% UCL of the mean of a detected metal is above the PSL, then the validated analytical results will be statistically compared to background concentrations (as described in Step 6). Detected metal concentrations that are identified as not comparable to the background (i.e., statistically significantly greater than background) will be selected as COPCs or COPECs if the EU/DU 95% UCL of the mean exceeds the appropriate PSL for human health or ecological receptors, respectively. For non-metal analytes, COPCs or COPECs will be identified by comparing the 95% UCL of the mean of each detected constituent in an EU/DU to the appropriate PSL for human health or ecological receptors, respectively. The ITRC Calculator will be used to compute the 95% UCL for each DU/EU. If the 95% UCL of the mean is greater than the PSL, it will be retained as a COPC or COPEC. The justification for retaining a constituent as a COPC / COPEC or screening it out will be clearly documented in the risk assessment report. • If surface soil results exceed appropriate PSLs and are significantly greater than background, sampling for vertical (subsurface) and horizontal (additional surface) delineation will be evaluated and coordinated with the PDT. Subsurface soil samples will be collected between 0.5 and 10 feet bgs. • If COPCs and/or COPECs are identified, then a Human Health Risk Assessment (HHRA) and or Screening Level Ecological Risk Assessment (SLERA) will be performed, and the results will be used to support the development of remedial alternatives for soil in a future FS. A more detailed Risk Assessment Work Plan is included as Appendix D to this document. • Data collected from each groundwater well will be screened separately initially. If the data suggest that groundwater should be carried forward into the risk assessment (without further sampling), each groundwater well will be considered separately in the risk assessment. If the results indicate additional groundwater sampling is necessary, groundwater 95% UCLs will be calculated for the individual monitoring well based on multiple rounds of groundwater sampling. • If results exceed the screening criteria in samples collected for the purpose of evaluating post-demolition soil concentrations, further sampling as 0.25-acre DU and/or the need for hot spot removal of soil will be evaluated and

Data Quality Objective (DQO) Steps and Description	DQO Step Activity
	coordinated with the PDT. Post-detonation samples will be collected to evaluate the potential for residuals after item detonation. • If there is a delineated MEC area where soil sample results show a significant exceedance of screening levels, the results and information on any known contamination within the aquifers under the MRS will be reviewed in consultation with the USACE PDT to determine if groundwater sampling should be conducted. If groundwater sampling is conducted, a memorandum detailing the rationale and locations for installation of temporary groundwater monitoring wells will be prepared and accepted prior to well installation. • If based on the validated analytical results, the site EU/DU MC means are confidently demonstrated to be less than the appropriate PSLs, or are not confidently demonstrated to be greater than the background means, then the MC concentrations meet no further action (NFA) criteria.
6) Specify Project-Specific Measurement Performance Criteria (MPC)	For MC, laboratory-specific quantitation limits are specified in Worksheet #15. Additional criteria to ensure that analytical samples meet quality objectives are presented in Worksheets #18 (which identifies the USEPA methods to be used), #28 (which presents the QC criteria, laboratory corrective actions, and validation actions), and #34 (which identifies the data verification and validation inputs). The 95% UCL of the mean of the DU/EU will be compared to the appropriate PAL (Worksheet #15) The ITRC Calculator will be used to compute the 95% UCL for each DU/EU. The onsite samples will be statistically compared to background soil samples using either a two sample t-test (for data sets that are normally distributed and do not have non-detect values; if the variances are not statistically significantly different, a Student's t-test will be used; if the variances are unequal, then the Welch-Satterthwaite approximation will be used) or a Wilcoxon-Mann-Whitney test (for data sets that are not normally distributed or have non-detects with a single detection limit) or the Taronne-Ware test and Gehan tests (for data sets with non-detect values with multiple detection limits). Form 1 of the null hypothesis will be used. Quantitative tolerances for Type I errors will be 5%, and null and alternative hypotheses as follows: H0: $\mu \geq$ PAL, H1: $\mu <$ PAL, where μ is the "true" DU/EU mean. The parametric and non-parametric statistical tests provided in ProUCL will be used as appropriate based on the distribution of the individual data sets as part of the COPC section along with comparisons to screening levels. If any metals appear to be potential risk drivers, background comparisons will be supplemented by graphical presentations (such as scatter plots, histograms, or box and whisker plots) as well as further statistical evaluation, including permutation tests if indicated.
7) Develop the Detailed Plan for Obtaining Data	The RI design is summarized below and detailed in Worksheet #17 and accompanying SOPs (Worksheet #21). The RI design is broken down into DFWs. The chemical constituent design is supported by Worksheets #19 & #30, #20, #24, #25, #26 & #27, and #28. **MC** • IS soil samples will be collected at locations where geophysical and intrusive investigation results indicate HUAs. HUAs are assumed to be areas with sufficient MEC density or significant quantities of small arms in a limited area. Additional IS samples will be collected where LUAs are found. o Residential Areas: ▪ If HUA is located across multiple parcels, subdivide HUA by residential parcel boundaries.

Data Quality Objective (DQO) Steps and Description	DQO Step Activity
	▪ If parcels are 0.25 acres or less, the parcel boundary will be the DU with one sampling unit (SU) sampled in triplicate. The existing parcel will be the EU, assuming the resident spends an equal amount of time in all outdoor areas of their property. The 95 % UCL of the mean will be estimated for that area. ▪ If parcels are between 0.25 and 1 acre, the parcel boundary will be a DU subdivided into equal SUs of up to 0.25 acres each. SUs will cover 100% of the DU. If the DU is made up of two SUs, each SU will be sampled in triplicate. If the DU is made up of three or four SUs, a single IS sample will be collected from each SUs, none will be collected in triplicate. The existing parcel will be the EU, assuming the resident spends an equal amount of time in all outdoor areas of their property. The 95 % UCL of the mean will be estimated for the EU by pooling and area weighting the results of the SUs. ▪ If parcels are larger than 1 acre, parcel boundary will be DU. A stratified sampling approach may be performed tied to the associated anomaly density distribution within the DU with the specified number of SUs TBD. SUs will be 0.25 acres and will not cover 100% of the DU. The DU will have at least three SUs (or more), where a single IS sample will be collected from each SUs, none will be collected in triplicate. The existing parcel will be the EU, assuming the resident spends an equal amount of time in all outdoor areas of their property, unless there is site-specific evidence to suggest otherwise. The 95 % UCL of the mean will be estimated for the EU by pooling and area weighting the results of the SUs. o Central Pine Barrens Areas: ▪ EUs of 2 acres in size were assumed for the human receptors present (i.e., recreational user and municipal worker). However, the EUs for ecological receptors may vary in this area. A receptor is assumed to spend an equal amount of time within an EU. The 95% UCL of the mean will be estimated for each EU/DU. ▪ If HUAs are less than 2 acres, HUA will be the DU with SUs of up to 0.25 acres each. SUs will cover 100% of the DU. ▪ If HUAs are larger than 2 acres, HUA will be divided into 2-acre DUs. ▪ Within each DU, a stratified sampling approach may be performed tied to the associated anomaly density distribution within the DU with the specified number of SUs TBD. SUs will be 0.25 acres and will not cover 100% of the DU. ▪ If three or more SUs are sampled within a DU, a single IS sample will be collected from each SU, none will be collected in triplicate. If a DU is covered by only one or two SUs, each SUs will be sampled in triplicate. o Industrial Areas: ▪ EUs of 2 acres or the existing parcel were assumed for the receptors present (i.e., commercial/industrial worker, construction worker, municipal worker, trespasser). A receptor is assumed to spend an equal amount of time within an EU. The 95 % UCL of the mean will be estimated for each EU/DU. ▪ If HUA is located across multiple parcels, subdivide HUA by individual parcel boundaries.

Data Quality Objective (DQO) Steps and Description	DQO Step Activity
	▪ If individual parcel is up to 2 acres, DU will correspond to parcel boundary. ▪ If DU (i.e., single parcel HUA or individual parcel) is less than 2 acres, subdivide into up to 0.25-acre SUs. SUs will cover 100% of the DU. ▪ If DU (i.e., single parcel HUA or individual parcel) is larger than 2 acres, a stratified sampling approach may be performed tied to the associated anomaly density distribution within the DU with the specified number of SUs TBD. SUs will be 0.25 acres and not cover 100% of the DU. ▪ If three or more SUs are sampled within a DU, a single IS sample will be collected from each SU, none will be collected in triplicate. If a DU is covered by only one or two SUs, each SUs will be sampled in triplicate. o LUAs are distinct, individual MEC items that visibly show likely potential release of MC ▪ Each LUA is a separate DU, and the SU will be equal to the DU. ▪ SU to be 10 feet by 10 feet, centered on the item. ▪ Performed to determine presence/absence within the SU. If screening levels are exceeded, additional sampling will be conducted in a 0.25 acres DU. o In areas where no evidence of munitions is found, no MC sampling will be conducted: ▪ Exception in known target areas, which may be sampled (even if not determined to be an HUA) unless there are field observations that negate the collection of soil samples (i.e., redevelopment, roads). o Background sampling will be conducted after all MRS sampling is completed. SUs will be 0.25 acres each. Eight (8) background samples will be collected (with at least one collected in triplicate). Background subsurface soil samples will be collected for comparison only if MRS subsurface soil samples are collected. Refer to the Risk Assessment Work Plan (Appendix D) for details on the assessment of background values. o Post-detonation sampling DU based on 10-foot diameter circular area or 10-foot by 10-foot area centered on detonation location. ▪ Determine presence/absence within the SU. If screening levels are exceeded, conduct additional sampling in the 0.25 acre DU. • Results will be evaluated IAW risk-based screening methods, as described in Worksheet #17. • For the LUAs, MC sampling would occur, for example, when there would be breached MEC with soil staining under the item, that looks like potential contamination exists. The 10 ft x 10 ft SU centered on the item and stained soil will be sampled specifically to determine presence or absence. This sample will not be used in the statistical means. If the results show impacts, then a DU/EU of 0.25 acres will be sampled for risk purposes (in triplicate). A DU/EU of this size will be approximately the same as the size of the background SUs collected. As such, the mean of the DU/EU would be calculated and will be statistically compared to the background mean using the statistical methods described in above Step 5. • IS soil samples will be collected following blow-in-place (BIP) or consolidated shots to evaluate the impact of these activities and determine the need for hot spot soil removal. Explosives and metals will be analyzed for the post-

Data Quality Objective (DQO) Steps and Description	DQO Step Activity
	detonation samples. Note that IS sampling will not be required for a single high-order BIP detonation. • Post-detonation samples will be performed initially as presence/absence, and not as part of the risk assessment. If an impact to the immediate area is found, then further discussion will occur with the PDT. The post-detonation area may be incorporated into the risk assessment, and if so, then an appropriately sized 0.25-acre DU/EU will be sampled and the statistical mean calculated. • Based on results of the soil samples, groundwater sampling may be conducted. If conducted, initial sampling will be to determine presence/absence of MC impacted groundwater. Each sampling location will be assessed separately for indication of MC impact. • If the initial results indicate additional groundwater sampling is necessary and groundwater should be carried forward to the risk assessment, groundwater 95% UCLs will be calculated for the individual monitoring well based on multiple rounds of groundwater sampling.

Table 11-1. Munitions Known/Suspected to be Present

Known or suspected munitions used (including nomenclature, if known)	Characteristics of Interest				
	MEC Type (UXO, Discarded Military Munitions [DMM], or both)	Potential Hazards/Severity	Expected Maximum Fragmentation Distance – Horizontal (MFD-H) (feet)	Approx. Diameter (inches)	Approx. Length (inches)
Small Arms (.50 caliber)	UXO	Naturally Fragmenting	346	0.4355	2.5
AN-M20 or AN-M18 100lb bomb, explosive burster tube	UXO	Non-Fragmenting	N/A	8.0	37.94
AN-M30 100lb Bomb HE	UXO	Naturally Fragmenting	1,833	8.18	36.0
AN-M64 & AN-M64A1 500lb Bomb HE	UXO	Naturally Fragmenting	2,849	14.18	56.8
AN-M50 4lb Incendiary Bomb	UXO	Naturally Fragmenting/ Incendiary	612	1.69	21.3
AN-M54 4lb Incendiary Bomb	UXO	Naturally Fragmenting/ Incendiary	792	1.69	21.3
AN-M69 6lb Incendiary Bomb	UXO	Naturally Fragmenting/ Incendiary	622	2.88	19.5
White Phosphorus Bombs	UXO	Naturally Fragmenting/ Chemical	644	8.0	51.9
M38A2 100lb practice bomb	UXO	Non-Fragmenting	N/A	8.13	47.5
M47A4 100lb smoke bomb	UXO	Naturally Fragmenting/ Chemical	644	8.0	51.9
2.25-inch practice rocket	UXO	Non-Fragmenting	N/A	2.25	29
M1 3lb black powder spotting charges	UXO	Non-Fragmenting	N/A	3.43	11.18
M77 10lb smoke or incendiary bomb	UXO	Non-Fragmenting	N/A	3.0	19.4
10lb bombs	UXO	Naturally Fragmenting/ Submunition	952	3.625	12.0

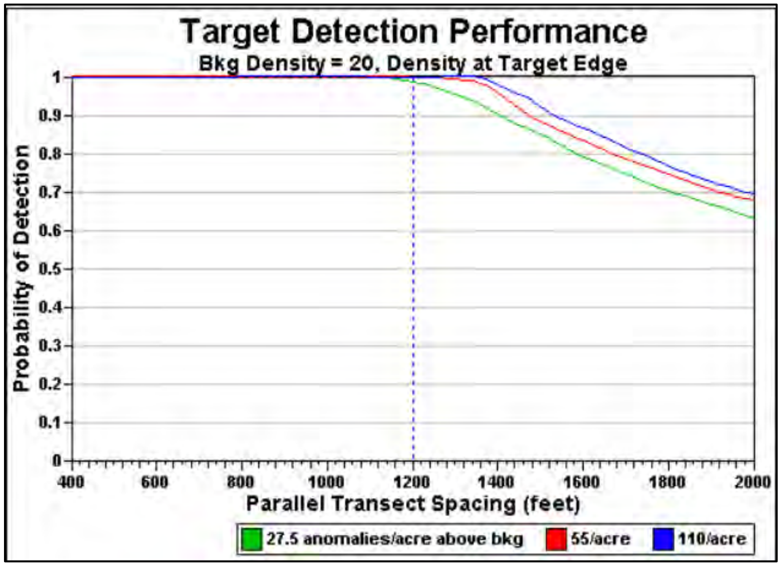
Table 11-2. VSP Inputs for Preliminary MRS Characterization

VSP Input	MRS-01
Target area size and pattern (from VSP)	Air-launched, ≤100-lb bomb target area of concern, circular pattern
Target diameter	1,428 feet
Background anomaly density	20/acre
Average target area density (above background)	55/acre
Average target area density (above background) input determined at:	Outer edge of target
Target distribution	Bivariate normal density
Probability of traversing and detecting target area	100%
Transect width	3.3 feet
Transect pattern	Parallel
Orientation	North-South

Table 11-3. VSP Outputs for Preliminary MRS Characterization

VSP Output	MRS-01
Upper bound transect spacing to achieve 100% detection and traversal of impact area	1,200 feet
Sensor type	Geonics, Ltd. EM61-MK2 (single coil)

Figure 11-1. Graphical Display of VSP Outputs for Preliminary MRS Characterization



QAPP WORKSHEET #12A – MPC –MEC INVESTIGATION

Table 12-1. Measurement Performance Criteria (MPC)

Measurement	Data Quality Indicator	Specification	Activity Used to Assess Performance
Site Preparation			
1. Accessibility	Completeness	All areas inaccessible to investigation or inaccessible to use of proposed geophysical systems are identified in project field records and incorporated into the project GIS.	Lead organization will visually inspect planned survey areas and review field records and GIS data to verify inaccessible areas are clearly and appropriately identified with adequate explanation. All necessary ROEs will be obtained for planned survey areas.
Sampling Design			
2. Planned survey coverage (Preliminary MRS Characterization)	Representativeness/ Completeness	Proposed initial transect spacing (i.e., Phase 1 DGM transects) will be sufficient to detect an HUA with a diameter of 1,428 feet at a confidence level of 100%.	QC geophysicist review of VSP output (VSP *Post-Survey-Probability-Of-Traversal* tool).
3. Detection threshold (transects & mini-grids)	Sensitivity	5x root mean square (RMS) noise levels for detection of munitions-related items.	• Review of sampling design • Initial data collected at instrument verification strip (IVS) • Evaluation of background response following transect survey to assess whether more aggressive multiple of the RMS noise can be used prior to selection of targets and geostatistical analysis in VSP. •
Data Acquisition			
4. Background data collection (AGC)	Representativeness/ Accuracy	Background locations will be selected to obtain spatial coverage of the MRS to account for potential variability in background response throughout the MRS associated with geologic and hydrologic conditions and both prior and current land use.	Data verification/data validation.

Measurement	Data Quality Indicator	Specification	Activity Used to Assess Performance
5. Positioning requirement (locating transects and mini-grids)	Accuracy	Actual DGM transect locations are within ±30 meters of planned transects and actual mini-grid center locations within ±10 meters of planned mini-grid locations. Exceptions include need to avoid treacherous terrain, trees or other vegetation which cannot be cut, manmade obstructions and access restrictions imposed by lack of ROEs. Exceptions also include re-location of mini-grids based on the Worksheet #11 decision rules.	Review of sampling design; QC Geophysicist reviews as-marked locations and field documentation prior to start of data collection; lead agency oversight. Impacts from exceptions will be discussed in DUAs.
6. Positioning requirement (AGC dynamic and cued surveys)	Accuracy	Recorded measurement positions are accurate to within 10 centimeters of actual positions. Specification applies to data gathered or field tasks performed using survey-grade position systems.	Review of sampling design; QC Geophysicist and lead agency oversight. Initial data verification/data validation at IVS prior to start of production surveys.
7. Survey coverage (DGM transects)	Accuracy/ Completeness	100% of planned transects are sampled. Exceptions include need to avoid treacherous terrain, trees which cannot be cut, manmade obstructions and access restrictions imposed by lack of ROEs	Actual survey path recorded and evaluated against planned transect alignment for each survey unit. Impacts from exceptions will be discussed in DUAs.
8. Survey coverage (mini-grids)	Accuracy/ Completeness	100% of specified acreage is sampled at the calculated lane spacing Exceptions include need to avoid treacherous terrain, trees which cannot be cut or manmade obstructions	Data verification/validation. Impacts from exceptions will be discussed in DUAs.
9. QC seeding (mini-grids)	Accuracy/ Completeness	Blind QC seeds placed within mini- grids at a frequency which facilitates field team encountering ≥1 seed/per team/field day. The Blind Seed Firewall Plan is included as Appendix C. Note: USACE will emplace blind validation seeds within mini grids.	Lead agency verifies seed failures are explained and corrective action implemented.

Measurement	Data Quality Indicator	Specification	Activity Used to Assess Performance
10. Anomaly density estimates (assessed during intrusive investigations)	Accuracy/ Representativeness	Mini-grids within the MRS will be mapped, and all anomalies meeting the project-specific detection threshold will be identified for follow-up cued surveying or excavation. The anomaly density in each mini-grid will not differ from that predicted by more than +50% or -30%. Exception: Because the mini-grids will be mapped using the MM2x2 sensor and Phase 1 transects will be completed with DGM, this density assessment will be based on a comparison of the mini-grid density with MM2x2 transect surveys completed at the beginning of Phase 2 along select portions of previously-collected Phase 1 DGM transects.	Total number of anomalies divided by the mini-grid area will be compared to the anomaly density predicted from geostatistical anomaly density analyses (e.g., VSP results) for that location. This comparison to the VSP-derived densities from the DGM data will be used primarily to inform the FS, if necessary, regarding the appropriateness of DGM and AGC, whereas the MPC evaluation will be based on anomaly densities derived from data sets collected with the MM2x2.
Anomaly Resolution/Classification			
11. Anomaly resolution (Dynamic MM2x2 surveys with no AGC)	Accuracy/ Completeness	HD Area Characterization: All items within 1.3 feet laterally must be recovered for each reacquired flag location	UXOSO/QCS performs qualitative examination and documentation of recovered items in the field; QC Geophysicist verifies recovered sources against classification results or geophysical anomaly characteristics within mini-grids not subject to cued surveying.
12. Anomaly classification (AGC)	Completeness/ Comparability	Library must include signatures for all items considered by the project team to be a TOI, as listed in the CSM. Exception: if a munition listed in CSM is not included in the current version of DoD-maintained AGC library, and no representative items are recovered from the site for which signatures can be included in the site-specific library, munitions with similar diameter, size and shape will be included as representative of these munitions for PDT review and concurrence.	Verification of site-specific library

Measurement	Data Quality Indicator	Specification	Activity Used to Assess Performance
13. Anomaly classification (AGC)	Completeness	All detected geophysical anomalies classified as one of the following: • TOI • Non-TOI • Inconclusive	Data verification
14. Anomaly classification (AGC)	Accuracy	100% of predicted non-TOI intrusively investigated are confirmed to be non-TOI.	Visual inspection of recovered items from classification validation
15. TOI Diameter Prediction (AGC)	Accuracy/Comparability	Diameter prediction for modeled sources for QC and QA seeds meet the requirements set forth in Worksheet #22 when a reduced MSD is recommended. Additionally, during Phase 3 intrusive operations, recovered sources match the outer diameter predictions for sources classified as TOIs. Exceptions: This MPC will not apply if the PDT does not agree to use of flexible MSDs. This specification does not apply to dig locations for which classification was not performed, as no flexible MSDs will be recommended during intrusive investigation of these targets.	Review of the QC seed registry by the QC Geophysicist and review of the classification results against QA seed details by the USACE QA Geophysicist. Additionally, the QC Geophysicist will monitor the recovered sources (i.e., ground truth) during intrusive operations, with specific attention to TOI diameter. UXOQCS will verify munition details are properly recorded in intrusive results provided during field operations.
NEU Confirmation			
16. NEU Confirmation	Representativeness/ Completeness	Well-developed CSM, confirmed by RI results, showing no evidence of munitions use.	DUA

QAPP WORKSHEET #12B: MPC – INCREMENTAL SAMPLING PREPARATION

Analytical Group: Explosives and Select Metals
Matrix: Solid
Sampling Procedure: Incremental Sampling (IS) (MC SOP 1)
Analytical Methods: SW-846 Method 8330B (CA-402) and SW-846 Method 6010D (CA-608)/6020A (CA-627)
Concentration Level: Low

Data Quality Indicators (DQIs)	QC Sample or Measurement Performance Activity	Measurement Performance Criteria (MPC)
Overall accuracy/bias (contamination)	Grinding blank (explosives only)	No reported analytes must be detected > 1/2 Limit of quantitation (LOQ)
Precision	Soil sample replicates (laboratory)	At the subsampling step, laboratory-performed on one ISM sample per batch. Relative Standard Deviation (RSD) for results above LOQ ≤20%.

QAPP WORKSHEET #12C: ANALYTICAL MPC - EXPLOSIVES

Analytical Group: Explosives
Matrix: Solid/Aqueous
Sampling Procedure: IS (MC SOP 1)/Low-flow (MC SOP 4)
Analytical Methods: SW-846 Method 8330B (CA-548, CA-402)
Concentration Level: Low

Data Quality Indicators (DQIs)	QC Sample or Measurement Performance Activity	Measurement Performance Criteria (MPC)
Precision (field)	Soil sample triplicate (field)	NA; statistical approach to be used to make inferences about contamination and risk
Precision (field)	Groundwater sample duplicate (field)	Relative Percent Different (RPD) ≤ 30% when both samples have detectable concentrations[1,2]
Field accuracy/bias (contamination)	Field equipment rinsate blank	No analytes detected > ½ limit of quantitation (LOQ) or > 1/10th the amount measured in any sample or 1/10th the regulatory limit, whichever is greater
Overall accuracy/bias (contamination)	Method blank	No analytes detected > ½ LOQ or > 1/10th the amount measured in any sample or 1/10th the regulatory limit, whichever is greater
Analytical accuracy/bias (laboratory)	Laboratory Control Sample (LCS)	Recoveries within DoD Quality Systems Manual (QSM) Table C-37 (soil) and Table C-36 (aqueous) limits. If not provided in QSM v5.3, use laboratory inhouse control limits [which may not be greater than ±3 times the standard deviation (SD) of the mean recovery]
Accuracy/bias	Matrix Spike (MS) and Matrix Spike Duplicate (MSD) [aqueous samples[3]]	Recoveries within DoD QSM Table C-36 (aqueous) limits. If not provided in QSM v5.3, use laboratory inhouse control limits [which may not be greater than ±3 times SD of the mean recovery]
Precision	MS/MSD [aqueous samples[3]]	≤ 20% RPD
Accuracy	Surrogate (1,2-dinitrobenzene)	Recovery within DoD QSM Table C-37 (soil) and Table C-36 (aqueous) limits. If not provided in QSM v5.3, use laboratory inhouse control limits [which may not be greater than ±3 times the SD of the mean recovery]
Accuracy	Internal Standards (IStd)	Retention time (RT) within ± 30 seconds from RT of initial calibration midpoint standard; IStd signal within -50% to +100% of initial calibration midpoint standard

Data Quality Indicators (DQIs)	QC Sample or Measurement Performance Activity	Measurement Performance Criteria (MPC)
Precision	Second column confirmation	Results between primary and second column RPD ≤ 40%
Sensitivity	Quarterly limit of detection (LOD)/LOQ verification	LOD/LOQ verification within DoD QSM acceptance criteria; LOQ < ½ PAL (i.e., the lowest PSL if possible; see Worksheet #15)
Representativeness	Data evaluation as part of Data Verification Procedures	Implementation of approved plans and procedures
Comparability	Data evaluation as part of Data Verification Procedures	Use of standard procedures/ methods as outlined in approved plans and/or approved modifications
Completeness	Data evaluation as part of Data Verification Procedures; Valid data points obtained relative to the expected number of data points	Completeness will be evaluated across the entire data set, with specific analytes and/or DUs assessed separately depending on obtained results and ability to make project decisions for that analyte/DU; completeness will be set at 100% for each analyte and DU when the sample size (n) is small (e.g., n<20)

Note: Since sampling will be completed by IS, precision will be evaluated from replicate incremental samples and the matrix effect is minimized; thus, no site-specific matrix spike/matrix spike duplicate analyses for soil will be performed.

[1] During data validation, the precision evaluation will include calculation of the RPD when both samples have detectable concentrations (regardless of the value relative to the LOQ). The RPD criterion will be applied as a guide only when both of the results are ≥ LOQ. Professional judgement will be used when one or both of the results are < LOQ. Replicates with RPDs outside the given limit will undergo further assessment to evaluate the likely sources of error and to determine if the larger variability can be tolerated as part of data usability.

[2] If future groundwater sampling is required (i.e., multiple rounds) and a statistical approach will then be used to make inferences about contamination and risk, evaluation of the field duplicate will be used only to identify/evaluate potential field/laboratory precision. Replicate results outside the given limit values will undergo further assessment to evaluate the likely sources of error and to determine if the larger variability can be tolerated as part of data usability.

[3] MSDs are proposed only for the initial aqueous samples, for which results will not be assessed using a statistical approach (single round of sampling). If subsequent sampling is performed and a statistical approach is utilized, MSDs will not be performed.

QAPP WORKSHEET #12D: ANALYTICAL MPC – SELECT METALS

Analytical Group: Select Metals
Matrix: Solid/Aqueous
Sampling Procedure: IS (MC SOP 1)/Low-flow (MC SOP 4)
Analytical Methods: SW-846 Method 6010D/6020A (CA-605, CA-604, CA-608, CA-627)
Concentration Level: Low

Data Quality Indicators (DQIs)	QC Sample or Measurement Performance Activity	Measurement Performance Criteria (MPC)
Precision (field)	Soil sample triplicate (field)	NA; statistical approach to be used to make inferences about contamination and risk
Precision (field)	Groundwater sample duplicate (field)	RPD ≤ 30% when both samples have detectable concentrations[1,2]
Field accuracy/bias (contamination)	Field equipment rinsate blank	No analytes detected > ½ LOQ or < $1/10^{th}$ the amount measured in any sample or < $1/10^{th}$ the regulatory limit, whichever is greater
Overall accuracy/bias (contamination)	Method blank	The absolute values of all analytes must be < ½ LOQ or < $1/10^{th}$ the amount measured in any sample or < $1/10^{th}$ the regulatory limit, whichever is greater
Analytical accuracy/bias (laboratory)	LCS	Recoveries within DoD QSM Table C-3/Table C-5 (soil) and Table C-4/Table C-6 (aqueous) limits. If not provided in QSM v5.3, use laboratory inhouse control limits [which may not be greater than ±3 times the SD of the mean recovery]
Accuracy/bias	MS [aqueous samples]	Recoveries within DoD QSM Table C-4/Table C-6 (aqueous) limits. If not provided in QSM v5.3, use laboratory inhouse control limits [which may not be greater than ±3 times the SD of the mean recovery]
Precision	Matrix Duplicate (MD) [aqueous samples[3]]	≤ 20% RPD
Bias/accuracy	Interference Check Sample A & Interference Check Sample AB	ICS-A: Absolute value of concentration for all non-spiked analytes < ½ LOQ (unless verified trace impurity); ICS-AB: ± 20% of true value [except for elements present in the ICS-AB solution at greater than 4X the instrument calibration range]

Data Quality Indicators (DQIs)	QC Sample or Measurement Performance Activity	Measurement Performance Criteria (MPC)
Sensitivity	Quarterly LOD/LOQ verification	LOD/LOQ verification within DoD QSM acceptance criteria; LOQ < ½ PAL (i.e., the lowest PSL if possible; see Worksheet #15)
Representativeness	Data evaluation as part of Data Verification Procedures	Implementation of approved plans and procedures
Comparability	Data evaluation as part of Data Verification Procedures	Use of standard procedures/ methods as outlined in approved plans and/or approved modifications
Completeness	Valid data points obtained relative to the expected number of data points	Completeness will be evaluated across the entire data set, with specific analytes and/or DUs assessed separately depending on obtained results and ability to make project decisions for that analyte/DU; completeness will be set at 100% for each analyte and DU when the sample size (n) is small (e.g., n<20)

Note: Since sampling will be completed by IS, precision will be evaluated from replicate incremental samples and the matrix effect is minimized; thus, no site-specific matrix spike/matrix spike duplicate analyses for soil will be performed.

[1] During data validation, the precision evaluation will include calculation of the RPD when both samples have detectable concentrations (regardless of the value relative to the LOQ). The RPD criterion will be applied as a guide only when both of the results are ≥ LOQ. Professional judgement will be used when one or both of the results are < LOQ. Replicates with RPDs outside the given limit will undergo further assessment to evaluate the likely sources of error and to determine if the larger variability can be tolerated as part of data usability.

[2] If future groundwater sampling is required (i.e., multiple rounds) and a statistical approach will then be used to make inferences about contamination and risk, evaluation of the field duplicate will be used only to identify/evaluate potential field/laboratory precision. Replicate results outside the given limit values will undergo further assessment to evaluate the likely sources of error and to determine if the larger variability can be tolerated as part of data usability.

[3] MDs are proposed only for the initial aqueous samples, for which results will not be assessed using a statistical approach (single round of sampling). If subsequent sampling is performed and a statistical approach is utilized, MDs will not be performed.

QAPP WORKSHEET #12E: ANALYTICAL MPC – pH

Analytical Group: pH
Matrix: Solid
Sampling Procedure: Discrete Grab (MC SOP 1)
Analytical Methods: Field Screening (MC SOP 1)
Concentration Level: Low

Data Quality Indicators (DQIs)	QC Sample or Measurement Performance Activity	Measurement Performance Criteria (MPC)
Precision (field)	Soil sample replicate (field)	NA; statistical approach to be used
Representativeness	Data evaluation as part of Data Verification Procedures	Implementation of approved plans and procedures
Comparability	Data evaluation as part of Data Verification Procedures	Use of standard procedures/ methods as outlined in approved plans and/or approved modifications
Completeness	Valid data points obtained relative to the expected number of data points	Completeness will be evaluated across the entire data set, with specific analytes and/or DUs assessed separately depending on obtained results and ability to make project decisions for that analyte/DU; completeness will be set at 100% for each analyte and DU when the sample size (n) is small (e.g., n<20)

QAPP WORKSHEET #13 – SECONDARY DATA USES AND LIMITATIONS

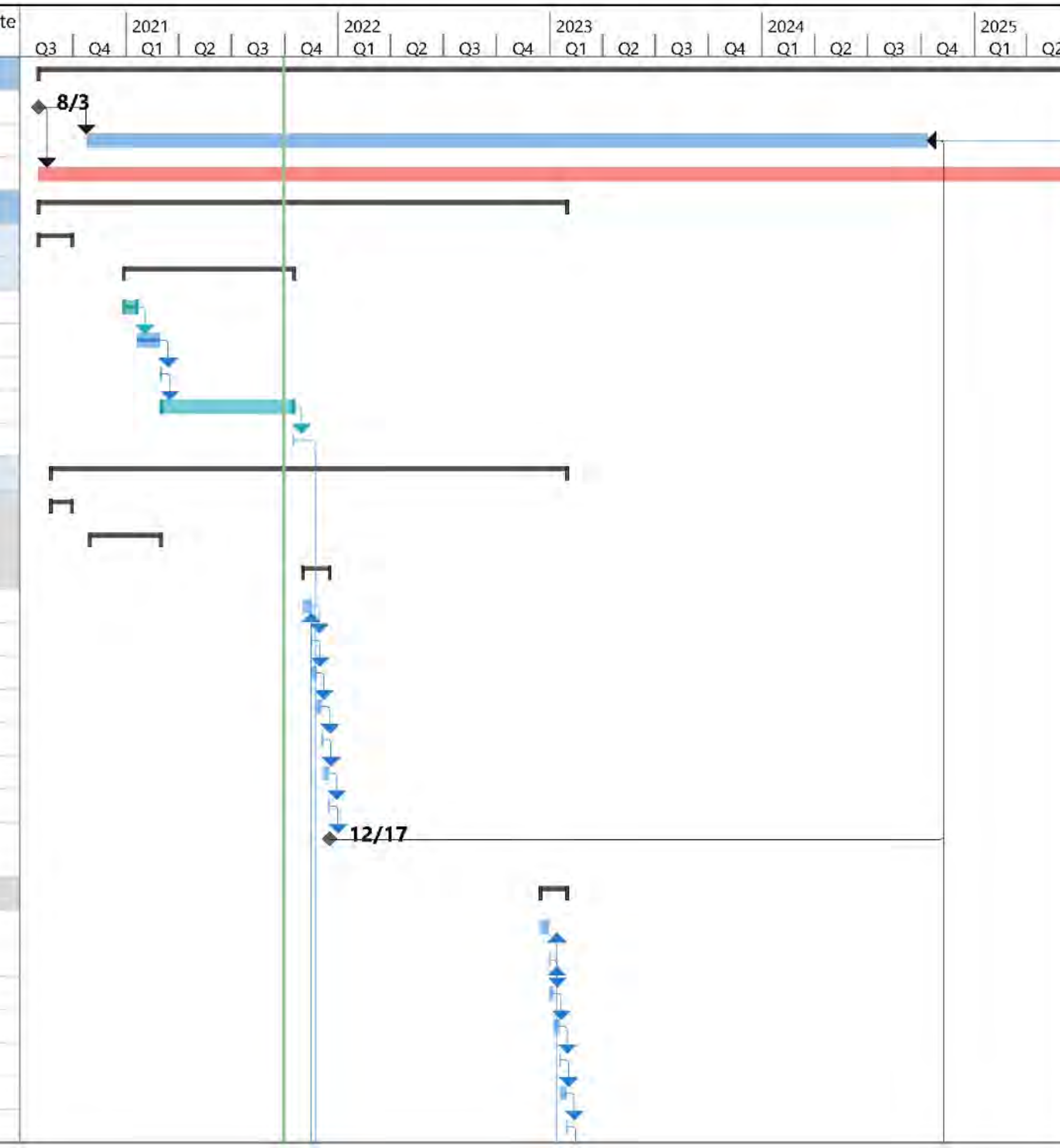
Table 13-1. Secondary Data Uses and Limitations

Data type	Source	Data uses relative to current project	Factors affecting the reliability of data and limitations on data use
Range boundaries	• ASR • SI • WS #10 provided by USACE	• Transect Planning • Identify targets • Identify potential LUAs	• ASR and SI boundaries are not accurate and did not fully identify the MRS boundary
Infrastructure locations	• Google Earth • Historical photo analysis	• Land-use estimating	• Aerial photographs are limited in their details • Army Geospatial Center provided a detailed analysis of 1947 aerial photograph
Range history	• ASR • SI • WS #10 provided by USACE	• Types of munitions used • Target areas	• ASR and SI boundaries are not accurate and did not fully identify the MRS boundary

QAPP WORKSHEET #14 & #16 – PROJECT TASKS AND SCHEDULE

Suffolk County Air Field Bombing & Gunnery Range MMRP RI - DD

ID	Task Name	Duration	Start	Finish	% Complete
1	**General Conditions**	**1800 days**	**Mon 8/3/20**	**Tue 7/8/25**	**0%**
2	Notice to Proceed (NTP)	0 days	Mon 8/3/20	Mon 8/3/20	100%
3	Project Duration	48.33 emons	Fri 10/23/20	Sat 10/12/24	0%
4	Task Order Period of Performance	60 emons	Mon 8/3/20	Tue 7/8/25	0%
5	**0001 -PMP and Meetings**	**910.5 days**	**Mon 8/3/20**	**Mon 1/30/23**	**46%**
6	**0001a - Project Management Plan (PMP)**	**58 days**	**Mon 8/3/20**	**Tue 9/29/20**	**100%**
10	**0001b - Community Relations Plan (CRP)**	**293 days**	**Mon 12/28/20**	**Sat 10/16/21**	**22%**
11	Tetra Tech Prepare and submit Draft CRP to USACE for review	22 days	Mon 12/28/20	Mon 1/18/21	100%
12	USACE review of Draft CRP	40 days	Tue 1/19/21	Sat 2/27/21	100%
13	Tetra Tech Respond to USACE comments on Draft CRP	3 days	Sun 2/28/21	Tue 3/2/21	100%
14	USACE review/accept RTCs	227 days	Wed 3/3/21	Fri 10/15/21	0%
15	Tetra Tech Submit Final CRP (USACE QA Surveillance Inspection)	1 day	Sat 10/16/21	Sat 10/16/21	0%
16	**0001c - Meetings**	**889.5 days**	**Mon 8/24/20**	**Mon 1/30/23**	**62%**
17	**Project Kick-off Meeting**	**36 days**	**Mon 8/24/20**	**Mon 9/28/20**	**100%**
22	**SPP Meeting 1**	**123 days**	**Fri 10/30/20**	**Mon 3/1/21**	**100%**
31	**SPP Meeting 2**	**46 days**	**Mon 11/1/21**	**Fri 12/17/21**	**0%**
32	Tetra Tech Prepare and Submit Pre-SPP Meeting 2 Materials	14 days	Mon 11/1/21	Mon 11/15/21	0%
33	Conduct SPP Meeting 2	1 day	Mon 11/15/21	Tue 11/16/21	0%
34	Tetra Tech Prepare and Submit Draft SPP Meeting 2 Memorandum	7 days	Tue 11/16/21	Tue 11/23/21	0%
35	USACE Review of Draft SPP Meeting 2 Memorandum	10 days	Tue 11/23/21	Fri 12/3/21	0%
36	Tetra Tech Address Comments	2 days	Fri 12/3/21	Sun 12/5/21	0%
37	Stakeholder Review of Draft SPP Meeting 2 Memorandum	10 days	Sun 12/5/21	Wed 12/15/21	0%
38	Tetra Tech Address Comments	2 days	Wed 12/15/21	Fri 12/17/21	0%
39	Tetra Tech Submit Final SPP Meeting 2 Memorandum (USACE QA Surveillance Inspection)	0 days	Fri 12/17/21	Fri 12/17/21	0%
40	**SPP Meeting 3**	**46 days**	**Thu 12/15/22**	**Mon 1/30/23**	**0%**
41	Tetra Tech Prepare and Submit Pre-SPP Meeting 3 Materials	14 days	Thu 12/15/22	Thu 12/29/22	0%
42	Conduct SPP Meeting 3	1 day	Thu 12/29/22	Fri 12/30/22	0%
43	Tetra Tech Prepare and Submit Draft SPP Meeting 3 Memorandum	7 days	Fri 12/30/22	Fri 1/6/23	0%
44	USACE Review of Draft SPP Meeting 3 Memorandum	10 days	Fri 1/6/23	Mon 1/16/23	0%
45	Tetra Tech Address Comments	2 days	Mon 1/16/23	Wed 1/18/23	0%
46	Stakeholder Review of Draft SPP Meeting 3 Memorandum	10 days	Wed 1/18/23	Sat 1/28/23	0%
47	Tetra Tech Address Comments	2 days	Sat 1/28/23	Mon 1/30/23	0%



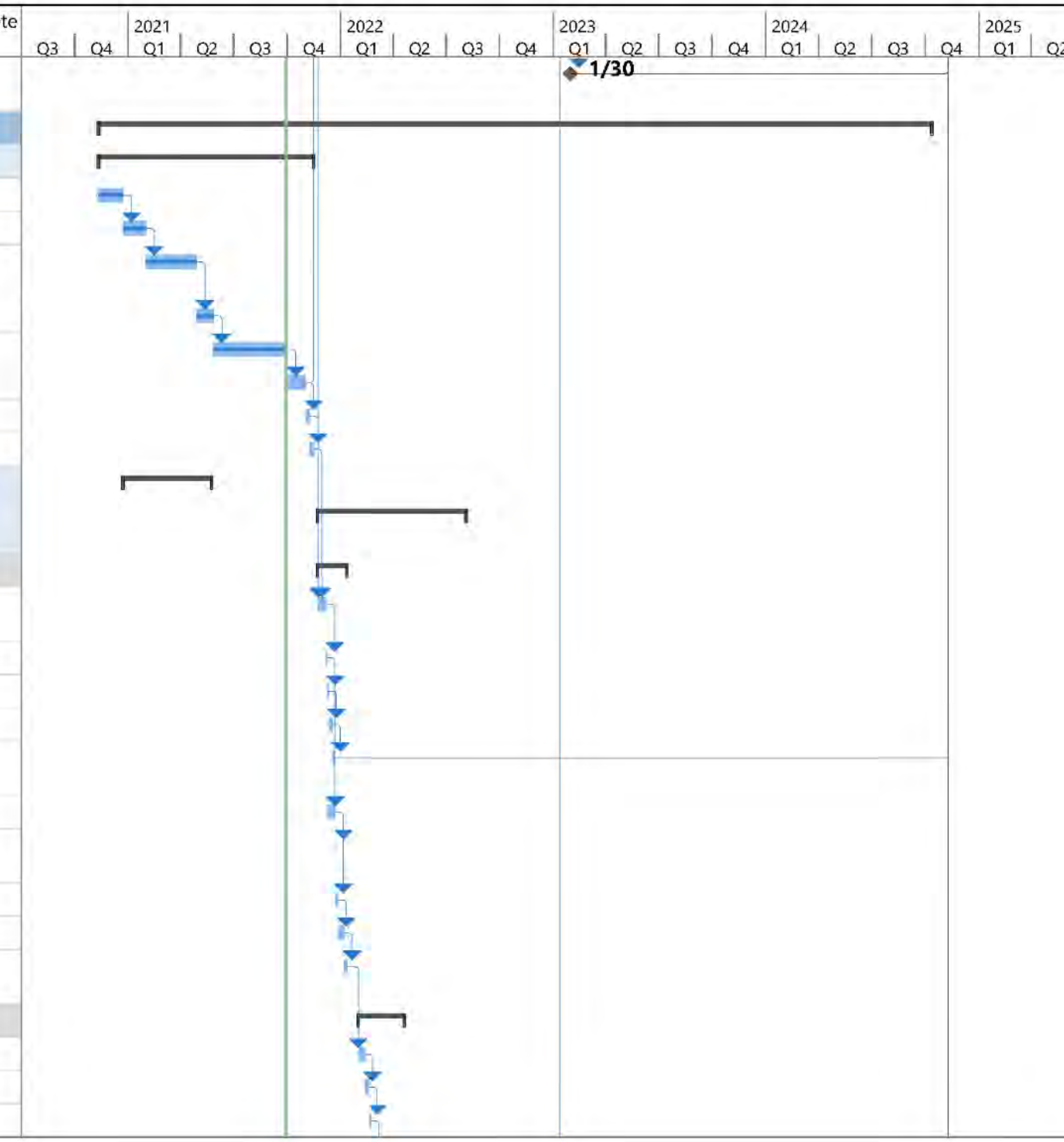
Date: Wed 9/29/21

Task		Summary		Manual Task		Finish-only		Progress	
Milestone	◆	Project Summary		Manual Summary		Critical		Manual Progress	

1

Suffolk County Air Field Bombing & Gunnery
Range MMRP RI - DD

ID	Task Name	Duration	Start	Finish	% Complete
48	Tetra Tech Submit Final SPP Meeting 3 Memorandum (USACE QA Surveillance Inspection)	0 days	Mon 1/30/23	Mon 1/30/23	0%
49	**0002 - MMRP MRS-01 Range Complex**	**1431.5 days**	**Wed 11/11/20**	**Sat 10/12/24**	**31%**
50	**0002a - UFP - QAPP**	**369.5 days**	**Wed 11/11/20**	**Mon 11/15/21**	**91%**
51	Tetra Tech Prepare and submit Preliminary Draft MR-QAPP to USACE for review	38 days	Wed 11/11/20	Wed 12/23/20	100%
52	USACE review of Preliminary Draft MR-QAPP	39 days	Wed 12/23/20	Sun 1/31/21	100%
53	Tetra Tech Respond to USACE comments, contract with new lab, and submit revised to Draft MR-QAPP	87 days	Sun 1/31/21	Wed 4/28/21	100%
54	EMCX review of Draft MR-QAPP (USACE QA Surveillance Inspection)	29 days	Wed 4/28/21	Thu 5/27/21	100%
55	Tetra Tech Respond to EMCX comments and revise to Draft-Final MR-QAPP	127 days	Thu 5/27/21	Fri 10/1/21	100%
56	Stakeholder review of Draft Final MR-QAPP (USACE QA Surveillance Inspection)	31 days	Fri 10/1/21	Mon 11/1/21	0%
57	Tetra Tech Respond to Stakeholder comments on Draft Final MR-QAPP	7 days	Mon 11/1/21	Mon 11/8/21	0%
58	Tetra Tech Prepare and submit Final MR-QAPP (USACE QA Surveillance Inspectio	7 days	Mon 11/8/21	Mon 11/15/21	0%
59	**Accident Prevention Plan (APP)/Site Safety Health Plan (SSHP)**	**152 days**	**Wed 12/23/20**	**Mon 5/24/21**	**100%**
64	**0002b - Remedial Investigation Field Work - will not be conducted during the summer tourist season, or from June 1 - July 31 due to Northern Long Eared Bat**	**255 days**	**Mon 11/22/21**	**Thu 8/4/22**	**0%**
65	**Preliminary MRS Characterization**	**50 days**	**Mon 11/22/21**	**Tue 1/11/22**	**0%**
66	Preliminary MRS Characterization - Mobilization / Site Prep / Vegetation Reduction	11 days	Mon 11/22/21	Tue 12/7/21	0%
67	EM61 IVS Survey	1 day	Tue 12/7/21	Wed 12/8/21	0%
68	Tetra Tech Prepare and Submit IVS Technical Memorandum	2 days	Wed 12/8/21	Fri 12/10/21	0%
69	USACE Review IVS Technical Memorandum	5 days	Fri 12/10/21	Fri 12/17/21	0%
70	Tetra Tech RTCs and Submit Final IVS Technical Memorandum (USACE QA Surveillance Inspection)	1 day	Fri 12/17/21	Mon 12/20/21	0%
71	EM61 Transect Surveys	10 days	Wed 12/8/21	Wed 12/22/21	0%
72	Submit geophysical data packages for transects (USACE QA Surveillance Inspection)	1 day	Wed 12/22/21	Thu 12/23/21	0%
73	Tetra Tech Submit Preliminary Characterization Memorandum	5 days	Wed 12/22/21	Mon 12/27/21	0%
74	USACE Review Preliminary Characterization Memorandum	10 days	Mon 12/27/21	Thu 1/6/22	0%
75	Tetra Tech Submit Final Preliminary Characterization Memorandum + Final Data Packages (USACE QA Surveillance Inspection)	5 days	Thu 1/6/22	Tue 1/11/22	0%
76	**HD/LD Investigation**	**79 days**	**Mon 1/31/22**	**Wed 4/20/22**	**0%**
77	Mini-grid layout/vegetation reduction/surface clearance	8 days	Mon 1/31/22	Thu 2/10/22	0%
78	QC Seeding/USACE QA Seeding	6 days	Thu 2/10/22	Fri 2/18/22	0%
79	MM2x2 IVS Survey	1 day	Fri 2/18/22	Mon 2/21/22	0%



Date: Wed 9/29/21

Task		Summary		Manual Task		Finish-only		Progress	
Milestone	◆	Project Summary		Manual Summary		Critical		Manual Progress	

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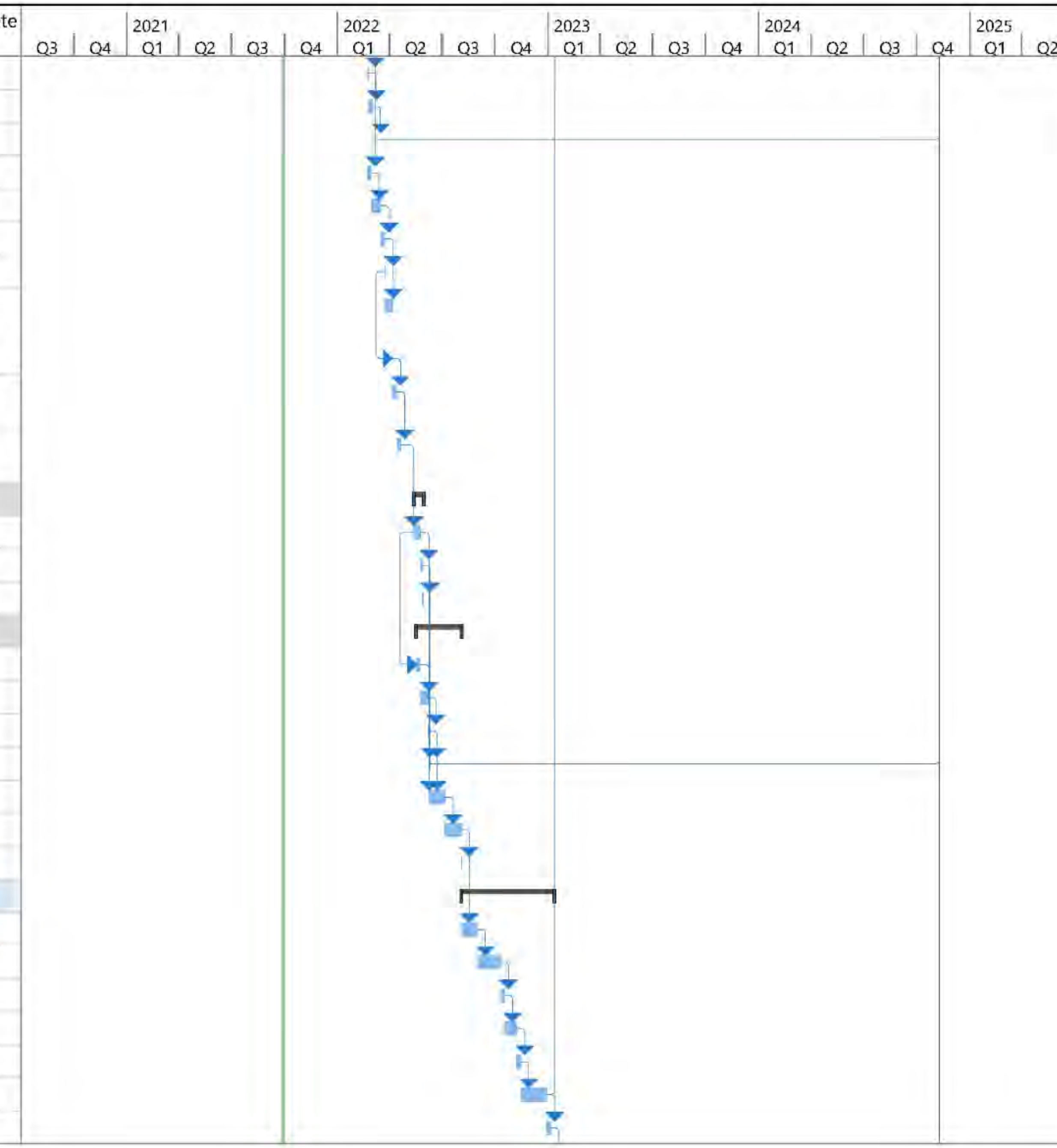
Suffolk County Air Field Bombing & Gunnery Range MMRP RI - DD

ID	Task Name	Duration	Start	Finish	% Complete
80	Tetra Tech Prepare and Submit Amended IVS Technical Memorandum	2 days	Mon 2/21/22	Wed 2/23/22	0%
81	USACE Review of Amended IVS Technical Memorandum	5 days	Wed 2/23/22	Wed 3/2/22	0%
82	Tetra Tech RTCs and Submit Final Amended IVS Technical Memorandum	1 day	Wed 3/2/22	Thu 3/3/22	0%
83	MM2x2 Transect Collection	5 days	Mon 2/21/22	Mon 2/28/22	0%
84	MM2x2 Dynamic Survey - Grids	13 days	Mon 2/28/22	Thu 3/17/22	0%
85	MM2x2 Cued Survey - Grids	5 days	Thu 3/17/22	Thu 3/24/22	0%
86	Submit geophysical data packages for grids (USACE QA Surveillance Inspection	1 day	Thu 3/24/22	Fri 3/25/22	0%
87	Tetra Tech Develop and Submit Final Data Package, Draft Dig List and Draft MSD Reduction Memorandum	10 days	Thu 3/24/22	Thu 4/7/22	0%
88	Conference call to discus MSD Reduction Memorandum	1 day	Tue 4/5/22	Wed 4/6/22	0%
89	Tetra Tech Submit Final Data Package, Final Dig List and MSD Reduction Memorandum	5 days	Wed 4/6/22	Wed 4/13/22	0%
90	USACE Acceptance Final Geophysical Data Packages/Dig List Concurrence (USACE QA Surveillance Inspection)	5 days	Wed 4/13/22	Wed 4/20/22	0%
91	**Intrusive Investigation**	**17 days**	**Fri 5/13/22**	**Mon 5/30/22**	**0%**
92	Intrusive Investigations	8 days	Fri 5/13/22	Wed 5/25/22	0%
93	MEC/MPPEH Management and Disposal	2 days	Wed 5/25/22	Fri 5/27/22	0%
94	Submit Intrusive Investigation Results (USACE QA Surveillance Inspection)	1 day	Fri 5/27/22	Mon 5/30/22	0%
95	**MC Sampling**	**79 days**	**Tue 5/17/22**	**Thu 8/4/22**	**0%**
96	Surface and subsurface soil sampling, including background	4 days	Tue 5/17/22	Mon 5/23/22	0%
97	Groundwater Well Installation and Development	8 days	Wed 5/25/22	Mon 6/6/22	0%
98	Groundwater Well Sampling	2 days	Mon 6/6/22	Wed 6/8/22	0%
99	Demobilization/IDW Removal/MDAS Removal	2 days	Wed 6/8/22	Fri 6/10/22	0%
100	Laboratory Analysis	20 days	Wed 6/8/22	Wed 7/6/22	0%
101	Data Validation	20 days	Wed 7/6/22	Wed 8/3/22	0%
102	Submit MC data package (USACE QA Surveillance Inspection)	1 day	Wed 8/3/22	Thu 8/4/22	0%
103	**0002c - Remedial Investigation Report**	**162 days**	**Wed 8/3/22**	**Thu 1/12/23**	**0%**
104	Tetra Tech Prepare and submit Preliminary Draft RI Report to USACE for review	28 days	Wed 8/3/22	Wed 8/31/22	0%
105	USACE review of Preliminary Draft RI Report	40 days	Wed 8/31/22	Mon 10/10/22	0%
106	Tetra Tech Respond to USACE comments and revised to Draft RI Report	7 days	Mon 10/10/22	Mon 10/17/22	0%
107	EMCX review of Draft RI Report (USACE QA Surveillance Inspection)	21 days	Mon 10/17/22	Mon 11/7/22	0%
108	Tetra Tech Respond to EMCX comments and revise to Draft-Final RI Report	7 days	Mon 11/7/22	Mon 11/14/22	0%
109	Stakeholder review of Draft Final RI Report (USACE QA Surveillance Inspection)	45 days	Mon 11/14/22	Thu 12/29/22	0%
110	Tetra Tech Respond to Stakeholder comments on Draft Final RI Report	7 days	Thu 12/29/22	Thu 1/5/23	0%



Date: Wed 9/29/21

Task | Summary | Manual Task | Finish-only | Progress
Milestone | Project Summary | Manual Summary | Critical | Manual Progress

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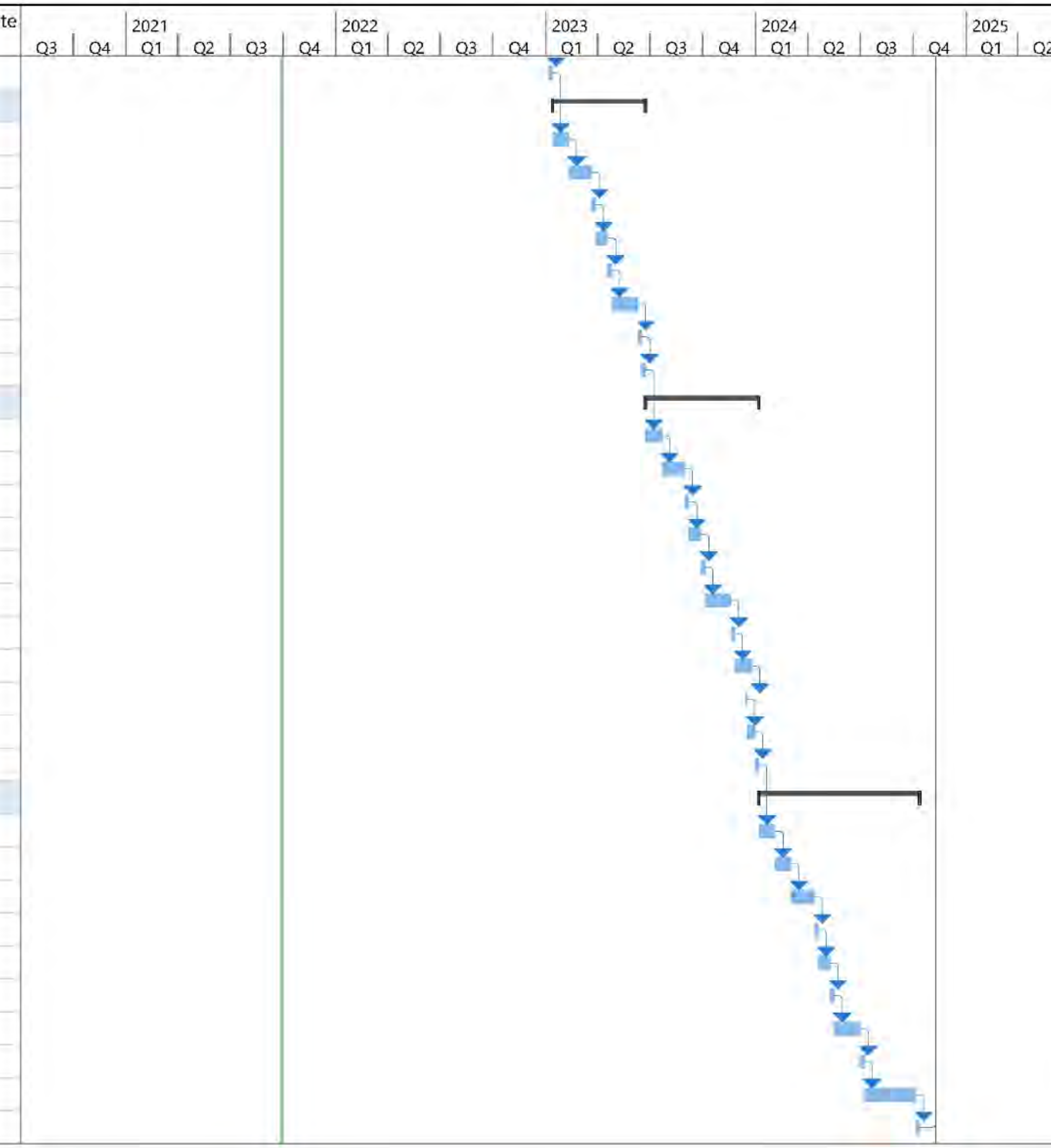
**Suffolk County Air Field Bombing & Gunnery
Range MMRP RI - DD**

ID	Task Name	Duration	Start	Finish	% Complete
111	Tetra Tech Prepare and submit Final RI Report (USACE QA Surveillance Inspectioi	7 days	Thu 1/5/23	Thu 1/12/23	0%
112	**0002d - Feasibility Study (FS)**	**162 days**	**Thu 1/12/23**	**Fri 6/23/23**	**0%**
113	Tetra Tech Prepare and submit Preliminary Draft FS to USACE for review	28 days	Thu 1/12/23	Thu 2/9/23	0%
114	USACE review of Preliminary Draft FS	40 days	Thu 2/9/23	Tue 3/21/23	0%
115	Tetra Tech Respond to USACE comments and revised to Draft FS	7 days	Tue 3/21/23	Tue 3/28/23	0%
116	EMCX review of Draft FS (USACE QA Surveillance Inspection)	21 days	Tue 3/28/23	Tue 4/18/23	0%
117	Tetra Tech Respond to EMCX comments and revise to Draft-Final FS	7 days	Tue 4/18/23	Tue 4/25/23	0%
118	Stakeholder review of Draft Final FS (USACE QA Surveillance Inspection)	45 days	Tue 4/25/23	Fri 6/9/23	0%
119	Tetra Tech Respond to Stakeholder comments on Draft Final FS	7 days	Fri 6/9/23	Fri 6/16/23	0%
120	Tetra Tech Prepare and submit Final FS (USACE QA Surveillance Inspection)	7 days	Fri 6/16/23	Fri 6/23/23	0%
121	**0002e - Proposed Plan (PP)**	**197 days**	**Fri 6/23/23**	**Sat 1/6/24**	**0%**
122	Tetra Tech Prepare and submit Preliminary Draft PP to USACE for review	28 days	Fri 6/23/23	Fri 7/21/23	0%
123	USACE review of Preliminary Draft PP	40 days	Fri 7/21/23	Wed 8/30/23	0%
124	Tetra Tech Respond to USACE comments and revised to Draft PP	7 days	Wed 8/30/23	Wed 9/6/23	0%
125	EMCX review of Draft PP (USACE QA Surveillance Inspection)	21 days	Wed 9/6/23	Wed 9/27/23	0%
126	Tetra Tech Respond to EMCX comments and revise to Draft-Final PP	7 days	Wed 9/27/23	Wed 10/4/23	0%
127	Stakeholder review of Draft Final PP (USACE QA Surveillance Inspection)	45 days	Wed 10/4/23	Sat 11/18/23	0%
128	Tetra Tech Respond to Stakeholder comments on Draft Final PP	7 days	Sat 11/18/23	Sat 11/25/23	0%
129	Public Review of Draft Final Proposed Plan	30 days	Sat 11/25/23	Mon 12/25/23	0%
130	PP Public Meeting	1 day	Fri 12/15/23	Sat 12/16/23	0%
131	PP Meeting Transcripts Submitted by Tetra Tech	14 days	Sat 12/16/23	Sat 12/30/23	0%
132	Tetra Tech Prepare and submit Final PP (USACE QA Surveillance Inspection)	7 days	Sat 12/30/23	Sat 1/6/24	0%
133	**0002f - Decision Document (DD)**	**280 days**	**Sat 1/6/24**	**Sat 10/12/24**	**0%**
134	Responsiveness Summary	28 days	Sat 1/6/24	Sat 2/3/24	0%
135	Tetra Tech Prepare and submit Preliminary Draft DD to USACE for review	28 days	Sat 2/3/24	Sat 3/2/24	0%
136	USACE review of Preliminary Draft DD	40 days	Sat 3/2/24	Thu 4/11/24	0%
137	Tetra Tech Respond to USACE comments and revised to Draft DD	7 days	Thu 4/11/24	Thu 4/18/24	0%
138	EMCX review of Draft DD (USACE QA Surveillance Inspection)	21 days	Thu 4/18/24	Thu 5/9/24	0%
139	Tetra Tech Respond to EMCX comments and revise to Draft-Final DD	7 days	Thu 5/9/24	Thu 5/16/24	0%
140	Stakeholder review of Draft Final DD (USACE QA Surveillance Inspection)	45 days	Thu 5/16/24	Sun 6/30/24	0%
141	Tetra Tech Respond to Stakeholder comments on Draft Final DD	7 days	Sun 6/30/24	Sun 7/7/24	0%
142	Signature/Approval Process	90 days	Sun 7/7/24	Sat 10/5/24	0%
143	Tetra Tech Prepare and submit Final DD (USACE QA Surveillance Inspection)	7 days	Sat 10/5/24	Sat 10/12/24	0%



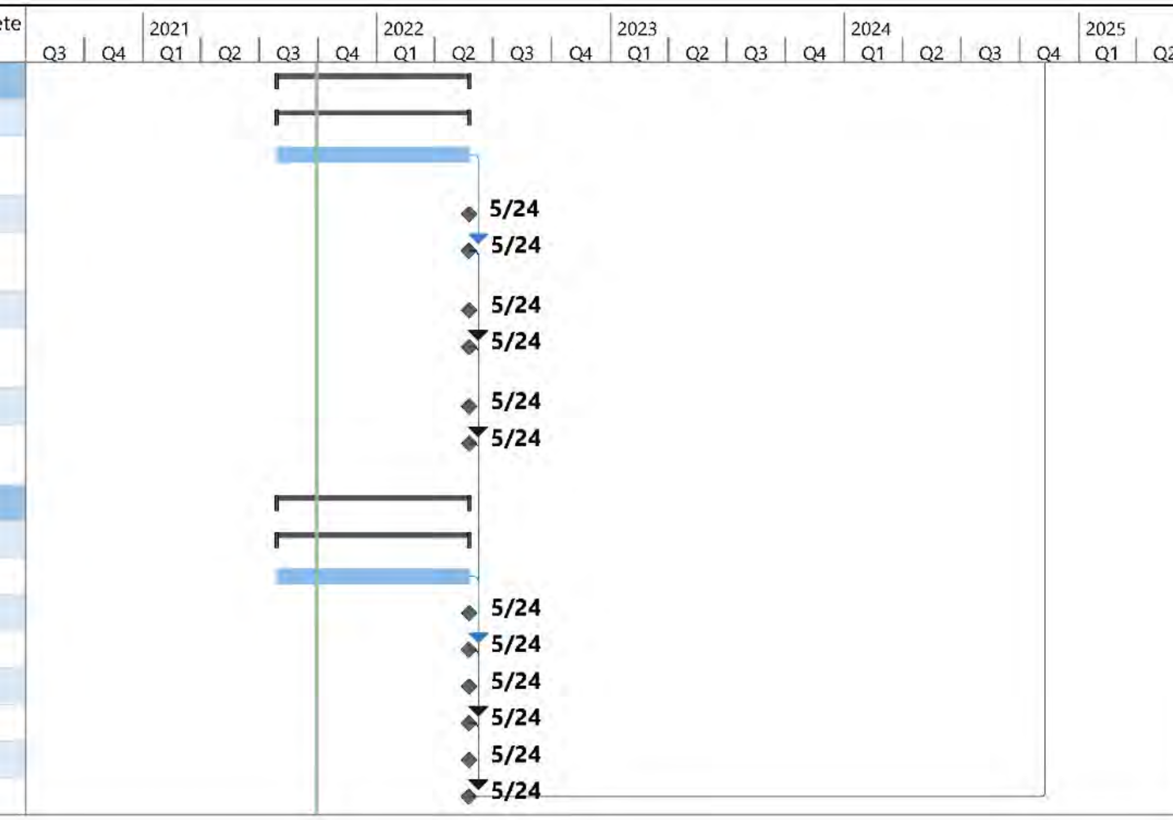
Date: Wed 9/29/21

Task		Summary		Manual Task		Finish-only	Progress
Milestone		Project Summary		Manual Summary		Critical	Manual Progress

4

Suffolk County Air Field Bombing & Gunnery Range MMRP RI - DD

ID	Task Name	Duration	Start	Finish	% Complete
144	**OPTION CLIN 0003 - Evacuation of Properties and Roads**	**300 days**	**Thu 7/29/21**	**Tue 5/24/22**	**0%**
145	**OPTION CLIN 0003a - Evacuation (Awarded 7/29/2021)**	**300 days**	**Thu 7/29/21**	**Tue 5/24/22**	**0%**
146	Achieve evacuation of residential and commercial properties, and roads during MEC intrusive investigation.	300 days	Thu 7/29/21	Tue 5/24/22	0%
147	**OPTION CLIN 0003b - Evacuation**	**0 days**	**Tue 5/24/22**	**Tue 5/24/22**	**0%**
148	Achieve evacuation of residential and commercial properties, and roads during MEC intrusive investigation.	0 days	Tue 5/24/22	Tue 5/24/22	0%
149	**OPTION CLIN 0003c - Evacuation**	**0 days**	**Tue 5/24/22**	**Tue 5/24/22**	**0%**
150	Achieve evacuation of residential and commercial properties, and roads during MEC intrusive investigation.	0 days	Tue 5/24/22	Tue 5/24/22	0%
151	**OPTION CLIN 0003d - Evacuation**	**0 days**	**Tue 5/24/22**	**Tue 5/24/22**	**0%**
152	Achieve evacuation of residential and commercial properties, and roads during MEC intrusive investigation.	0 days	Tue 5/24/22	Tue 5/24/22	0%
153	**OPTION CLIN 0004 - Private Property Restoration**	**300 days**	**Thu 7/29/21**	**Tue 5/24/22**	**0%**
154	**OPTION CLIN 0004a - Property Restoration (Awarded 7/29/2021)**	**300 days**	**Thu 7/29/21**	**Tue 5/24/22**	**0%**
155	Achieve approved property restoration at private properties.	300 days	Thu 7/29/21	Tue 5/24/22	0%
156	**OPTION CLIN 0004b - Property Restoration**	**0 days**	**Tue 5/24/22**	**Tue 5/24/22**	**0%**
157	Achieve approved property restoration at private properties.	0 days	Tue 5/24/22	Tue 5/24/22	0%
158	**OPTION CLIN 0004c - Property Restoration**	**0 days**	**Tue 5/24/22**	**Tue 5/24/22**	**0%**
159	Achieve approved property restoration at private properties.	0 days	Tue 5/24/22	Tue 5/24/22	0%
160	**OPTION CLIN 0004d - Property Restoration**	**0 days**	**Tue 5/24/22**	**Tue 5/24/22**	**0%**
161	Achieve approved property restoration at private properties.	0 days	Tue 5/24/22	Tue 5/24/22	0%



Date: Wed 9/29/21

Task		Summary		Manual Task		Finish-only		Progress	
Milestone		Project Summary		Manual Summary		Critical		Manual Progress	

5

QAPP WORKSHEET #15A: PROJECT ACTION LIMITS[5] AND LABORATORY-SPECIFIC DETECTION/QUANTITATION LIMITS – EXPLOSIVES

Matrix: Solids (Soil)
Analytical Group: Explosives (SW-846 Method 8330B)

Analyte	CAS Number	Human Health PSL [1,4] (milligrams per kilogram [mg/kg])	Human Health PSL Reference [1]	Ecological PSL (mg/kg) [2,4]	Ecological PSL Reference [2]	Project LOQ Goal [3,4] (mg/kg)	Achievable Laboratory Limits		
							DL (mg/kg)	LOD (mg/kg)	LOQ (mg/kg)
1,3,5-Trinitrobenzene (1,3,5-TNB)	99-35-4	220	USEPA Residential RSL	0.3	USEPA Region IV Eco-SSL	0.15	0.0127	0.05	0.1
1,3-Dinitrobenzene (1,3-DNB)	99-65-0	0.63	USEPA Residential RSL	0.034	USEPA Region IV Eco-SSL	0.10	0.00751	**0.05**	**0.1**
2,4,6-Trinitrotoluene (2,4,6-TNT)	118-96-7	3.6	USEPA Residential RSL	7.5	USEPA Region IV Eco-SSL	1.8	0.00943	0.05	0.1
2,4-Dinitrotoluene (2,4-DNT)	121-14-2	1.7	USEPA Residential RSL	6	USEPA Region IV Eco-SSL	0.85	0.00734	0.05	0.1
2,6-Dinitrotoluene (2,6-DNT)	606-20-2	0.36	USEPA Residential RSL	4	USEPA Region IV Eco-SSL	0.18	0.00756	0.05	0.1
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	35572-78-2	0.77	USEPA Residential RSL	14	USEPA Region IV Eco-SSL	0.385	0.0062	0.05	0.1
2-Nitrotoluene (2-NT)	88-72-2	3.2	USEPA Residential RSL	0.19	USEPA Region IV Eco-SSL	0.10	0.0142	0.05	0.1

Analyte	CAS Number	Human Health PSL [1,4] (milligrams per kilogram [mg/kg])	Human Health PSL Reference [1]	Ecological PSL (mg/kg) [2,4]	Ecological PSL Reference [2]	Project LOQ Goal [3,4] (mg/kg)	Achievable Laboratory Limits		
							DL (mg/kg)	LOD (mg/kg)	LOQ (mg/kg)
3-Nitrotoluene (3-NT)	99-08-1	0.63	USEPA Residential RSL	0.13	USEPA Region IV Eco-SSL	0.10	0.0118	0.05	0.1
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	19406-51-0	0.77	USEPA Residential RSL	12	USEPA Region IV Eco-SSL	0.385	0.00975	0.05	0.1
4-Nitrotoluene (4-NT)	99-99-0	25	USEPA Residential RSL	0.14	USEPA Region IV Eco-SSL	0.10	0.0153	0.05	0.1
Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)	121-82-4	8.3	USEPA Residential RSL	2.3	USEPA Region IV Eco-SSL	1.15	0.00816	0.05	0.1
Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX)	2691-41-0	390	USEPA Residential RSL	16	USEPA Region IV Eco-SSL	8	0.008	0.05	0.1
3,5-Dinitroaniline (3,5-DNA)	618-87-1	No Criteria (NC)	No Value Identified in Applicable Literature	20	USEPA Region IV Eco-SSL	0.50	0.00284	0.05	0.1
Methyl-2,4,6-trinitrophenylnitramine (Tetryl)	479-45-8	16	USEPA Residential RSL	0.018	USEPA Region IV Eco-SSL	0.10	0.0166	**0.05**	**0.1**
Nitrobenzene (NB)	98-95-3	5.1	USEPA Residential RSL	2.2	USEPA Region IV Eco-SSL	1.1	0.00767	0.05	0.1
Pentaerythritol tetranitrate (PETN)	78-11-5	13	USEPA Residential RSL	2.2	USEPA Region IV Eco-SSL	1.1	0.0786	0.4	0.8

Analyte	**CAS Number**	**Human Health PSL [1,4] (milligrams per kilogram [mg/kg])**	**Human Health PSL Reference [1]**	**Ecological PSL (mg/kg) [2,4]**	**Ecological PSL Reference [2]**	**Project LOQ Goal [3,4] (mg/kg)**	**Achievable Laboratory Limits**		
							DL (mg/kg)	**LOD (mg/kg)**	**LOQ (mg/kg)**
Nitroglycerin (NG)	55-63-0	0.63	USEPA Residential RSL	13	USEPA Region IV Eco-SSL	0.80	0.124	0.4	**0.8**

Notes:

[1] The PSL is set using most conservative screening level between [1] USEPA Regional Screening Levels (RSLs) for Residential Soil (May 2021) with excess lifetime cancer risk (ELCR) = $1x10^{-6}$, [2] USEPA RSL for Residential Soil (May 2021) with a target hazard quotient (THQ) =0.1, [3] USEPA RSL for Industrial Soil (May 2021) with a ELCR of $1x10^{-6}$, and [4] USEPA RSL for Industrial Soil (May 2021) with a THQ=0.1. PSLs will be used in the RI in the fate and transport, HHRA and ERA sections.

[2] The PSL for ecological receptors is set at the lowest concentration (most conservative value) among the USEPA Region IV Ecological Screening Values and USEPA Ecological Soil Screening Level (Eco-SSL) Guidance Documents. PSLs will be used in the RI in the fate and transport, HHRA and ERA sections.

[3] The overall “Project LOQ Goal” is ½ PAL (i.e., the lowest PSL); see Note 5. For those constituents where ½ PAL would be less than the LOQ, the value was set at the LOQ as per USACE New England District convention. For those constituents without a PSL, the value has been set to five times (5x) the LOQ by the acceptable methodology. The DLs, LODs, and/or LOQs that are higher than the given PSLs have been highlighted yellow and bolded for ease of identification.

[4] The screening levels are used in project planning to help target the selection of the most appropriate methods and analyses for the project. In some cases, laboratories may not be able to reach detection limits below the screening level. In these cases, the project team will address this issue in the risk management decision process. For analytes with the LOQ > PAL, the risk assessment will address the analyte using a weight-of-evidence approach. Lines of evidence include: was the analyte detected in other media; is the analyte is an expected degradation product of another analyte that was detected (or conversely is the analyte the original/parent compound); and is the combination of media and endpoint associated with the PAL likely to result in a significant underestimate of risk (e.g., is the pathway likely complete and is the LOD associated with a significant risk-level). This would be a qualitative, not quantitative, evaluation. Additional discussion on performance of the risk assessments is provided in the Risk Assessment Work Plan (Appendix D). These initial screening levels are used in the MR-QAPP for project planning, and may not be appropriate for use in subsequent steps of the project (e.g., RI Report, Risk Assessment, Feasibility Study). A review of available detection limits was performed as part of the evaluation/selection of the analytical laboratory.

[5] Although not shown in the table, the PAL is the most conservative (i.e., lowest) of the human health and ecological PSLs and is used to make sure the selected analytical laboratory and method can provide accurate data (i.e., quantitative results with known precision and bias) at the PAL.

QAPP WORKSHEET #15B: PROJECT ACTION LIMITS[4] AND LABORATORY-SPECIFIC DETECTION/QUANTITATION LIMITS – EXPLOSIVES

Matrix: Aqueous (Groundwater)
Analytical Group: Explosives (SW-846 Method 8330B)

Analyte	CAS Number	Human Health PSL [1,3] (micrograms per liter [µg/L])	Human Health PSL Reference [1]	Project LOQ Goal [2,3] (µg/L)	Achievable Laboratory Limits		
					DL (µg/L)	LOD (µg/L)	LOQ (µg/L)
1,3,5-Trinitrobenzene (1,3,5-TNB)	99-35-4	59	USEPA Tap Water RSL	29.5	0.0555	0.125	0.25
1,3-Dinitrobenzene (1,3-DNB)	99-65-0	0.2	USEPA Tap Water RSL	0.25	0.0242	0.125	**0.25**
2,4,6-Trinitrotoluene (2,4,6-TNT)	118-96-7	0.98	USEPA Tap Water RSL	0.495	0.0532	0.125	0.25
2,4-Dinitrotoluene (2,4-DNT)	121-14-2	0.24	USEPA Tap Water RSL	0.25	0.0401	0.125	**0.25**
2,6-Dinitrotoluene (2,6-DNT)	606-20-2	0.049	USEPA Tap Water RSL	0.25	**0.0776**	**0.125**	**0.25**
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	35572-78-2	0.19	USEPA Tap Water RSL	0.25	0.0436	0.125	**0.25**
2-Nitrotoluene (2-NT)	88-72-2	0.31	USEPA Tap Water RSL	0.25	0.041	0.125	0.25
3-Nitrotoluene (3-NT)	99-08-1	0.17	USEPA Tap Water RSL	0.25	0.0569	0.125	**0.25**
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	19406-51-0	0.19	USEPA Tap Water RSL	0.25	0.0746	0.125	**0.25**
4-Nitrotoluene (4-NT)	99-99-0	4.3	USEPA Tap Water RSL	2.15	0.0807	0.125	0.25
Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)	121-82-4	0.97	USEPA Tap Water RSL	0.485	0.0546	0.125	0.25

Analyte	CAS Number	Human Health PSL [1,3] (micrograms per liter [µg/L])	Human Health PSL Reference [1]	Project LOQ Goal [2,3] (µg/L)	Achievable Laboratory Limits		
					DL (µg/L)	LOD (µg/L)	LOQ (µg/L)
Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX)	2691-41-0	100	USEPA Tap Water RSL	50	0.0517	0.125	0.25
3,5-Dinitroaniline (3,5-DNA)	618-87-1	NC	No Value Identified in Applicable Literature	1.25	0.042	0.125	0.25
Methyl-2,4,6-trinitrophenylnitramine (Tetryl)	479-45-8	3.9	USEPA Tap Water RSL	1.9	0.0674	0.125	0.25
Nitrobenzene (NB)	98-95-3	0.14	USEPA Tap Water RSL	0.25	0.0287	0.125	**0.25**
Pentaerythritol tetranitrate (PETN)	78-11-5	3.9	USEPA Tap Water RSL	4	0.157	2	**4**
Nitroglycerin (NG)	55-63-0	0.2	USEPA Tap Water RSL	4	**0.772**	**2**	**4**

Notes:

[1] The PSL is set at the lowest concentration (most conservative value) among [1] USEPA RSL for Tap Water (May 2021) with ELRC = $1x10^{-6}$, [2] USEPA RSL for Tap Water (May 2021) with a THQ=0.1, and [3] the USEPA Maximum Contaminant Levels (MCL) in drinking water. PSLs will be used in the RI in the fate and transport, HHRA and ERA sections.

[2] The overall "Project LOQ Goal" is ½ PAL (i.e., the lowest PSL); see Note 4. For those constituents where ½ PAL would be less than the LOQ, the value was set at the LOQ as per USACE New England District convention. For those constituents without a PSL, the value has been set to five times (5x) the LOQ by the acceptable methodology. The DLs, LODs, and/or LOQs that are higher than the given PSLs have been highlighted yellow and bolded for ease of identification.

[3] The screening levels are used in project planning to help target the selection of the most appropriate methods and analyses for the project. In some cases, laboratories may not be able to reach detection limits below the screening level. In these cases, the project team will address this issue in the risk management decision process. For analytes with the LOQ > PAL, the risk assessment will address the analyte using a weight-of-evidence approach. Lines of evidence include: was the analyte detected in other media; is the analyte is an expected degradation product of another analyte that was detected (or conversely is the analyte the original/parent compound); and is the combination of media and endpoint associated with the PAL likely to result in a significant underestimate of risk (e.g., is the pathway likely complete and is the LOD associated with a significant risk-level). This would be a qualitative, not quantitative, evaluation. Additional discussion on performance of the risk assessments is provided in the Risk Assessment Work Plan (Appendix D). These initial screening levels are used in the MR-QAPP for project planning and may not be appropriate for use in subsequent steps of the project (e.g., RI Report, Risk Assessment, Feasibility Study). A review of available detection limits was performed as part of the evaluation/selection of the analytical laboratory.

[4] Although not shown in the table, the PAL is the most conservative (i.e., lowest) of the human health PSLs and is used to make sure the selected analytical laboratory and method can provide accurate data (i.e., quantitative results with known precision and bias) at the PAL.

QAPP WORKSHEET #15C: PROJECT ACTION LIMITS[6] AND LABORATORY-SPECIFIC DETECTION/QUANTITATION LIMITS – SELECT METALS

Matrix: Solids (Soil)
Analytical Group: Select Metals (SW-846 Method 6010D [top row] and Method 6020A [bottom row])

Analyte	CAS Number	Human Health PSL [1,4] (mg/kg)	Human Health PSL Reference [1]	Ecological PSL (mg/kg) [2,4]	Ecological PSL Reference [2]	Project LOQ Goal [3,4] (mg/kg)	Achievable Laboratory Limits		
							DL (mg/kg)	LOD (mg/kg)	LOQ (mg/kg)
Aluminum (Al)	7429-90-5	7700	USEPA Residential RSL	pH dependent[5]	USEPA Eco-SSL	3850	0.71 0.51	10 4	30 30
Antimony (Sb)[6]	7440-36-0	3.1	USEPA Residential RSL	0.27	USEPA Eco-SSL	0.80 / 0.10	0.070 0.020	**0.50** 0.05	**0.80** 0.10
Barium (Ba)	7440-39-3	1500	USEPA Residential RSL	330	USEPA Eco-SSL	165	0.026 0.037	0.30 0.10	0.50 0.20
Copper (Cu)	7440-50-8	310	USEPA Residential RSL	28	USEPA Eco-SSL	14	0.16 0.071	1.0 0.20	2.5 0.30
Iron (Fe)	7439-89-6	5500	USEPA Residential RSL	pH dependent[5]	USEPA Eco-SSL	2750	1.4 2.4	8.0 6.0	10 10
Lead (Pb)	7439-92-1	400	USEPA Residential RSL	11	USEPA Eco-SSL	5.5	0.09 0.007	0.40 0.05	0.5 0.10
Nickel (Ni)	7440-02-0	150	USEPA Residential RSL	38	USEPA Eco-SSL	19	0.04 0.026	0.40 0.12	4.0 0.20

Notes:
[1] The PSL is set using most conservative screening level between [1] USEPA RSLs for Residential Soil (May 2021) with excess lifetime cancer risk (ELCR) = $1x10^{-6}$, [2] USEPA RSL for Residential Soil (May 2021) with a THQ =0.1, [3] USEPA RSL for Industrial Soil (May 2021) with a ELCR of $1x10^{-6}$, and [4] USEPA RSL for Industrial Soil (May 2021) with a THQ=0.1. PSLs will be used in the RI in the fate and transport, HHRA and ERA sections.

[2] The PSL for ecological receptors is set at the lowest concentration (most conservative value) among the USEPA Region IV Ecological Screening Values and USEPA Eco-SSL Guidance Documents. PSLs will be used in the RI in the fate and transport, HHRA and ERA sections.

[3] The overall "Project LOQ Goal" is ½ PAL (i.e., the lowest PSL); see Note 6. For those constituents where ½ PAL would be less than the LOQ, the value was set at the LOQ as per USACE New England District convention. For those constituents without a PSL, the value has been set to five times (5x) the LOQ by the acceptable methodology. The DLs, LODs, and/or LOQs that are higher than the given PSLs have been highlighted yellow and bolded for ease of identification.

[4] The screening levels are used in project planning to help target the selection of the most appropriate methods and analyses for the project. In some cases, laboratories may not be able to reach detection limits below the screening level. In these cases, the project team will address this issue in the risk management decision process. For analytes with the LOQ > PAL, the risk assessment will address the analyte using a weight-of-evidence approach. Lines of evidence include: was the analyte detected in other media; is the analyte is an expected degradation product of another analyte that was detected (or conversely is the analyte the original/parent compound); and is the combination of media and endpoint associated with the PAL likely to result in a significant underestimate of risk (e.g., is the pathway likely complete and is the LOD associated with a significant risk-level). This would be a qualitative, not quantitative, evaluation. Additional discussion on performance of the risk assessments is provided in the Risk Assessment Work Plan (Appendix D). These initial screening levels are used in the MR-QAPP for project planning and may not be appropriate for use in subsequent steps of the project (e.g., RI Report, Risk Assessment, Feasibility Study). A review of available detection limits was performed as part of the evaluation/selection of the analytical laboratory.

[5] Aluminum and iron EcoSSLs are dependent on soil pH.

[6] The use of Method 6020 to achieve lower laboratory limits (of specific concern for antimony) will be further evaluated prior to the collection/analysis of soil samples. This evaluation will be part of the assessment of results from the previous investigation tasks, and final method selection will be included in the Technical Memorandum for the MC sampling program. Concurrence from USACE on the Technical Memorandum recommendations will be obtained prior to proceeding with the MC investigation.

[7] Although not shown in the table, the PAL is the most conservative (i.e., lowest) of the human health and ecological PSLs and is used to make sure the selected analytical laboratory and method can provide accurate data (i.e., quantitative results with known precision and bias) at the PAL.

QAPP WORKSHEET #15D: PROJECT ACTION LIMITS[5] AND LABORATORY-SPECIFIC DETECTION/QUANTITATION LIMITS – SELECT METALS

Matrix: Aqueous (Groundwater)
Analytical Group: Select Metals (SW-846 Method 6010D [top row] and Method 6020A [bottom row])

Analyte	CAS Number	Human Health PSL [1,3] ([µg/L])	Human Health PSL Reference [1]	Project LOQ Goal [2, 3] (µg/L)	Achievable Laboratory Limits		
					DL (µg/L)	LOD (µg/L)	LOQ (µg/L)
Aluminum (Al)	7429-90-5	2000	USEPA Tap Water RSL	1000	15 4.4	100 40	300 100
Antimony (Sb) [4]	7440-36-0	0.78	USEPA Tap Water RSL	8.0 / 1.0	**1.3** 0.054	**5.0** 0.5	**8.0** **1.0**
Barium (Ba)	7440-39-3	380	USEPA Tap Water RSL	190	0.2 0.27	3.0 1.0	5.0 2.0
Copper (Cu)	7440-50-8	80	USEPA Tap Water RSL	40	0.63 0.18	10 2.0	25 3.0
Iron (Fe)	7439-89-6	1400	USEPA Tap Water RSL	700	5.4 13	80 60	100 100
Lead (Pb)	7439-92-1	15	USEPA Tap Water RSL & MCL	7.5	1.1 0.074	4.0 0.5	5.0 1.0
Nickel (Ni)	7440-02-0	39	USEPA Tap Water RSL	19.5	0.28 0.15	4.0 1.2	10 2.0

Notes:
[1] The PSL is set at the lowest concentration (most conservative value) among USEPA RSL for Tap Water (May 2021) with ELRC = 1x10^{-6}, [2] USEPA RSL for Tap Water (May 2021) with a THQ=0.1, and [3] the USEPA Maximum Contaminant Levels (MCL) in drinking water. PSLs will be used in the RI in the fate and transport, HHRA and ERA sections.

[2] The overall "Project LOQ Goal" is ½ PAL (i.e., the lowest PSL); see Note 5. For those constituents where ½ PAL would be less than the LOQ, the value was set at the LOQ as per USACE New England District convention. For those constituents without a PSL, the value has been set to five times (5x) the LOQ by the acceptable methodology. The DLs, LODs, and/or LOQs that are higher than the given PSLs have been highlighted yellow and bolded for ease of identification.

[3] The screening levels are used in project planning to help target the selection of the most appropriate methods and analyses for the project. In some cases, laboratories may not be able to reach detection limits below the screening level. In these cases, the project team will address this issue in the risk management decision process. For analytes with the LOQ > PAL, the risk assessment will address the analyte using a weight-of-evidence approach. Lines of evidence include: was the analyte detected in other media; is the analyte is an expected degradation product of another analyte that was detected (or conversely is the analyte the original/parent compound); and is the combination of media and endpoint associated with the PAL likely to result in a significant underestimate of risk (e.g., is the pathway likely complete and is the LOD associated with a significant risk-level). This would be a qualitative, not quantitative, evaluation. Additional discussion on performance of the risk assessments is provided in the Risk Assessment Work Plan (Appendix D). These initial screening levels are used in the UFP-QAPP for project planning and may not be appropriate for use in subsequent steps of the project (e.g., RI Report, Risk Assessment, Feasibility Study). A review of available detection limits was performed as part of the evaluation/selection of the analytical laboratory.

[4] The use of Method 6020 to achieve lower laboratory limits (of specific concern for antimony) will be further evaluated prior to the collection/analysis of groundwater samples. This evaluation will be part of the assessment of results from the previous investigation tasks, and final method selection will be included in the Technical Memorandum for the MC sampling program. Concurrence from USACE on the Technical Memorandum recommendations will be obtained prior to proceeding with the MC investigation.

[5] Although not shown in the table, the PAL is the most conservative (i.e., lowest) of the human health PSLs and is used to make sure the selected analytical laboratory and method can provide accurate data (i.e., quantitative results with known precision and bias) at the PAL.

QAPP WORKSHEET #17 – SURVEY AND PROJECT WORKFLOW (MEC)

The approach to characterizing the nature and extent of munitions-related items at MRS-01 includes site preparation, geophysical surveys, AGC, and intrusive investigation of geophysical target and anomaly source locations. Data will be gathered in three phases: transect surveys (Phase 1), mini-grid surveys (Phase 2), and intrusive investigation of targets and sources within the mini-grids (Phase 3). Information gathered during each of these stages will be used to inform subsequent stages.

Site preparation activities and transect surveys will be conducted as part of the preliminary MRS characterization stage, which intends to identify HD areas. The results of this stage will inform the placement of follow-up mini-grids in the HD areas. HD/LD characterization will be performed through dynamic AGC surveys of the follow-up mini-grids, followed by cued surveys and classification in 50% of the mini-grids.

Follow-up intrusive investigation will characterize the nature of the sources from the classification results. Intrusive investigation will also identify the nature of the geophysical anomaly sources in the mini-grids without cued surveys. The following sections present the workflow in greater detail along with the DFW for each stage. Also included is the identification of the decision points throughout the process between Tetra Tech and USACE.

Table 17-1 summarizes the project workflow. It presents the DFWs, which will govern the implementation of the approach through each phase of the investigation. The DFWs are presented in sequential order of execution, with applicable critical questions and decision points identified within the process. This table also lists the outputs associated with each DFW along with applicable Standard Operating Procedures (SOPs).

The preliminary MRS characterization phase corresponds to DFWs 1 through 4. HD/LD area characterization corresponds to DFWs 5 through 11. The final characterization corresponds to DFW 13. Additional data gathering will be performed in DFW 12, as needed and determined by the PDT. Figures 17-1 and 17-2 present the overall field investigation workflow process.

Table 17.1. Project Workflow and Documentation

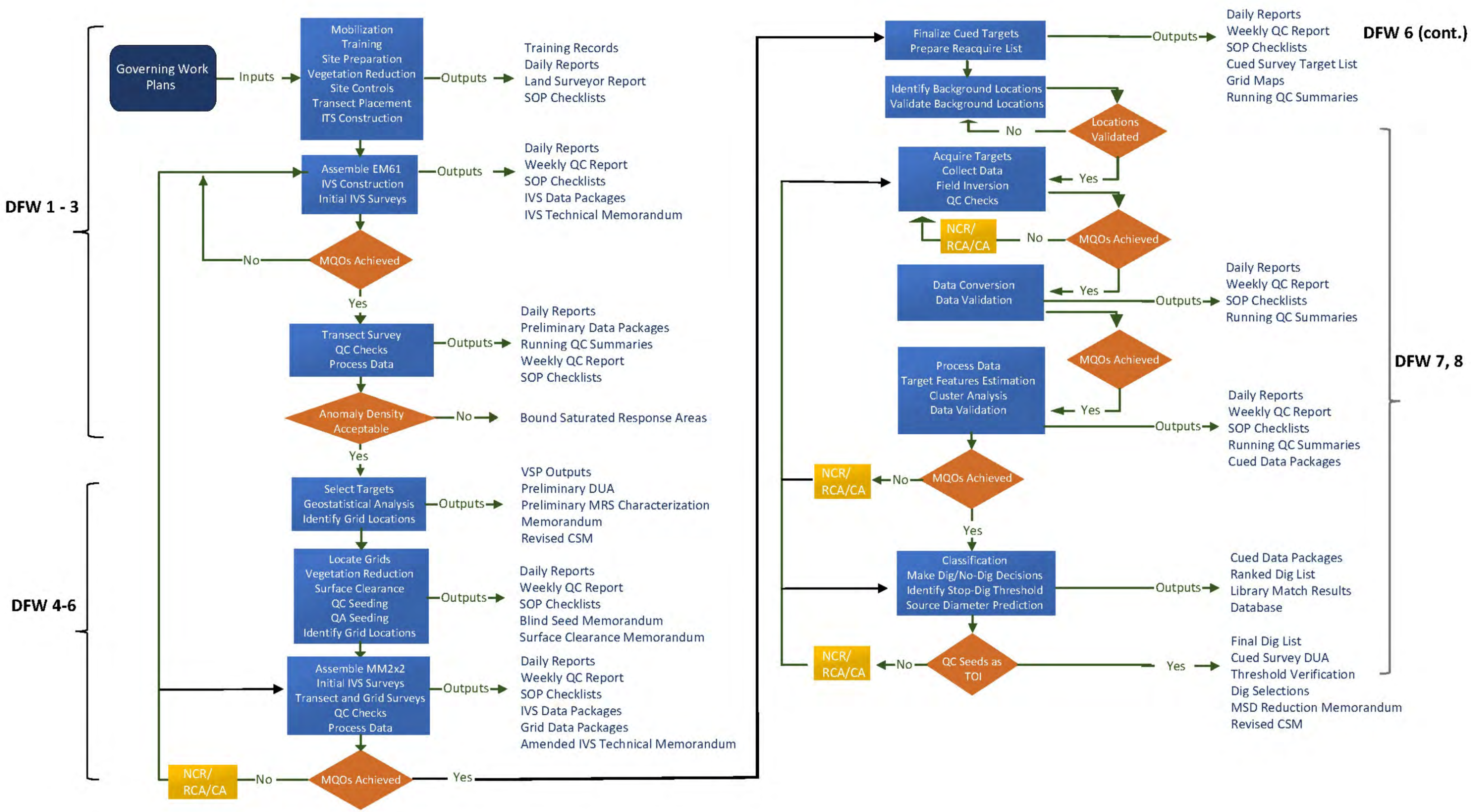
DFW	Title	Documentation	Applicable SOPs
1	Training, Site Preparation, Vegetation Reduction, and Site Controls	• Training records • Preparatory and initial inspection records • Daily field production and QC reports • Land surveyor report • Instrument test strip (ITS) construction details • Updated project GIS • SOP checklists	• UXO SOP 1 • UXO SOP 2 • AGC SOP 9 • AGC SOP 11
2	Geophysical Sensor Assembly, IVS Establishment, and Initial IVS Survey	• Preparatory and initial inspection records • Daily field production and QC reports • Weekly DGM/AGC QC report • Processed DGM data package (IVS surveys) • IVS ground truth locations • QC database • Training records • IVS Technical Memorandum • SOP checklists	• AGC SOP 1c • AGC SOP 2 • AGC SOP 4 • AGC SOP 6 • AGC SOP 11 • AGC SOP 13

DFW	Title	Documentation	Applicable SOPs
Critical Question: Were IVS MQOs achieved? If yes, proceed to DFW 3. If no, perform root cause analysis (RCA), develop CA, and re-evaluate steps completed in DFW 2.			
3	Initial Transect Survey, Data Processing	• Preparatory and initial inspection records • Daily field production and QC reports • Weekly DGM/AGC QC report • QC database • SOP checklists	• UXO SOP 1 • AGC SOP 5 • AGC SOP 6
Critical Question: Were dynamic survey MQOs achieved? If yes, proceed to DFW 4. If no, perform RCA, develop CA, and re-evaluate steps completed in DFW 3.			
4	Preliminary Dynamic DUA, HD/LD Delineation	• Preparatory and initial inspection records • Weekly DGM/AGC QC report • Dynamic target list (transects) • Preliminary dynamic DUA • Revised CSM • Preliminary MRS Characterization Memorandum	• AGC SOP 13
Critical Decision Point: USACE review of DUA and concurrence with target selections and proposed grid layout.			
5	Mini-grid Layout and Blind Seeding	• Preparatory and initial inspection records • Daily field production and QC reports • Weekly DGM/AGC QC report • As-staked mini-grid locations • Updated project GIS • Blind QC Seed Memorandum • Surface Clearance Memorandum • SOP checklists	• AGC SOP 3 • AGC SOP 11 • AGC SOP 13 • UXO SOP 1
6	Dynamic AGC Surveys (Transects and Mini-grids)	• Preparatory and initial inspection records • Daily field production and QC reports • Weekly DGM/AGC QC report • Amended IVS Technical Memorandum • Dynamic and cued MM2x2 IVS survey data packages • Processed dynamic AGC data packages • Intrusive investigation database • QC database • Cued target list • Dig list (for mini-grids with no cued surveying) • SOP checklists	• AGC SOP 1a • AGC SOP 4 • AGC SOP 5 • AGC SOP 6 • AGC SOP 7 • AGC SOP 8 • AGC SOP 13 • UXO SOP 3 • UXO SOP 4
7	Cued Surveys (Mini-grids)	• Preparatory and initial inspection records • Daily field production and QC reports • Weekly DGM/AGC QC report • Processed cued data packages • QC database • SOP checklists	• AGC SOP 7 • AGC SOP 8
Critical Question: Were dynamic and cued survey MQOs achieved? If yes, proceed to DFW 8. If no, perform RCA, develop CA, and re-evaluate steps completed in DFWs 7 & 8.			

DFW	Title	Documentation	Applicable SOPs
8	Classification, Data Assessment, and Validation, Preparation of Dig List	• Preparatory and initial inspection records • Weekly DGM/AGC QC report • Updated dynamic survey DUA (mini-grids) • Cued survey DUA • Revised CSM • Dig list • MSD Reduction Memorandum	• AGC SOP 10 • AGC SOP 13 • AGC SOP 14
Critical Decision Point: USACE review of DUAs and concurrence with dig list.			
9	Target Reacquisition, Intrusive Investigation, Identification of Sources, and MPPEH Inspection, Verification, and Certification	• Preparatory and initial inspection records • Daily field production and QC reports • Intrusive investigation database • QC database (with anomaly resolution results) • Material Documented as Safe (MDAS) disposal form (1348-1)	• AGC SOP 10 • AGC SOP 11 • AGC SOP 14 • UXO SOP 4 • UXO SOP 5 • UXO SOP 6
10	MC Sampling	• Collect soil samples to confirm presence and determine nature/extent of MC • Data validation and QC data procedures • Well installation and development if necessary • Collect groundwater samples, if warranted, to confirm presence and determine nature/extent of MC	• MC SOP 1 • MC SOP 2 • MC SOP 3 • MC SOP 4
11	Characterize HUA, Establish LUA and Buffer Area, determine if NEU Area Exists	• Preparatory and initial inspection records • Updated project GIS • Revised CSM • Draft version of final DUA	• AGC SOP 13
Critical Decision Point: USACE review of draft intrusive DUA and concurrence that gathered data support effective characterization of the sites. **Critical Question: Are additional data needed to support achievement of project objectives? If yes, proceed to DFW 12. If no, proceed to DFW 13**.			
12	Gather Additional Data (As Needed)	• As appropriate for data gathered	• As appropriate for data gathered
13	Final DUA, Submit Data for FS Development	• Preparatory and initial inspection records • Updated project GIS • Revised CSM • Final DUA	• AGC SOP 13

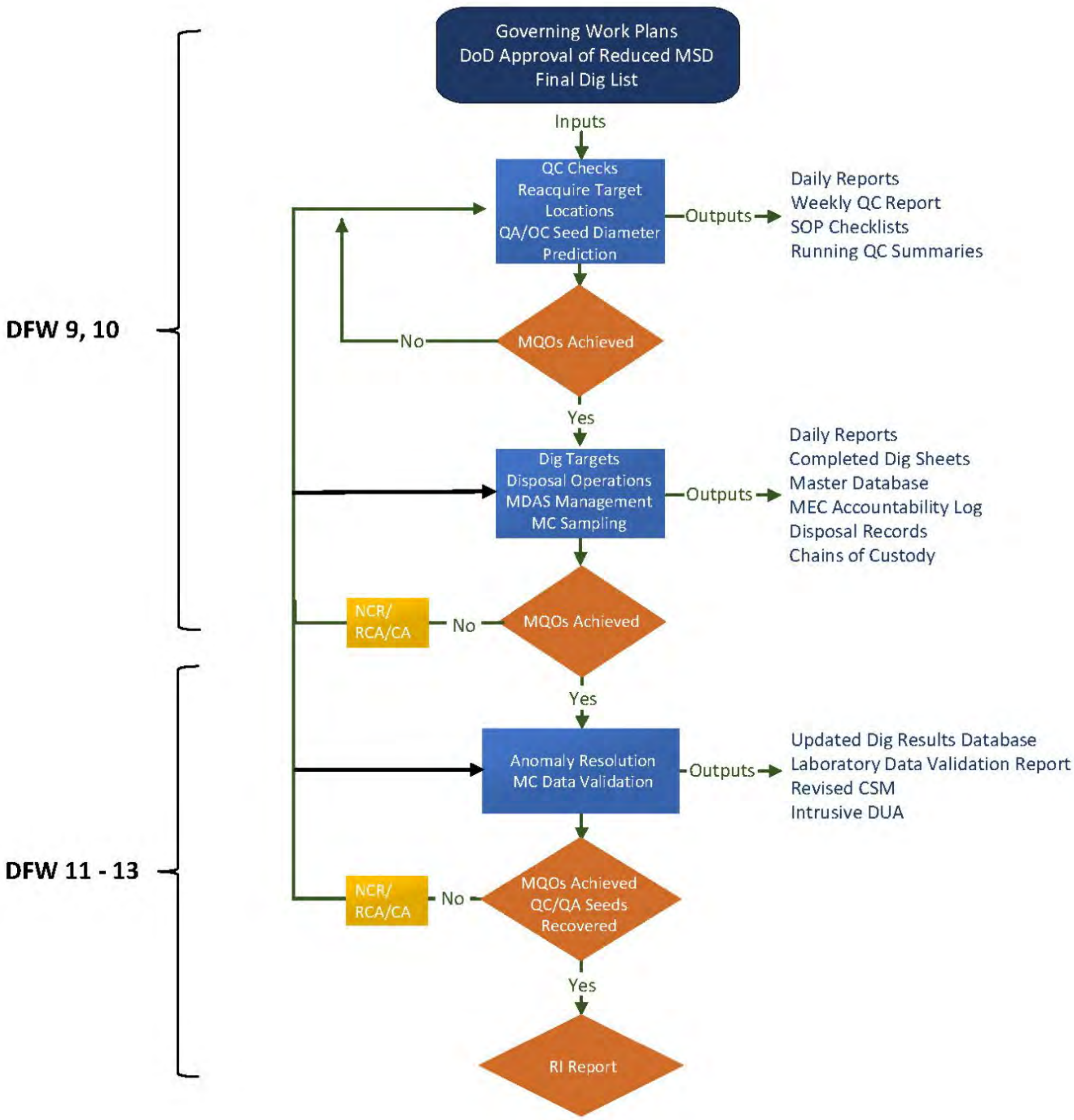
1 **Figure 17-1. DFWs 1 through 9 Workflow Process**

2



3

Figure 17-2. DFWs 9 through 13 Workflow Process



17.1 Preliminary MRS Characterization

VSP was used to design the transect survey to be performed as part of the Preliminary MRS Characterization. Table 11-2 in Worksheet 11 presents the additional VSP inputs used in deriving the transect layout in MRS. Estimated densities are based on a review of historical data and known and expected munitions from the CSM in Worksheet 10.

The design transect spacing is 500 feet for the majority of the MRS except for the residential area in the southwest corner of the MRS (Figure A-6). Figures A-7 through A-14 show the proposed transect layout in smaller subsections throughout the MRS. In order to reduce impacts to the local community, the PDT agreed to use 750 feet spacing between transects in the residential area in the southeastern portion of the MRS (Figure A-14).

The VSP results in Table 11-2 demonstrate both design spacings exceed the requirement for 100% traversal and detection of an AN-M54 4lb incendiary bomb (1,028 ft). Table 17-2 summarizes the estimated densities and transect survey coverage at the project design spacing for Phase 1 transects. Our rationale for spacing of 500 feet intends to not only minimize the need for adding interleaved transects during Phase 1 operations but also considers the site history for MRS-01 in Worksheet #10. The smaller spacing of 500 feet compared to the VSP outputs in Table 11-2 is warranted to provide consistent, adequate coverage of the MRS and accurate delineation of HD areas.

Table 17-2. Preliminary MRS Characterization Survey Coverage

MRS	Background Density	Critical Density	Transect Survey Coverage
MRS-01	20 anomalies/acre	75 anomalies/acre	• 324,350 linear feet of EM61-MK2 transects; 3.3-foot swath • 1.4% coverage of MRS

17.2 DFW 1: Training, Site Preparation, Vegetation Reduction, and Site Controls

Training sessions in support of this project will be conducted both prior to mobilization to the site and once on-site. Prior to mobilization, a field readiness review will be conducted. In addition, all staff performing tasks that directly impact the quality of geophysical and AGC data collected onsite will undergo training on Tetra Tech's DAGCAP requirements and accredited AGC procedures relevant to the work they will be doing IAW AGC SOP 9.

After mobilization of personnel, equipment, and materials to the project site, onsite training will be conducted by field management. The focus of the training is to ensure site personnel fully understand the operational procedures/planned activities and their roles and responsibilities as defined in the governing work plans and to review and acknowledge the Accident Prevention Plan (APP)/Site Safety and Health Plan (SSHP) (Appendix G). Training will be conducted by the SUXOS, UXOSO/QCS, or other personnel deemed technically competent. Biological awareness, avoidance, and protection training will be provided by the biologist. All training will be documented in project training records at the start of the project.

Vegetation Reduction: Vegetation reduction will be performed by our UXO personnel IAW the APP/SSHP, and UXO SOP 2, as allowed based on ROEs, and final consultation with the NY State Natural Heritage Division. Vegetation reduction will be conducted along planned transects using a skid steer with flail attachment. Additional vegetation clearance may be conducted at the end of transects as needed to assist field teams in traversing between transects. Personnel will not intentionally contact the ground surface with cutting tools during the removal process. Vegetation will be removed to a height of approximately 4 to 6 inches above ground surface, and trees with a diameter of 4 inches or more at chest height will be left in place. Stumps and roots will be left in place to protect the soil and foster regeneration, and brush material will be chipped and left in place. Appropriate precautions will be taken to ensure site activities do not cause a wildfire.

Surface MEC avoidance will be conducted by UXO technicians during vegetation reduction IAW UXO SOP 1.

Site Control: Tetra Tech's NY-licensed land surveying subcontractor will establish site-specific control within MRS-01 IAW AGC SOP 11. Control will be established to a minimum of third-order accuracy (1:10,000) and will be referenced to a high-accuracy reference network (HARN), continually operating reference station (CORS), Virtual Reference Station (VRS), or equivalent network. If site-specific control exists, the land surveyor will first verify it meets the project accuracy requirements and MQOs. If necessary, new temporary control points will be established for use by Tetra Tech in performing resections and required geodetic functionality checks. Our UXO personnel will implement MEC avoidance and subsurface anomaly avoidance procedures during land survey activities IAW UXO SOP 1.

Analog Geophysical Instrument Test Strip: An instrument test strip (ITS) will be constructed to test and confirm that analog geophysical instruments are working properly. Analog instruments will only be used for MEC avoidance. The ITS will be established in a location convenient to but outside the work area. Three (3) ISOs, two small and one medium ISOs, will be seeded in the ITS in a horizontal orientation at 4, 8, and 12 inches bgs, respectively.

Analog instrument field QC will include instrument verification checks at the ITS daily before fieldwork begins. The ITS will be used to confirm and document that the hand-held analog geophysical instruments are working properly, and the operator is able to detect the ISOs at their respective depths consistently.

Instrument-Aided MEC Avoidance: UXO personnel will implement anomaly avoidance measures IAW UXO SOP 1 when escorting the land surveyor subcontractor on-site. MEC avoidance will also be implemented when Tetra Tech UXO personnel are conducting any brush clearing operations. MPPEH identified on-site will be handled IAW UXO SOP 6. UXO personnel will also implement anomaly avoidance measures prior to the placement of wooden stakes, nails, hubs, or other objects in the ground and during IVS and ITS construction.

17.4 DFW 2: Geophysical Sensor Assembly, IVS Establishment, and Initial IVS Survey

Prior to the start of data collection, the field team will assemble the Geonics EM61-MK2 and perform initial function checks on the sensor and positioning system IAW AGC SOP 1c.

IVS Establishment: Tetra Tech will construct an IVS to perform initial sensor validation IAW AGC SOP 2. Prior to IVS construction, a pre-seeded "background" dynamic survey of the area will be completed using the EM61-MK2 to assess suitability and identify candidate locations for the seeds. Small schedule ISO80s (McMaster Carr part number 4550K226) will be used as seeds in the IVS at depths, which provide a signal-to-noise ratio acceptable for identifying system failures. The IVS will also include a blank space to be used as a background location during subsequent AGC phases of work. Table 17-3 presents the planned IVS construction details.

Table 17-3. Planned IVS Construction Details

Seed	Type	Depth (cm)	Orientation	Inclination
IVS1	Small ISO80	10	Cross-line	Horizontal
IVS2	Small ISO80	15	Cross-line	Horizontal
IVS3	Blank Space	NA	NA	NA

The seeds will be photo-documented during construction, and details such as position, depth to the approximate center of mass, orientation, and inclination will be recorded and presented as part of the IVS Technical Memorandum. Vinyl-stem flags labeled with the IVS seed identification will mark each of the three locations in the IVS. A noise strip will be positioned approximately 3m from the seeded line to effectively monitor EM61-MK2 noise levels throughout data collection. UXO personnel will implement subsurface anomaly avoidance measures during the construction of the IVS and the emplacement of seed items.

Initial IVS Survey: Following construction and documentation that the IVS is complete, an initial dynamic survey of the IVS will be performed with the EM61-MK2 using a Robotic Total Station (RTS) positioning system IAW AGC SOP 4. Data processing steps will be performed IAW AGC SOP 6.

Processed data packages will be provided to the USACE QA Geophysicist for review, along with the IVS Technical Memorandum and other documentation listed in Table 17-1. The IVS Technical Memorandum will be generated IAW AGC SOP 13.

17.5 DFW 3: Initial Transect Survey and Data Processing

Tetra Tech will perform the transect surveys using the Geonics, Ltd. EM61-MK2 along transects spaced at 500-foot intervals throughout the majority of the MRS and at nominal 750-foot spacing in the residential areas IAW AGC SOP 5. Each transect will be completed as a single pass with a single 1-meter x 0.5-meter EM61-MK2 coil, with the coil's long axis oriented perpendicular to the direction of travel. UXO personnel will navigate along a series of pre-planned transects loaded onto a handheld GPS unit walking ahead of the DGM team providing MEC avoidance. Observed MPPEH at the surface will be conspicuously marked by the UXO escort, and the DGM team will evacuate the area. The location of the item will be further categorized, documented, and handled IAW the ESP.

Deviations along transects may be necessary to avoid site infrastructure (e.g., signs, guard rails, and so forth), trees, or other obstructions that cannot be removed. In these cases, the DGM team will traverse around the obstruction and maintain data collection along the as-walked path. Sections of a transect path may be minimally rerouted during fieldwork if it is discovered the planned transect alignment passes through a building, secure fenced site, or any other feature which presents a physical impasse. Adjustments may be permitted to the extent the transect survey still meets the traversal and detection goals for the project.

The raw field data (production and QC test data), daily field notes, and other supporting field documentation will be uploaded at the end of each day by the Site Geophysicist to a secure Tetra Tech network server or project Share Point site. The Site Geophysicist will verify field records are complete prior to uploading the information for the Data Processor and provide necessary information to the SUXOS and UXOSO/QCS for completion of daily field production and QC reports. Raw data packages may be uploaded the following morning if internet connectivity or outages affect the ability to upload data at the end of a workday. Instrument field QC testing frequency and performance criteria for this phase of work are presented in Worksheet # 22.

The EM61-MK2 data will be pre-processed using Geonics, Ltd. or Geomar software, and final processing will be performed using Geosoft Oasis Montaj (Geosoft) IAW Tetra Tech AGC SOP 6.

17.6 DFW 4: Target Selection, Preliminary Dynamic DUA, HD/LD Delineation

Target selection will be performed by deriving locations of geophysical anomalies with peak amplitudes above the project target selection threshold. This threshold will be established at 5x the RMS noise. A review of the data collected at the IVS and initial transects will be reviewed to assess whether a more aggressive multiple of the RMS noise is appropriate.

The target selections and the surveyed transect paths will be imported into VSP for geostatistical analysis and determination of relative anomaly density using the Target of Interest (TOI) Estimation/Comparison module in VSP. Tetra Tech will generate a DGM Target Selection Memorandum IAW AGC SOP 13, which will combine a discussion of the target threshold establishment process and preliminary MRS characterization results. Site-specific noise levels will be discussed in this memorandum as part of the target threshold establishment process. The Preliminary MRS Characterization Memorandum will include an assessment of the geostatistical analysis results and present recommendations for follow-up mini-grid locations for review by USACE.

SRAs identified in the transect data will be excluded from the VSP analysis. The occurrence of SRAs will be addressed with the PDT and included in the preliminary characterization and data usability assessment after completion of the transect survey. Tetra Tech will assess the usability of data gathered to this point to provide confidence that the quality and quantity of data are appropriate for informing the next steps.

17.7 DFW 5: Grid Layout, Blind Seeding, and Surface Clearance

Upon concurrence of follow-up mini-grid locations, fifty (50) 0.11-acre (50 x 100 ft) mini-grids will be physically marked in the field by a Professional Land Surveyor IAW AGC SOP 11. Tetra Tech intends to layout mini-grids based on geostatistical analysis results from Phase 1. Precise placement of mini-grids will be adjusted, as necessary, to avoid site features (e.g., roads, parking lots, and so forth), which may limit the ability to collect high-quality geophysical data, reduce survey coverage or perform follow-up intrusive investigation. The overall coverage area for the mini-grids is approximately 5.7 acres.

Vegetation reduction will be performed for the mini-grids using the skid steer with flail attachment in heavily vegetated areas; if required, handheld vegetation removal tools may also be used. An additional 10-foot buffer will be cut around the perimeter of each mini-grid, as needed, to provide adequate room for field teams to maneuver and operate equipment. Determination of the need for vegetation reduction and property restoration on residential properties will be discussed with the PDT, and options will be awarded for property restoration, if needed.

UXO personnel will complete an instrument-aided surface clearance using Schonstedt GA-52Cx gradiometers in mini-grids planned for geophysical surveys IAW UXO SOP 3. Search lanes will be established and oriented in a direction that provides the best metallic anomaly response to instrument detection and will be noted in field documentation. Search lanes will be marked with rope or an equivalent method to ensure 100% coverage of the clearance area. The team will remove all surface metal objects greater than 5 cm in any dimension from the surface.

If suspect MEC is identified, non-essential personnel will leave the area while pertinent information is electronically recorded by the SUXOS or UXO Technician III. The USACE PM will be notified immediately of a MEC discovery, and recovered MEC/MPPEH will be managed IAW with the ESP. All metallic objects recovered will be documented IAW the criteria presented in Worksheet # 22 and presented in the Surface Clearance Memorandum.

Blind QC seeds will be placed within full-coverage grids at a frequency of 1 seed per mini-grid IAW AGC SOP 3, using approximately 70% small ISOs, 20% medium ISOs and 10% large ISOs. Tetra Tech's Blind Seeding Firewall Plan (Appendix C) will be followed to ensure the seed details are properly firewalled from production and processing personnel. The maximum burial depth and planned orientation for each seed type are presented in Table 17-4. These maximum burial depths are consistent with the example detection depths listed in Worksheet #11, DQO Step #4, Spatial and Temporal Boundaries.

A complete list of QC seed locations will be included in the Blind QC Seed Memorandum. This memorandum and the accompanying seed registry will include the emplacement details for each seed. Seeds will be emplaced by UXO personnel using hand tools. Localized site conditions preventing achievement of maximum seed burial depths will be documented in the Blind QC Seed Memorandum. USACE will place QA seeds within the mini-grids, although this information will remain blind to Tetra Tech.

Table 17-4. Blind QC Seed Maximum Depths

Seed Type	% of Total	Orientation	Maximum Burial Depth (in)
Small ISO80	60	Horizontal	12
Small ISO80	10	Vertical	18
Medium ISO40	20	Horizontal	24
Large ISO40	10	Horizontal	36

17.8 DFW 6: Dynamic Surveys (Transects and Mini-grids)

Prior to starting dynamic surveys of follow-up mini-grids as part of Phase 2, Tetra Tech will use the MM2x2 with RTS positioning to collect sections of transects from the Phase 1 DGM survey as part of this DFW. The selected transect segments will intend to span LD and HD areas, including buffer zones, identified from the Phase 1 VSP geostatistical analysis. The sections of transects to be collected with the MM2x2 and the justification for their inclusion will be addressed in the Preliminary MRS Characterization Memorandum. The purpose of this follow-up dynamic transect survey is to facilitate a comparison of derived anomaly densities in mini-grids with transects as part of the project MPCs, as well as to assess density estimates derived using DGM and AGC sensors to inform development of the FS, as necessary. Tetra Tech will collect an estimated two miles of transect data with the MM2x2.

Prior to dynamic data collection, the MM2x2 field team will assemble the AGC sensor, positioning system, and Inertial Measurement Unit IAW AGC SOP 1a. Initial dynamic and cued surveys of the IVS will be performed with the MM2x2 IAW AGC SOP 4, and data processing of the IVS survey will be performed IAW AGC SOPs 6 and 8. Prior to collecting cued measurements at the IVS, the blank space location will undergo the background validation process in AGC SOPs 7 and 8. The IVS Technical Memorandum will be amended to include validation of the MM2x2 system at the IVS. This amendment will be prepared IAW AGC SOP 13.

Transect surveys will comprise a single pass with the MM2x2 along the selected transect segments identified in the Preliminary MRS Characterization Memorandum. The dynamic mini-grid surveys will be completed using a 1.6-foot line spacing in order to provide 100% coverage of the accessible mini-grid area. The MM2x2 data will be collected, uploaded, and processed as discussed in DFW 3. Data processing will culminate in a list of target locations derived from the dynamic data sets for follow-up cued interrogation and/or intrusive investigation. The Target Selection Memorandum will be amended to include discussion of the target threshold establishment process for the MM2x2 dynamic surveys; site-specific noise levels in the MM2x2 detection data will addressed in this amendment.

SRAs identified within the mini-grids will be delineated as polygons on the results maps for incorporation into the project GIS and refinement of the CSM, as appropriate. If mini-grid locations appear to be placed in areas where anomaly density prevents reliable target selection, discussions with USACE will be initiated to determine an appropriate path forward to achieve the RI objectives.

17.9 DFW 7: Cued Surveys (Mini-grids)

The MM2x2 will be used to perform cued interrogation of all targeted anomalies in 50% of the mapped mini-grids, for an estimated total of 3 acres. This data will be used to evaluate clutter rejection rates and help to minimize impact to property owners during Phase 3 operations.

Selection of grids to undergo cued interrogation will be discussed with the PDT and will consider the severity of impacts to the local community during intrusive operations in Phase 3. Because Tetra Tech plans to dig 100% of the mini-grid target locations, regardless of whether they undergo cued interrogation, the use of AGC as the basis for reducing the MSD in these areas will be a PDT consideration in identifying grids to undergo cued surveys.

Planned background locations will be selected from the processed dynamic AGC surveys and validated for use as suitable locations in the field. Background data will be collected with the MM2x2 at a minimum of once every two hours of data collection IAW AGC SOP 7. Cued measurements will be processed IAW AGC SOP 8, and data will be uploaded as discussed in DFW 4. Field QC testing frequency and performance criteria for this phase of work are presented in Worksheet # 22.

17.10 DFW 8: Classification, Data Assessment, and Validation, Preparation of Dig List

Tetra Tech will use the UX-Analyze extension in Geosoft to process and classify the cued data IAW AGC SOP 8. Geophysical anomaly sources will be classified as either TOI, non-TOI, or Inconclusive. Outer diameter predictions will be provided for TOI designations in accordance with AGC SOP 14 along with the classification results if the PDT elects to consider flexible MSDs. Tetra Tech will develop a site-specific library from the DoD master reference library to include site-specific TOIs discussed in the CSM. If the current version of the DoD-managed TOI library does not include munitions listed in the CSM, Tetra Tech will discuss with the PDT, which munitions are suitable representatives for inclusion in the site-specific library. These munitions items will serve as the starting point for the development of specific failure criteria to be determined during the SPP. Data validation and verification will be performed IAW AGC SOP 10.

Final deliverables for this phase will include the raw and processed data, as well as decision plots containing polarizability curves and other information necessary for confirming the data quality and rationale for classification and TOI diameter prediction, and the final dig list. An MSD

Reduction Memorandum will be provided with the final dig list for PDT review and acceptance with the dig list. This memorandum will be prepared in accordance with AGC SOP 13. Acceptance of the memorandum will be considered DoD approval of the use of the reduced MSD, although Tetra Tech understands ongoing evaluations of recovered sources (i.e., ground truth) and TOI prediction performance may result in changes to this acceptance status and/or the need to amend the memorandum.

Tetra Tech will perform a data usability assessment of the dynamic and cued mini-grid surveys as part of DFW 8. The DUAs will serve as validation memoranda, which will document achievement of the MQOs and summarize activities completed to date, and facilitate input from USACE and the PDT, as appropriate, regarding the usability of the data to support the use of a reduction in the MSD and meet the overall project objectives.

17.11 DFW 9: Target Reacquisition, Intrusive Investigation, Identification of Sources, and MPPEH Inspection, Verification, and Certification

Targets selected for intrusive investigation will be reacquired by the UXO team IAW AGC SOP 11. As-placed flag locations will be compared to the supplied target locations to verify the accurate placement of flags in the field.

All UXO personnel conducting the intrusive investigations will be qualified for their position IAW TP-18, and work will be conducted IAW UXO SOP 4. The primary means of investigating subsurface anomalies will be by hand excavation within a 1.3-foot radius around each reacquired source location. All munitions debris and other debris will be segregated and managed separately from MEC/MPPEH. All encountered MEC will be documented in the MEC tracking log and reviewed for accuracy by the SUXOS and UXOSO/QCS. An exclusion zone of 638 ft will be established around the dig area when excavating potential munitions, and field management will coordinate with the PDT to limit impacts to the community and environmentally sensitive areas. Community evacuations and property restoration will be facilitated as needed. This exclusion will be appropriately reduced in accordance with the recommendations in the DoD-accepted MSD Reduction Memorandum submitted with the final dig list and DDESB-approved ESP.

Target locations will be investigated, and descriptions will be entered on dig sheets or into tablets. Documentation will include the measured distance from the flag for each metallic object (i.e., source) identified within the 1.3-foot radius around the flag location. Distances will be measured as cardinal directions. The position of MPPEH will be recorded using RTS (or equivalent). The resulting intrusive investigation database will include the supplied source northing and easting on the dig list, date discovered, transect/mini-grid, specific target identifier, nomenclature, source depth, source type, weight, photograph number, and disposition method and date. The measured position (X, Y) of discovered MEC items will also be included in the database. Multiple sources identified at a single flag location will be logged individually using separate identifiers (e.g., A, B, C, etc.) in the database. Each dig location will be photo-documented using a whiteboard and scale for the recovered sources. MEC/MPPEH will be managed IAW the approved ESP. Recovered MEC will be documented in the MEC tracking log and reviewed for accuracy by the SUXOS and UXOSO/QCS.

Once anomaly sources have been resolved, the target locations will be made available to the UXOSO/QCS for inspection and verification. Excavations will be backfilled once QC has been completed and following any sampling required for the respective location.

Anomaly Resolution: As part of the anomaly resolution process, the UXOSO/QCS will perform a qualitative assessment of the intrusive findings at each geophysical anomaly source location intrusively investigated. The QC Geophysicist will review the excavated result against the predicted source size, shape, fit location, and fit depth in the classification results for those locations having undergone cued interrogation. The QC Geophysicist will review the excavated result against the anomaly characteristics (e.g., amplitude, footprint) in the dynamic survey data and the outer diameter prediction in the classification results. These assessments will be documented in the master project database and will be used as part of the ongoing assessment of the use of reduced MSDs during intrusive operations. Specific failure criteria for the anomaly resolution process are identified in Worksheet #22. When using reduced MSDs, if a recovered object classified as a TOI on the final dig results does not match the outer diameter prediction, the MSD will revert to the munition with the greatest fragmentation distance in the ESP.

MEC Accountability. During fieldwork, our SUXOS, UXOSO/QCS, and UXO Team Leader will maintain a detailed accounting of all MEC items/components encountered IAW UXO SOP 5 and 6.

MEC Disposal and Donor Explosives. All MPPEH and MD will be processed IAW EM 200-1-15 and EM 385-1-97, applicable Errata Sheets, the ESP, and UXO SOP 5. One hundred percent of the observed MPPEH will be inspected by a UXO Tech II or higher, re-inspected by a UXO Tech III, and certified by the SUXOS as MDAS or MPPEH if further venting is required to fully determine the explosive status. If determined to be MPPEH or if an item requires explosive venting for verification, the items will be detonated IAW ESP requirements. Tetra Tech will use on-call donor explosives and have them delivered the day they will be used.

Disposal/Disposition of MDAS. Any MD recovered during the investigation will be properly inspected, characterized, containerized, labeled, and secured IAW UXO SOP 6. Upon completion of the field activities, all waste items will be disposed IAW all DoD, DA, USACE, federal, state, and local guidance and regulations. The certification/verification process will be documented on form DD 1348-1A. Dual independent 100% inspections will be performed on all MDAS prior to being shipped off-site. The Tetra Tech SUXOS will sign the DD 1348-1A as the certifier, and the UXOSO/QCS, in the absence of a government representative, will sign as the MDAS verifier.

Backfill and Site Restoration. Once each anomaly location has been confirmed, cleared, or characterized, and following any required sampling or QC inspection, the anomaly location will be backfilled to the original grade with spoils from the excavation. This approach will eliminate any excavations remaining open for extended periods and creating hazards for personnel and wildlife.

Evacuations (Optional Task): Evacuations of residents, commercial properties, and roads may be required, based on the locations of the intrusive investigations. Our Community Relations Specialist, Whitney Gross, will lead this effort. We will make every effort to reduce inconveniences to the resident and minimize the time they have to be away from their home (e.g., implement a flexible MSD approach). We will meet with each resident requiring evacuation to discuss key considerations for the homeowner, including relocation and special needs, schedules, pet boarding requirements, suggestions for personal items they should bring with them or secure, and which expenses are eligible for reimbursement. There are more than 20 hotels within 20 minutes of the project site, ensuring there are adequate facilities to handle all residents during evacuations; these hotels also have rooms that can be rented for a hospitality area. There are also at least four pet boarding facilities for both cats and dogs, and we have identified licensed driving services to provide transport IAW state and local regulations. Upon completion of any evacuation, we will prepare a MEC Intrusive Investigation Technical Memorandum summarizing results of the evacuation activities, which will include lessons learned to improve any follow-on events.

Protection of Property (Optional Task): Should intrusive investigations need to be conducted within residential or commercial properties, property restoration costs will be awarded as separate Optional "not-to-exceed" awards, subject to USACE approval prior to execution. Our Community Relations Specialist, Whitney Gross, will work with USACE and the property owners to conduct video landscape surveys with a qualified arborist and landscape firm if intrusive work may destroy any landscaping. Our subcontractors will provide electronic spreadsheets for appraisals that aid the technical team in efficiently and accurately tracking agreements or decisions made with property owners regarding every plant. Tetra Tech will conduct post-restoration landscape surveying to assess any damage caused and estimate the costs for repairs. Based on our experience with this work in residential/ commercial areas, restoration work could include replacement of sod, planting of new flora, transplanting of original vegetation, or hardscape repair such as steel reinforced concrete driveways, sidewalks, brick patios, or fences. Our landscape contractor will secure any required permits, and as necessary, use geotextile and plywood to access entry points to minimize impacts on residential properties.

Prior to intrusive investigation, we will mark plants and landscape features that do not require removal with yellow caution tape. Shrubs and small trees will be tied back to prevent damage. Site clearing may include removal of vegetation and potentially temporary re-location of ornamental objects or equipment. All vegetation removal will be IAW the approved agreements.

17.12 DFW 10: MC Sampling

The objective of this task is to collect sufficient data of known quality and quantity that meets the project DQOs as defined during the SPP process. Data will be used to determine the nature and extent of MC to support characterization, and perform human health and ecological risk assessments. All field activities will be conducted IAW NYSDEC guidance.

Soil sampling will be performed to characterize potential MC exposure areas by collecting data to compare constituent concentrations (if detected) to applicable regulatory criteria for current and/or future land use (residential and/or industrial/commercial) to support the performance of human health and ecological risk assessments. The risk-based screening levels for soil are discussed in the Risk Assessment Work Plan (Appendix D), with the most conservative level chosen as the PSL (refer to Worksheet #15).

Soil sampling locations will be based on the results of the geophysical and intrusive investigations, as detailed in Table 17.5. If no munitions related items (i.e., HUA of MEC) are found in an area, no MC sampling will be conducted with the exception that the known target areas may be sampled, provided that there are no field observations that would negate the collection of soil samples (e.g., redevelopment, roadways).

The proposed approach is outlined in Table 17.5 below. In Table 17.5, HUAs and LUAs will be determined based on the MEC characterization activities previously described. HUAs are assumed to be areas with sufficient MEC density, while LUAs are assumed to be distinct, individual MEC items that visibly show a likely potential release of MC (breach/corrosion). A groundwater investigation may be performed based on the results of the geophysical surveys and soil sampling, with consideration of the local geological and hydrogeological characteristics (e.g., soil types, groundwater elevations).

All collected samples will be analyzed for select metals (aluminum, antimony, barium, copper, iron, lead, and nickel) based on known/potential munitions, and explosives/propellants. Soil samples will also be analyzed for pH by collecting ten (10) discrete grab samples randomly located within each DU and performing field screening via test kit. A statistical mean of the DU pH will be calculated. During collection of the soil samples within a DU, the sampling technician will conduct a visual survey of the soils to determine general soil type (e.g., sand, silt, clay) and if the soil is geologically homogenous throughout the DU. The visual observations are not to be used to determine soil homogeneity in relation to consistency of pH measurements. Soil type(s) will be noted in the daily report, and reviewed by the Project Chemist. Any significant differences that could impact comparability of soil samples within a DU will be identified by the Project Chemist and discussed with the PDT, if necessary.

The groundwater investigation (including installation of temporary monitoring wells) will only occur based on the results of the geophysical survey and soil sampling, and knowledge of the groundwater of the area. Previous SI results indicated detectable concentrations of aluminum, iron, and lead, with no unacceptable risks to receptors. If concentrations during the RI are deemed sufficiently elevated to indicate potential for release to groundwater via leaching, Tetra Tech will present the logistics of the final groundwater investigation activities to CENAB/stakeholders for concurrence. If performed, the initial sampling will be to determine presence/absence of MC impacted groundwater. If those results indicate additional groundwater sampling is necessary, with PDT concurrence, then subsequent multiple rounds of groundwater sampling will be proposed.

Table 17-5. Proposed MC Program Approach

Location / Feature	Sampling Program
Residential Areas	
HUAs	DU/SU Approach: • If HUA is located across multiple parcels, subdivide HUA by residential parcel boundaries. • If parcel is 0.25 acres or less, the parcel boundary will be the DU with one SU. • If parcel is between 0.25 and 1 acre, the parcel boundary will be a DU, with SUs of up to 0.25 acres each. SUs will cover 100% of the DU. • If parcels are larger than 1 acre, parcel boundary will be a DU. A stratified sampling approach may be performed tied to the associated anomaly density distribution within the DU, and the specified number of SUs will be evaluated. SUs will be 0.25 acres and will not cover 100% of the DU. Sampling Procedure: • Mark out square/rectangle/circle IS SU(s) (depending on approximate shape of HUA). • Perform IS using 1 to 2-in corer to obtain an ~1 kg composite sample composed of 30 discrete soil increments to 6 inches deep below vegetation cover.
LUAs	DU/SU Approach: • If an LUA is found, each LUA will be a separate DU and single SU of approximately 10 ft by 10 ft (100 square feet) centered on the item (final shape of SU to be dependent on site conditions). • Determine presence/absence; if screening levels are exceeded, conduct additional sampling in the 0.25-acre DU. Sampling Procedure: • Mark out square IS SU, approximately centered on item location. • Perform IS using 1 to 2-in corer to obtain an ~1 kg composite sample composed of 30 discrete soil increments to 6 inches deep (below depth of MEC).

<table>
<tr><th>Location / Feature</th><th>Sampling Program</th></tr>
<tr><td colspan="2">Central Pine Barrens Areas</td></tr>
<tr><td>HUAs</td><td>DU/SU Approach:
If HUAs are less than 2 acres, HUA will be the DU with SUs of up to 0.25 acres each. SUs will cover 100% of the DU.
If HUAs are larger than 2 acres, HUA will be divided into 2 acre DUs.
Within each DU, stratified sampling approach may be performed tied to the associated anomaly density distribution within the DU, and the specified number of SUs will be evaluated. SUs will be 0.25 acres and will not cover 100% of the DU.
Sampling Procedure:
Mark out square/rectangle/circle IS SU(s) (depending on approximate shape of HUA).
Perform IS using 1 to 2-in corer to obtain an ~1 kg composite sample composed of 30 discrete soil increments to 6 inches deep below vegetation cover.</td></tr>
<tr><td>LUAs</td><td>DU/SU Approach:
If an LUA is found, each LUA will be a separate DU and single SU of approximately 10 ft by 10 ft (100 square feet) centered on the item (final shape of SU to be dependent on site conditions).
Determine presence/absence; if screening levels are exceeded, conduct additional sampling in 0.25-acre DU.
Sampling Procedure:
Mark out square IS SU, approximately centered on item location.
Perform IS using 1 to 2-in corer to obtain an ~1 kg composite sample composed of 30 discrete soil increments to 6 inches deep (below depth of MEC).</td></tr>
<tr><td colspan="2">Industrial Areas:</td></tr>
<tr><td>HUAs</td><td>DU/SU Approach:
If HUA is located across multiple parcels, subdivide HUA by individual parcel boundary.
If individual parcel is up to 2 acres, DU will correspond to parcel boundary.
If DU (i.e., single parcel HUA or individual parcel) is less than 2 acres, subdivide into ~0.25-acre SUs. SUs will cover 100% of DU (HUA/parcel).
If DU (i.e., single parcel HUA or individual parcel) is larger than 2 acres, a stratified sampling approach may be performed tied to the associated anomaly density distribution within the DU, and the specified number of SUs will be evaluated. SUs will be 0.25 acres and will not cover 100% of the DU.
Sampling Procedure:
Mark out square/rectangle/circle IS SU(s) (depending on approximate shape of HUA).
Perform IS using 1 to 2-in corer to obtain an ~1 kg composite sample composed of 30 discrete soil increments to 6 inches deep below vegetation cover.</td></tr>
<tr><td>LUAs</td><td>DU/SU Approach:
If an LUA is found, each LUA will be a separate DU and single SU of approximately 10 ft by 10 ft (100 square feet) centered on the item (final shape of SU to be dependent on site conditions).
Determine presence/absence; if screening levels are exceeded, conduct additional sampling in 0.25-acre DU.
Sampling Procedure:
Mark out square IS SU, approximately centered on item location.
Perform IS using 1 to 2-in corer to obtain an ~1 kg composite sample composed of 30 discrete soil increments to 6 inches deep (below depth of MEC).</td></tr>
</table>

Location / Feature	Sampling Program
Soil Background - Obtain representative samples for comparison	
DU/SU Approach: • Background sampling will be conducted after all MRS sampling is completed. • SUs will be 0.25 acres each. Sampling Procedure: • Mark out square/rectangle/circle IS SU(s) (depending on approximate shape of HUA). • Perform IS using 1 to 2-in corer to obtain an ~1 kg composite sample composed of 30 discrete soil increments to 6 inches deep below vegetation cover.	
Post-Detonation - Obtain representative samples to evaluate potential for residuals after item detonation	
DU/SU Approach: • DU based on 10 ft diameter circular area or 10 ft by 10 ft area centered on detonation location (final shape to be dependent on site conditions). • Determine presence/absence within the SU; if screening levels are exceeded, conduct additional sampling in the 0.25-acre DU. • Note that IS sampling will not be required for a single high-order BIP detonation. Sampling Procedure: • Mark out circular/square IS SU, approximately centered on item location. • Perform IS using 1 to 2-in corer to obtain an ~1 kg composite sample composed of 30 discrete soil increments to 6 inches deep (below depth of MEC item).	
Temporary Monitoring Wells	
Approach: • Installation of temporary monitoring wells will be based on geophysical surveys, soil sampling results, and knowledge of the groundwater of the area. • Groundwater samples will be collected after well installation and 24 to 48 hours after development. Sampling Procedure: • Obtain groundwater levels (the wells will be allowed to equilibrate with the air pressure before readings are taken if the wells have been closed). • Collect groundwater samples using low-flow methodologies after stabilization of water quality parameters to obtain samples which are representative of the formation water and the mobile load of any contaminants (including dissolved and colloid-associated). • If turbidity remains elevated (i.e., greater than 10 NTUs), collect a filtered groundwater sample for dissolved metals analysis. Note that the FUDSChem eQAPP will designate “dissolved metals” as a separate analytical method from “total metals” for aqueous samples.	

17.13 DFW 11: Characterize HUA, Establish LUA and Buffer Area, Determine if NEU Area Exists

The weight of evidence compiled throughout the fieldwork completed through DFW 10 will culminate in the characterization of the HD areas as either HUAs or NEUs. The weight of evidence approach will also be used to evaluate whether identified HD areas are more appropriately designated LUAs in characterizing the MRS. Similarly, the data gathered on-site will be used to establish LUAs, establish the buffer zone between HD areas and LUAs, and, as appropriate, determine whether areas can be considered NEU Areas.

Tetra Tech will perform a data usability assessment of the intrusive investigation findings as the findings support the overall project objectives. We will assess the usability of data gathered to this point to provide confidence that the quality and quantity of data are appropriate for supporting the RI objectives. Onboard reviews with USACE and the PDT will be conducted as part of obtaining acceptance of data gathered to this point and concurrence on the next steps. An updated project

GIS will be provided outlining these proposed HUA, LUA, buffer zone areas, and NEU areas to support onboard reviews. As appropriate, a revised CSM will be provided as part of the usability assessment if the intrusive investigation of the geophysical anomaly sources or MC sampling identifies evidence of munitions-related items not previously thought to exist on-site.

17.14 DFW 12: Gather Additional Data (As Needed)

This DFW addresses any additional data that may need to be gathered in order to fill in gaps in the CSM or overall characterization of the site. For example, this DFW may be used to address the inspection of SRAs identified on-site. The need for additional data will be addressed in the DUAs submitted throughout the project and will be determined in conjunction with review by USACE and project stakeholders and with the input of deliverables provided to this point.

17.15 DFW 13: Final DUA, Submit Data for FS Development

Tetra Tech will prepare an RI Report for MRS-01, documenting the following:

- Site description, history, and boundaries;
- Geophysical survey results;
- Classification results;
- MEC investigation results;
- MC results;
- Revised CSM and contaminant fate and transport graphics;
- Evaluate preliminary applicable or relevant and appropriate requirements;
- MC human health and ecological risk assessments;
- Baseline MEC risk assessment IAW RMM;
- Munition Response Site Prioritization Protocol scores; and,
- Overall conclusions regarding data usability (and limitations), residual risks, and recommendations for MRS-01.

The RI Report will be submitted in four versions for review, including the draft, EMCX draft, draft final, and final versions. Comments will be addressed and resolved prior to the submittal of the next version. The report will include a section on the final data usability assessment for data gathered throughout the project and will draw on previously submitted DUAs. The final DUA will not be issued as a standalone document but instead will be discussed as part of the final RI Report.

QAPP WORKSHEET #18: SAMPLING LOCATIONS AND METHODS

Soil samples will be collected during the RI using the decision logic presented in Worksheet #17. Field sampling procedures and sample nomenclature for MC are provided in the SOPs in Appendix E. Quality control (QC) samples will be collected during sampling; see WS #20.

Location	Estimated No. of DUs [1]	Estimated No. of SUs [1]	Rationale	Media	Depth	Sample Type [2]	Analyte Group [Method]	Sampling SOP Reference
Residential Areas: (HUAs)	TBD	TBD	Based on geophysical survey and intrusive investigation findings	Soil (solids)	0 to 6 inches below vegetative cover	IS	Explosives [SW-846 Method 8330B] Metals [SW-846 Method 6010D/6020A] pH [Field Screening]	MC SOP 1 (WS 21, and Appendix E)
Residential Areas: (LUAs)	TBD	TBD	Based on geophysical survey and intrusive investigation findings	Soil (solids)	0 to 6 inches below depth of MEC	IS	Explosives [SW-846 Method 8330B] Metals [SW-846 Method 6010D/6020A] pH [Field Screening]	MC SOP 1 (WS 21, and Appendix E)
Central Pine Barrens Areas (HUAs)	TBD	TBD	Based on geophysical survey and intrusive investigation findings	Soil (solids)	0 to 6 inches below vegetative cover	IS	Explosives [SW-846 Method 8330B] Metals [SW-846 Method 6010D/6020A] pH [Field Screening]	MC SOP 1 (WS 21, and Appendix E)

Location	Estimated No. of DUs [1]	Estimated No. of SUs [1]	Rationale	Media	Depth	Sample Type [2]	Analyte Group [Method]	Sampling SOP Reference
Central Pine Barrens Areas (LUAs)	TBD	TBD	Based on geophysical survey and intrusive investigation findings	Soil (solids)	0 to 6 inches below depth of MEC	IS	Explosives [SW-846 Method 8330B] Metals [SW-846 Method 6010D/6020A] pH [Field Screening]	MC SOP 1 (WS 21, and Appendix E)
Industrial Areas (HUAs)	TBD	TBD	Based on geophysical survey and intrusive investigation findings	Soil (solids)	0 to 6 inches below vegetative cover	IS	Explosives [SW-846 Method 8330B] Metals [SW-846 Method 6010D/6020A]] pH [Field Screening]	MC SOP 1 (WS 21, and Appendix E)
Industrial Areas (LUAs)	TBD	TBD	Based on geophysical survey and intrusive investigation findings	Soil (solids)	0 to 6 inches below depth of MEC	IS	Explosives [SW-846 Method 8330B] Metals [SW-846 Method 6010D/6020A]] pH [Field Screening]	MC SOP 1 (WS 21, and Appendix E)
Background	8	8	Selected to be representative of surficial conditions	Soil (solids)	0 to 6 inches below vegetative cover	IS	Metals [SW-846 Method 6010D/6020A]] pH [Field Screening]	MC SOP 1 (WS 21, and Appendix E)
	TBD	TBD	Selected to be representative of subsurface conditions	Soil (solids)	>6 inches to 10 feet bgs; actual depth TBD	IS	Metals [SW-846 Method 6010D/6020A]] pH [Field Screening]	MC SOP 1 (WS 21, and Appendix E)

Location	Estimated No. of DUs [1]	Estimated No. of SUs [1]	Rationale	Media	Depth	Sample Type [2]	Analyte Group [Method]	Sampling SOP Reference
Post-Detonation	TBD	TBD	Evaluate potential for residuals after item detonation (note that IS sampling will not be required for a single high-order BIP detonation)	Soil (solids)	0 to 6 inches below depth of MEC	IS	Explosives [SW-846 Method 8330B] Metals [SW-846 Method 6010D/6020A]] pH [Field Screening]	MC SOP 1 (WS 21, and Appendix E)
Monitoring Wells	TBD	TBD	Based on geophysical results, soil sampling results, and knowledge of groundwater in area	Groundwater (aqueous)	Within well screen	Low-flow	Explosives [SW-846 Method 8330] Metals (total) [SW-846 Method 6010D/6020A] Metals (dissolved)[3] [SW-846 Method 6010D/6020A]	MC SOP 4 (WS 21, and Appendix E)

Notes:

[1] Numbers of DUs and SUs will be determined subsequent to geophysical survey/intrusive investigation activities, and a Technical Memorandum with a revised Worksheet #18 will be provided prior to commencement of the MC sampling program. Post-detonation sampling performed subsequent to consolidated shot or BIP activities. Number of post-detonation DUs/SUs will also be determined based on survey/investigation results.

[2] IS Preparation to be performed at laboratory includes the following: Upon receipt at the laboratory, soil samples will be air-dried, and then passed through a No. 10 (2-mm) sieve. The weights of the < 2 mm and > 2 mm size fractions will be recorded. The < 2mm size fraction for explosives will be ground using an appropriate mechanical grinder (e.g., ring puck mill, chrome steel ring mill). The equipment will be cleaned after each grind by washing with soapy water, followed by an acetone rinse and air-drying. Select explosive compounds have a potential for loss during the air-drying step, and subsurface soils and/or post-detonation soils may be dried only to a moisture content below 10%. In addition, for the post-detonation samples, fine vegetation will not be removed prior to preparation. Tetra Tech will work with the laboratory in appropriately planning the sample processing for the type of sample collected. See WS #23 for laboratory SOPs.

[3] Note that the FUDSChem eQAPP will designate “dissolved metals” as a separate analytical method from “total metals” for aqueous samples.

QAPP WORKSHEET #19 & 30: SAMPLE CONTAINERS, PRESERVATION, AND HOLD TIMES

Laboratory: Katahdin Analytical Services, Inc.
600 Technology Way
Scarborough, ME 04074
Project Manager: Heather Manz
Phone: (207) 874-2400

Required Accreditation / Certification (Expiration Date): DoD ELAP ID #2936.01 (December 31, 2022); certification provided in Appendix F.

Sample Delivery Method: FedEx

Analyte/Analyte Group	Matrix	Analytical Method/ Lab SOP	Container(s) (number, size, & type)	Preservation	Preparation Holding Time	Analytical Holding Time
Explosives	Solids (soil)	Preparation Method/SOP: SW-846 Method 8330 / CA-548 Analysis Method/SOP: SW-846 Method 8330B/CA-402	1-gallon Ziplock bag[1]	Cool to 4±2°C	14 days	40 days
Select Metals [aluminum (Al), antimony (Sb), barium (Ba), copper (Cu), iron (Fe), lead (Pb), nickel (Ni)]	Solids (soil)	Preparation Method/SOP: SW-846 Method 3051A / CA-605 Analysis Method/SOP SW-846 Method 6010D / CA-608 or Method 6020A / CA-627]	1-gallon Ziplock bag[1]	None	6 mo.	
Explosives	Aqueous (groundwater and rinsates)	Preparation Method/SOP: SW-846 Method 8330 / CA-548 Analysis Method/SOP: SW-846 Method 8330B / CA-402	Two (2) 1-L glass bottles	Cool to 4±2°C	7 days	40 days
Select Metals [aluminum (Al), antimony (Sb), barium (Ba), copper (Cu), iron (Fe), lead (Pb), nickel (Ni)]	Aqueous (groundwater and rinsates)	Preparation Method/SOP: SW-846 Method 3015A / CA-604 Analysis Method/SOP SW-846 Method 6010C / CA-608 or Method 6020A / CA-627]	1-L polyethylene bottle[2]	HNO_3 to pH <2; Cool to 4±2°C	6 mo.	

Notes:
[1] Containers may be combined into a single 1-gallon Ziplock bag.
[2] For dissolved metals, the groundwater shall be filtered prior to containerization and preservation. If filtration of a groundwater sample is required/performed, an equipment rinsate blank of the groundwater sampling and filtration equipment will be collected on each day (one per day) for dissolved metals (see also Worksheet #20).

QAPP WORKSHEET #20: FIELD QUALITY CONTROL (QC) – MC[1]

Location	Analyte Group	Estimated No. of DUs [2]	Estimated No. of SUs [2]	Rate of Field QC Replicate Collection [3]	Estimated No. of SUs for Field QC Replicates	Estimated No. of Samples [4]
Residential Areas: (HUAs)	Explosives, Metals, pH	TBD	TBD	See Footnote 3	TBD	TBD
Residential Areas: (LUAs)	Explosives, Metals, pH	TBD	TBD	See Footnote 3	TBD	TBD
Central Pine Barrens Areas (HUAs)	Explosives, Metals, pH	TBD	TBD	See Footnote 3	TBD	TBD
Central Pine Barrens Areas (LUAs)	Explosives, Metals, pH	TBD	TBD	See Footnote 3	TBD	TBD
Industrial Areas (HUAs)	Explosives, Metals, pH	TBD	TBD	See Footnote 3	TBD	TBD
Industrial Areas (LUAs)	Explosives, Metals, pH	TBD	TBD	See Footnote 3	TBD	TBD
Background – Surface	Explosives and Metals	8	8	See Footnote 3	1	10
Background - Subsurface	Explosives and Metals	TBD	TBD	See Footnote 3	TBD	TBD
Post-Detonation	Explosives, Metals, pH	TBD	TBD	See Footnote 3	TBD	TBD
Temporary Monitoring Wells	Explosives and Metals	TBD	TBD	One duplicate every 10 samples[5]	TBD	TBD

Notes:

[1] Aqueous field equipment rinsate blanks will be collected following a decontamination event (not to exceed one rinsate blank per day) when sampling with non-dedicated equipment occurs. Decontamination of equipment will occur between DUs/SUs (for soil) and between well locations (for groundwater). If filtration of a groundwater sample is required/performed, the equipment rinsate blank will also be analyzed for dissolved metals.

[2] The number samples per DUs/SUs will be determined subsequent to geophysical survey/intrusive investigation activities (refer to Worksheet #18). As applicable, a Technical Memorandum with a revised Worksheet #20 will be provided prior to commencement of the MC sampling program.

[3] Field QC replicates for soil samples will be collected in 'triplicates' – i.e., the SU will be sub-sampled three times (the primary environmental sample and two separate replicates). Replicate collection will be performed as follows:

- If a DU is approximately 0.25 acres in size or smaller, it will be covered by one SU of 0.25 acres in size and sampled in triplicate.
- If a DU is subdivided into two 0.25-acre SUs, both SUs will be sampled in triplicate to calculate a weighted 95% UCL.
- If a SU is subdivided into three or more 0.25-acre SUs, a single IS sample will be collected from each SU to calculate a 95% UCL across the DU. In these cases, a replicate sample will not be required.

Replicates will be "blind" to the laboratory, and will be labeled with the MRS location, "REP01" or "REP02" and the date of collection. If multiple replicates are collected on the same day from the same area, then an additional alpha-numeric identification ("REPA01", "REPB02") will be added. Replicate identification will be outlined in the field documentation.

Samples for pH will not be replicated.

[4] Total calculated as estimated number of primary SU samples plus two times estimated number of replicate samples.

[5] Field QC replicates for initial round of groundwater samples will be duplicates (primary samples and one separate replicate).

Duplicates will be "blind" to the laboratory and will be labeled "DUP01" and the date of collection. Duplicate identification will be outlined in the field documentation.

QAPP WORKSHEET #21: FIELD SOPS

SOP # or reference	Title, Revision, Date, and URL (if available)	Originating Organization	Reviewed for Site Specific Conditions? Y/N	Comments
UXO SOP 1	MEC Avoidance	Tetra Tech	Y	NA
UXO SOP 2	Vegetation Clearance	Tetra Tech	Y	NA
UXO SOP 3	Surface Sweep-Clearance Operations	Tetra Tech	Y	NA
UXO SOP 4	Intrusive Investigation Operations	Tetra Tech	Y	NA
UXO SOP 5	MEC Management and Disposal	Tetra Tech	Y	NA
UXO SOP 6	MPPEH and MDAS Management and Disposal	Tetra Tech	Y	NA
AGC SOP 1a	MetalMapper 2x2 Assembly	Tetra Tech	N	NA
AGC SOP 1c	EM61 Assembly	Tetra Tech	N	NA
AGC SOP 2	Instrument Verification Strip Installation	Tetra Tech	N	NA
AGC SOP 3	QC Blind Seed Installation	Tetra Tech	N	NA
AGC SOP 4	Instrument Verification at IVS	Tetra Tech	N	NA
AGC SOP 5	Perform Dynamic Detection Survey	Tetra Tech	N	NA
AGC SOP 6	Process Dynamic Survey Data	Tetra Tech	N	NA
AGC SOP 7	Collect Cued Measurements	Tetra Tech	N	NA
AGC SOP 8	Process Cued Measurements	Tetra Tech	N	NA
AGC SOP 9	Demonstrations of Capability	Tetra Tech	N	NA
AGC SOP 10	Verification and Validation of the Classification Process	Tetra Tech	N	NA
AGC SOP 11	Civil Survey	Tetra Tech	N	NA
AGC SOP 13	Technical Reporting	Tetra Tech	N	NA
AGC SOP 14	Reducing the Minimum Separation Distance when Using Advanced Geophysical Classification	Tetra Tech	N	New Tetra Tech SOP generated in response to the May 2021 DoD Guidance
MC SOP 1	Soil Sample Collection	Tetra Tech	Y	Revised as required for project
MC SOP 2	Analytical and Field Data Management	Tetra Tech	Y	Revised as required for project
MC SOP 3	Analytical and Field Data Review	Tetra Tech	Y	Revised as required for project
MC SOP 4	Well Installation and Low-flow Groundwater Sampling	Tetra Tech	Y	Revised as required for project

1 # QAPP WORKSHEET #22 – EQUIPMENT TESTING, INSPECTION, AND QUALITY CONTROL

2 ## Table 22-1. Site Preparation (All Instruments)

Measurement Quality Objective	MQO#	Frequency	Responsible Person/ Reporting Method/ Verified by:	Acceptance Criteria	Failure Response
Vegetation clearance Verification (All clearance mechanisms)	1	Random locations at frequency between four and twelve per acre	Project/QC Geophysicist/ Surface Sweep Technical Memorandum/ Lead Organization or designee	All vegetation within transect paths removed to height ≤5 inches; All trees less than 4 inches diameter at breast height are removed; No obstacles (e.g., felled trees or limbs) remain; No vegetation will be removed by their roots. Brush material will be chipped and left in place.	NCR/RCA/corrective action (CA); Re-verify. Exception: documented site-specific conditions prevent vegetation removal in environmentally sensitive areas.
Vegetation clearance Verification (mechanized): Verify correct assembly (1 of 2)	2	Once following assembly	Field Team Leader/ Instrument Assembly Checklist/ Lead Organization or designee	As specified in Assembly Checklist	If failure observed after assembly and before production work begins, make necessary adjustments and reverify; if failure persists, NCR/RCA/CA
Vegetation clearance Verification (mechanized): Verify correct assembly (2 of 2)	3	Daily prior to operations	Field Team Leader/ Daily QC Report/ UXOSO/QCS	Deck height is set to a maximum height of 6 inches	NCR/RCA/CA; Make necessary changes to deck height and re-verify. Exception: documented site-specific conditions prevent achievement of the planned removal height
Geodetic accuracy	4	Once before use	Site Geophysicist/ running QC summary; land survey report (as applicable)/ Project Geophysicist	Project network must be tied to HARN, CORS, VRS network, OPUS, or other recognized network.	If error is identified during equipment setup before production data are collected, make adjustments and re-verify. Otherwise, NCR/RCA/CA.

Measurement Quality Objective	MQO#	Frequency	Responsible Person/ Reporting Method/ Verified by:	Acceptance Criteria	Failure Response
Initial geodetic equipment function test (RTS)	5	Daily prior to operations	Field Team Leader/ GIS data recorded/ Project QC or designee	Measured position of known location within ±10cm of ground truth	If error is identified during equipment setup before production data are collected, make adjustments and re-verify. Otherwise, NCR/RCA/CA
Construct IVS: Verify as-built IVS against design plan (Digital sensors)	6	Once following IVS construction	Project Geophysicist/ IVS Technical Memorandum/ Lead Organization	Small ISO80 buried IAW design specifications in Table 17-3	NCR/RCA/CA; Make necessary changes to seeded items and re-verify. Exception: documented site-specific conditions prevent achievement of the planned seed depths
Construct ITS: Verify as-built ITS against design plan (Analog sensors)	7	Once following ITS construction	Project Geophysicist/ IVS Technical Memorandum/ Lead Organization	One small ISO80 buried at 10 cm; one small ISO 80 buried at 20 cm; one medium ISO40 buried at 30 cm. All seeds buried horizontally in the horizontal orientation	NCR/RCA/CA; Make necessary changes to seeded items and re-verify. Exception: documented site-specific conditions prevent achievement of the planned seed depths.
Verify correct assembly (All sensors)	8	Once following assembly	Field Team Leader/ Instrument Assembly Checklist/ Project Geophysicist	As specified in Assembly Checklist	If failure observed after assembly and before production work begins, make necessary adjustments and reverify; if failure persists, NCR/RCA/CA

Measurement Quality Objective	MQO#	Frequency	Responsible Person/ Reporting Method/ Verified by:	Acceptance Criteria	Failure Response
Initial instrument function test: Five measurements over a small ISO80 target, one in each quadrant of the sensor and one directly under the center of the array; Derived polarizabilities for each measurement are compared to the library (AGC)	9	Once following assembly	Field Team Leader/ Instrument Assembly Checklist/ Project Geophysicist	Library match metric ≥ 0.95 for each of the five sets of inverted polarizabilities	NCR/RCA/CA: Make necessary adjustments, and re-verify
Initial Instrument Function Test (EM61)	10	Once following assembly	Field Geophysicist/ Initial IVS Memorandum/ Project Geophysicist	Response (mean static spike minus mean static background) within ±20% of predicted response from theoretical model (i.e., predicted response).	If failure observed before production work begins and is attributable to known reason (e.g., sensor moved), make necessary adjustments and reverify; if failure persists, NCR/RCA/CA
Initial Instrument Function Test (Analog)	11	Once upon arrival at project site	Field Geophysicist or UXO Team Lead/ Initial IVS Memorandum/ Project Geophysicist or designee	Audible response consistent with expected change in tone over ITS items	If failure observed after assembly and before production work begins and is attributable to known reason (e.g., low battery), make necessary adjustments and reverify; if failure persists, NCR/RCA/CA
Initial pre-seeded survey of planned IVS and ITS areas (All sensors)	12	Once prior to start of IVS of ITS construction	Site Geophysicist or UXO Team Lead/ IVS Memorandum/ QC Geophysicist	All seeds placed in locations that are free of detected anomalies within a radius of ≥1.5m	Identify new location and reverify; if failure occurs after IVS or ITS construction, then NCR/RCA/CA
Initial dynamic positioning accuracy at IVS (Digital Sensors)	13	Once prior to start of dynamic data acquisition	Project Geophysicist/ IVS Memorandum/ QC Geophysicist	Derived positions of IVS target(s) are within ±0.25m of the ground truth positions	NCR/RCA/CA: Make necessary adjustments, and re-verify

Measurement Quality Objective	MQO#	Frequency	Responsible Person/ Reporting Method/ Verified by:	Acceptance Criteria	Failure Response
Initial IVS background validation (at IVS blank space); five background measurements: one centered at the flag and one offset at least ½ sensor spacing in each cardinal direction (MM2x2)	14	Once after IVS blank space is located	Site Geophysicist/ IVS technical memorandum/ Project Geophysicist	All five measurements have a library match within 0.9	CA: Reject IVS blank space location and find another location; if failed background location is carried through to production survey, then NCR/RCA/CA
Initial derived polarizabilities accuracy (IVS) (MM2x2)	15	Once during initial system IVS test (cued measurements)	Project Geophysicist/ IVS technical memorandum/ QC Geophysicist	Library match metric ≥ 0.9 for each set of inverted polarizabilities.	NCR/RCA/CA
Initial derived target position accuracy (IVS) (MM2x2)	16	Once during initial system IVS test (cued measurements)	Project Geophysicist/ IVS technical memorandum/ QC Geophysicist	All IVS item fit locations are within 0.25m of ground truth locations.	NCR/RCA/CA

Table 22-2. Surface Clearance (Schonstedt GA-52Cx)

Measurement Quality Objective	MQO#	Frequency	Responsible Person/ Reporting Method/ Verified by:	Acceptance Criteria	Failure Response
Ongoing instrument function test (Analog); MQO applies to all phases of work when analog instruments are used	17	Beginning and end of each day and each time instrument is turned on	Field Team Leader/ Running QC Summary/ Project/QC Geophysicist or designee	Audible response consistent with expected change in tone in presence of standard object with documented response	If failure observed before production work begins and is attributable to known reason (e.g., low battery), make necessary adjustments and reverify; if failure persists, NCR/RCA/CA

Measurement Quality Objective	MQO#	Frequency	Responsible Person/ Reporting Method/ Verified by:	Acceptance Criteria	Failure Response
Ongoing instrument function test (Analog); MQO applies to all phases of work when analog instruments are used	18	Hourly	Field Team Leader/ Running QC Summary/ Project/QC Geophysicist or designee	All instrument settings adjusted to provide audible response consistent with expected change in tone in presence of visible object.	Make necessary repairs and re-validate; if failure persists, NCR/RCA/CA
Surface clearance coverage	19	Verified for each mini-grid	Field Team Leader/ Daily QC Report/ UXOSO/QCS	Visual inspection and photographic records documenting ≤1.5m survey lane/line spacing using established using tape measures and rope lanes or tapes and marking paint. Specific procedure described in UXO SOP 3.	NCR/RCA/CA
Surface clearance documenting recovered surface MEC, MD, and scrap within mini-grids (Analog sensors)	20	Daily	UXOSO/QCS GIS data recorded/ Project/ QC Geophysicist or designee	All metallic objects ≥5cm in any dimension collected, counted, and documented in the project database for the following attributes: designation as MEC/MPPEH, MD, or NMRD; UXO and MD described by type (if can be determined) and weight. Photos displaying all MD recovered (individual MD photos not necessary), and photos showing all surfaces of each MEC (TOI) are recorded.	NCR/RCA/CA; document questionable information in database; justify safety concerns

Table 22-3. Preliminary Characterization Dynamic Surveys (Transects) (Instrument: EM61-MK2)

Measurement Quality Objective	MQO#	Frequency	Responsible Person/ Reporting Method/ Verified by:	Acceptance Criteria	Failure Response
Ongoing instrument function test (EM61)	21	Beginning and end of each day and each time instrument is turned on	Field Team Leader/ Running QC Summary/ Project/QC Geophysicist or designee	Response (mean static spike minus mean static background) within ±20% of initial response	Make necessary adjustments and re-validate; if failure persists, NCR/RCA/CA
Ongoing detection survey positioning precision (IVS) (EM61)	22	Beginning and end of each day instrument is used	Project Geophysicist/ Running QC Summary/ QC Geophysicist	Derived positions of IVS targets are within ±25cm of average of derived positions.	NCR/RCA/CA
In-line measurement spacing (EM61)	23	Verified for each processed transect data set using the Sample Separation purpose-built tool based on monostatic Z coil data positions	Project Geophysicist/ Running QC Summary/ QC Geophysicist	98% ≤ 25cm between successive measurements; 100% ≤1.0m.	NCR/RCA/CA: Collect additional data to meet acceptance criterion. Exception: In-line gaps are filled or adequately explained (e.g., unsafe terrain)
Coverage – Transect (EM61)	24	Verified with target radius from WS#17 for each MRS using VSP ‘Post-survey probability of traversal’ tool	Project Geophysicist/ VSP Report/ QC Geophysicist	Probability of traversal and detection is 100% (excluding site-specific access limitations, e.g., obstacles, unsafe terrain, ROE refusal).	NCR/RCA/CA: Collect additional data to increase coverage percentage to meet acceptance criterion. Exception: Coverage gaps are filled or adequately explained in field notes.
Battery Voltage (EM61)	25	Verified to be within operating specifications of sensor before collection of static or dynamic data	Field Team/ Running QC Summary/ Project/QC Geophysicist	Voltage must be ≥11.5V	NCR/RCA/CA: Recollect all out of spec data
Confirm adequate spacing between units (EM61)	26	Evaluated at start of each day (or transect)	Field Team Leader/ Field Logbook/ Project Geophysicist	Minimum separation of 50m	NCR/RCA/CA: Recollect all coincident measurements

Table 22-4. HD Area Characterization Dynamic Surveys (Instrument: Metal Mapper 2x2)

Measurement Quality Objective	MQO#	Frequency	Responsible Person/ Reporting Method/ Verified by:	Acceptance Criteria	Failure Response
Ongoing geodetic equipment function test (RTS); MQO applies to all phases of work when RTS is used	27	Each time equipment is moved	Field Team Leader/ GIS data recorded/ Project/QC Geophysicist or designee	Measured position of control point within ±10cm of ground truth	If error is identified during equipment setup before production data are collected, make adjustments and re-verify. Otherwise, NCR/RCA/CA; identify questionable information in database
Ongoing instrument function test (MM2x2); MQO applies to all phases of work when MM2x2 used	28	Beginning and end of each day and each time instrument is turned on	Field Team Leader/ Running QC Summary (Excel/Geosoft)/ Project/QC Geophysicist or designee	Response (mean static spike minus mean static background) within ±20% of predicted response for all Tx/Rx combinations	If failure observed before production work begins and is attributable to known reason (e.g., sensor moved), make necessary adjustments and reverify; if failure persists, NCR/RCA/CA.
Ongoing derived dynamic position accuracy (IVS) (MM2x2)	29	Beginning and end of each day as part of IVS testing	Project Geophysicist/ Running QC Summary/ QC Geophysicist	All IVS item fit locations are within ±25cm of ground truth positions.	NCR/RCA/CA
In-line measurement spacing (MM2x2)	30	Verified for each processed mini-grid using the Sample Separation purpose-built tool based on monostatic Z coil data positions	Project Geophysicist/ Running QC Summary/ QC Geophysicist	98% ≤ 25cm between successive measurements; 100% ≤1.0m.	NCR/RCA/CA: Collect additional data to increase coverage percentage to meet acceptance criterion. Exception: In-line gaps are filled or adequately explained (e.g., unsafe terrain)

Measurement Quality Objective	MQO#	Frequency	Responsible Person/ Reporting Method/ Verified by:	Acceptance Criteria	Failure Response
Coverage – Mini-grid (MM2x2)	31	Verified for each mini-grid using the Footprint Coverage purpose-built tool based on monostatic Z coil data positions	Project Geophysicist/ Running QC Summary/ QC Geophysicist	≥ 90% at ≥70cm spacing ; 100% ≤75cm	NCR/RCA/CA: Collect additional data to increase coverage percentage to meet acceptance criterion. Exception: Coverage gaps are filled or adequately explained in field notes.
Transmit current levels (MM2x2); MQO applies to all phases of work when MM2x2 used	32	Evaluated for each sensor measurement	Field Team Leader/ Running QC Summary/ Project Geophysicist	Current must be ≥6A for all transmitters	NCR/RCA/CA: stop data acquisition activities until condition corrected
Detection Survey Performance (MM2x2)	33	Average one blind QC seed per instrument per day. Seeds to be placed throughout expected detection depth range	QC Geophysicist/ Running QC Summary/ Lead Organization QA Geophysicist	All blind seeds must be detected and positioned within 40cm radius of ground truth	NCR/RCA/CA: Verify instrument is functioning properly; if so, reduce threshold, or determine if item is buried too deep. If instrument is not functioning correctly, recollect data

Table 22-5. HD Area Characterization Cued Surveys (Instrument: Metal Mapper 2x2)

Measurement Quality Objective	MQO#	Frequency	Responsible Person/ Report Method/ Verified by:	Acceptance Criteria	Failure Response
Initial measurement of production area background locations and background validation (five background measurements: one centered at the flag and one offset at least $^{1}/_{2}$ sensor spacing in each cardinal direction) (MM2x2)	34	Once per background location selected from dynamic survey data	Field Team Leader/ IVS Memorandum/ Background Validation Plots and Running QC Summary/ Project Geophysicist	All five measurements have a library match within 0.9	CA: Reject background location and find another location; if failed background location is carried through to production survey, then NCR/RCA/CA
Ongoing production area background measurement frequency (MM2x2)	35	Background data collected a minimum of every two hours during production (does not include sensor downtime due to weather, safety reasons, etc.)	Field Team Leader/ Field Log and Running QC Summary/ Project Geophysicist	Background data from a validated location collected within two hours of all cued measurements	NCR/RCA/CA: Document environmental changes; Project Geophysicist must approve before proceeding.
Ongoing production area background measurement validity (MM2x2)	36	Evaluated for each background measurement at verified background locations	Project Geophysicist/ Running QC Summary/ Project Geophysicist	A TOI (e.g., small ISO80) in the site-specific library synthetically seeded in the ongoing background and background-corrected using the initial background measurement results in polarizabilities with a library match of ≥ 0.9	NCR/RCA/CA: Background measurement rejected and removed from active background measurements
Ongoing derived target position precision (IVS) (MM2x2)	37	Beginning and end of each day as part of IVS testing	Project Geophysicist/ Running QC Summary/ QC Geophysicist	All IVS items fit locations within ±25cm of average of derived fit locations	NCR/RCA/CA

Measurement Quality Objective	MQO#	Frequency	Responsible Person/ Report Method/ Verified by:	Acceptance Criteria	Failure Response
Ongoing derived polarizabilities accuracy (IVS) (MM2x2)	38	Beginning and end of each day as part of IVS testing	Project Geophysicist/ Running QC Summary/ QC Geophysicist	Library match to initial polarizabilities metric ≥ 0.9 for each set of three inverted polarizabilities.	NCR/RCA/CA
Confirm inversion model supports classification (MM2x2, 1 of 3)	39	Evaluated for all models derived from a measurement (i.e., single item and multi-item models)	Project Geophysicist/ UX-Analyze Source Geosoft database/ QC Geophysicist	Derived model response must fit the observed data with a fit coherence ≥ 0.8	Follow procedure in SOP and re-verify; if failure persists, NCR/RCA/CA
Confirm inversion model supports classification (MM2x2, 2 of 3)	40	Evaluated for derived target	Project Geophysicist/ UX-Analyze Source Geosoft database/ QC Geophysicist	Fit location estimate of item ≤ 40cm from center of sensor	Follow procedure in SOP and re-verify; if failure persists, NCR/RCA/CA
Confirm inversion model supports classification (MM2x2, 3 of 3)	41	Evaluated for all seeds	QC Geophysicist/ Seed Tracking Log/ Lead Organization QA Geophysicist	100% of predicted QA and QC seed positions ≤ 25cm radially from ground truth position (x, y) and (z) ≤ 15cm	NCR/RCA/CA
Classification performance (MM2x2)	42	Evaluated for all seeds	QC Geophysicist/ Seed Tracking Log/ USACE QA Geophysicist	100% of QA and QC seeds classified as TOI	NCR/RCA/CA
TOI Diameter Prediction Performance (MM2x2)	43	Evaluated for all seeds	QC Geophysicist/ Seed Tracking Log/ USACE QA Geophysicist	100% of QA and QC seed outer diameter prediction match emplaced ground truth (e.g., predicted small ISO corresponds to small ISO ground truth). Exception: if AGC data collection and classification is performed to supplement USACE validation seeding, and USACE-accepted solutions include mismatches with QA seed ground truth, performance criterion will be seed size	NCR/RCA/CA CA: If data are determined to be usable and nonconformance persists, CA will include discussion with PDT regarding appropriateness of ongoing use of flexible MSDs.

Measurement Quality Objective	MQO#	Frequency	Responsible Person/ Report Method/ Verified by:	Acceptance Criteria	Failure Response
				prediction will match accepted solution results.	

Table 22-6. Intrusive Investigation (Schonstedt GA-52Cx)

Measurement Quality Objective	MQO#	Frequency	Responsible Person/ Report Method/ Verified by:	Acceptance Criteria	Failure Response
Documenting recovered sources (Analog)	44	Daily	UXOSO/QCS/ GIS data recorded/ Intrusive database and field logs/ QC Geophysicist	All metallic debris collected is documented for the following attributes: Designation as UXO, MD, range related debris or OD; UXO and MD described by type, weight, depth, and as TOI or non-TOI. Photos displaying all MD recovered (individual MD photos not necessary), and photos showing all surfaces of each MEC are recorded.	NCR/RCA/CA; document questionable information in database
Confirm derived features match ground truth (MM2x2, 1 of 2)	45	Evaluated for all recovered items	Project Geophysicist/ Running QC Summary or Intrusive Database/QC Geophysicist	100% of recovered objects classified as TOI ≤ 25cm from predicted position (x, y) and ≤ 15cm from predicted depth (z); recovered sources classified as non-TOI ≤40cm from predicted position (x,y)	NCR/RCA/CA CA: If data are determined to be usable and nonconformance persists, CA will include discussion with PDT regarding impacts on use of flexible MSDs.
Confirm derived features match ground truth (MM2x2, 2 of 2)	46	Evaluated for all recovered items including seeds	Project Geophysicist/ Dig List and Master Project Database/ Project or QC Geophysicist	Cued data analysis shows 100% of seeds and recovered TOI have polarizability parameters that are consistent with their actual size, shape/symmetry, and wall thickness	NCR/RCA/CA CA: If data are determined to be usable and nonconformance persists, CA will include discussion with PDT regarding impacts on use of flexible MSDs.

Measurement Quality Objective	MQO#	Frequency	Responsible Person/ Report Method/ Verified by:	Acceptance Criteria	Failure Response
Confirm anomaly resolution (MM2x2)	47	Evaluated for all intrusive results	Project Geophysicist/ UXOSO/QCS/ Dig List and Master Project Database/ QC Geophysicist	Intrusive results confirm anomaly source is resolved and reported excavation findings match expectations. TOI outer diameter prediction for recovered sources classified as TOI on dig list are consistent with recovered ground truth. All QA and QC seeds recovered by dig teams. Recovered sources from target locations without cued interrogation and classification from within ≤40cm of derived target location or otherwise specified expanded search radius.	NCR/RCA/CA Exception includes sources recovered from dig locations without corresponding cued measurements, where data processor specified expanded search radius due to anomaly footprint size. CA: If data are determined to be usable and nonconformance persists, CA will include discussion with PDT regarding impacts on use of flexible MSDs.

Table 32-7. MC Investigation

Field Equipment	Calibration Activity	Maintenance Activity	Testing/ Inspection Activity	Frequency	Acceptance Criteria		Corrective Action	Responsible Person	SOP Reference
Horiba U22 (or equivalent)	Calibrate with standard solutions	NA	NA	Prior to day's activities; end of day's activities; anytime anomaly suspected	pH Meter	+/- 0.1 units	Clean probe, replace battery, replace membrane, replace probe	Tetra Tech Field Technician	MC SOP 4
					Dissolved Oxygen	± 3%			
					Specific Conductivity	± 1% of full scale			
					ORP	± 10 mV			
					Temperature	± 0.1 °C			
					Turbidity	± 2 NTU			
Horiba U22 (or equivalent)	NA	NA	Visual inspection	Prior to day's activities	No defects noted		Replace probe	Tetra Tech Field Technician	MC SOP 4
Horiba U22 (or equivalent)	NA	Check/replace battery	NA	Prior to day's activities; anytime anomaly suspected	pH Meter	+/- 0.1 units	Replace battery; replace probe	Tetra Tech Field Technician	MC SOP 4
					Dissolved Oxygen	± 3%			
					Specific Conductivity	± 1% of full scale			
					ORP	± 10 mV			
					Temperature	± 0.1 °C			
					Turbidity	± 2 NTU			

Field Equipment	Calibration Activity	Maintenance Activity	Testing/ Inspection Activity	Frequency	Acceptance Criteria	Corrective Action	Responsible Person	SOP Reference
Water Level Indicator or Interface Probe	NA	NA	Visual inspection	Prior to day's activities	No defects noted (markings in increments of ± 0.01 feet)	Replace	Tetra Tech Field Technician	MC SOP 4
Water Level Indicator or Interface Probe	NA	NA	Auditory inspection	Prior to day's activities; end of day's activities; anytime anomaly suspected	Audio tone for contact with water/NAPL	Replace	Tetra Tech Field Technician	MC SOP 4
Water Level Indicator or Interface Probe	NA	Check/replace battery	NA	Prior to day's activities; anytime anomaly suspected	Audio tone for contact with water/NAPL	Replace battery	Tetra Tech Field Technician	MC SOP 4
Photoionization Detector (PID)	Calibrate with standard gasses	NA	NA	Prior to day's activities; end of day's activities; anytime anomaly suspected	+/- 5 ppm	Clean probe, replace battery, replace probe	Tetra Tech Field Technician	MC SOP 4
PID	NA	NA	Visual inspection	Prior to day's activities	No defects noted	Replace probe	Tetra Tech Field Technician	MC SOP 4
PID	NA	Check/replace battery	NA	Prior to day's activities; anytime anomaly suspected	+/- 5 ppm	Replace battery; replace probe	Tetra Tech Field Technician	MC SOP 4

Field Equipment	Calibration Activity	Maintenance Activity	Testing/ Inspection Activity	Frequency	Acceptance Criteria	Corrective Action	Responsible Person	SOP Reference
pH Meter	NA	NA	Visual inspection	Prior to day’s activities	No defects noted	Replace spot plate	Tetra Tech Field Technician	MC SOP 1

1 # QAPP WORKSHEET #23: ANALYTICAL STANDARD OPERATING PROCEDURES

2 Worksheet #23 provides laboratory SOP references from Katahdin. SOPs for Katahdin are detailed in Appendix F.

SOP #	Title, Date, and URL (if available)	Definitive or Screening Data	Matrix/Analytical Group	SOP Option or Equipment Type	Modified for Project? Y/N
CA-548	Preparation of Aqueous and Solid Samples for Explosive Analysis by Method 8330 Revision 06, July 2020	Definitive [Preparatory]	Solid (soils) and Aqueous (groundwater) / Explosives	NA	N
CA-402	Determination of Nitroaromatics and Nitramines by HPLC Method 8330 Revision 12, April 2020	Definitive [Analysis]	Solid (soils) and Aqueous (groundwater) / Explosives	Agilent Hewlett Packard HPLC System	N
CA-605	Acid Digestion of Solid Samples by USEPA Method 3050 for Metals Analysis by ICP-AES, ICP-MS Revision 10, June 2020	Definitive [Preparatory]	Solid (soils)/ Select Metals	NA	N
CA-604	Acid Digestion of Aqueous Samples by EPA Method 3010 for ICP and ICP-MS Analysis of Total or Dissolved Metals Revision 09, January 2019	Definitive [Preparatory]	Aqueous (groundwater)/ Select Metals	NA	N
CA-608	Trace Metals Analysis by ICS-AES using USEPA Method 6010 Revision 20, April 2020	Definitive [Analysis]	Solid (soils) and Aqueous (groundwater) / Select Metals	Thermo ICAP 6500 ICP Spectrophotometer	N
CA-627	Trace Metals Analysis by ICS-MS using USEPA Method 6020 Revision 14, June 2020	Definitive [Analysis]	Solid (soils) and Aqueous (groundwater) / Select Metals	Agilent 7800 ICP MS system	N

3 Note: IS preparation for samples is included in the explosives preparation SOP, CA-548.

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1 QAPP WORKSHEET #24: ANALYTICAL INSTRUMENT CALIBRATION

Instrument	Calibration Procedure	Calibration Frequency	Acceptance Criteria	Corrective Action	Personnel Responsible for Corrective Action	Analyte Group; Method/ Lab SOP
HPLC	5-point ICAL for linear calibration	Prior to sample analysis; Minimum of five calibration standards with the lowest standard concentration at or below the LOQ; Once calibration curve or line is generated, the lowest calibration standard must be re-analyzed	Option 1: RSD for each analyte ≤ 15%; Option 2: linear least squares regression $r^2 \geq 0.99$; Option 3: non-linear least squares regression (quadratic)for each analyte $r^2 \geq 0.99$	Correct problem then repeat initial calibration	Analyst or certified instrument technician	Explosives; CA-402
HPLC	Initial Calibration Verification (ICV)/Second source calibration verification	Daily, before sample analysis, unless ICAL performed same day	Analytes within ± 20% of true value	Correct problem and verify second source standard. Rerun second source verification. If fails, correct problem and repeat initial calibration.	Analyst or certified instrument technician	Explosives; CA-402
HPLC	RT window width	At method set-up and after major maintenance	RT width is ± 3 times standard deviation for each analyte RT from 72-hour study.	NA	Analyst or certified instrument technician	Explosives; CA-402
HPLC	Establishment and verification of the RT window for each analyte and surrogate	Once per ICAL and at the beginning of the analytical shift for establishment of RT; and with each Continuing Calibration Verification (CCV) for verification of RT	Using the midpoint standard or the CCV at the beginning of the analytical shift for RT establishment; analyte must fall within established window during RT verification	NA	Analyst or certified instrument technician	Explosives; CA-402

Instrument	Calibration Procedure	Calibration Frequency	Acceptance Criteria	Corrective Action	Personnel Responsible for Corrective Action	Analyte Group; Method/ Lab SOP
HPLC	CCV	After every 10 samples and at the end of the analysis sequence	All analytes within ± 20% of true value (%D)	Correct problem, rerun CCV. Reanalyze all samples since last successful calibration verification	Analyst or certified instrument technician	Explosives; CA-402
ICP-OES	Linear dynamic range or high-level check standard	Every 6 months	Within ± 10% of true value	NA	Analyst or certified instrument technician	Select Metals; CA-608
ICP-OES	Instrument Detection Level (IDL) Study	At initial set-up and after significant change in instrument type, personnel, test method, or sample matrix	IDLs shall be ≤ LOD	Samples may not be analyzed without a valid IDL.	Analyst or certified instrument technician	Select Metals; CA-608
ICP-OES	ICAL for all analytes: minimum one high standard and a calibration blank	Daily ICAL prior to sample analysis	If more than one calibration standard is used, $r^2 \geq 0.99$	Correct problem, then repeat ICAL.	Analyst or certified instrument technician	Select Metals; CA-608
ICP-OES	ICV (second source)	Once after each ICAL, prior to beginning a sample run	All reported analytes within ± 10% of true value	Correct problem and verify second source standard. Rerun ICV. If that fails, correct problem and repeat ICAL	Analyst or certified instrument technician	Select Metals; CA-608

Instrument	Calibration Procedure	Calibration Frequency	Acceptance Criteria	Corrective Action	Personnel Responsible for Corrective Action	Analyte Group; Method/ Lab SOP
ICP-OES	CCV	After every 10 field samples and at the end of the analysis sequence	All reported analytes within ± 10% of true value	Correct problem, rerun calibration verification. If that fails, then repeat ICAL. Reanalyze all samples since the last successful calibration verification.	Analyst or certified instrument technician	Select Metals; CA-608
ICP-OES	Low-level calibrations check standard (LLCCV)	Daily, after one-point ICAL	LLCCV ≤ LOQ; all reported analytes within ± 20% of true value	Correct problem, then reanalyze.	Analyst or certified instrument technician	Select Metals; CA-608
ICP-OES	Initial and Continuing Calibration Blank (ICB/CCB)	Immediately after the ICV and immediately after every CCV (every 10 samples)	The absolute values of all analytes must be < ½ LOQ or < 1/10th the amount measured in any sample	Terminate analysis; recalibrate and reanalyze the samples.	Analyst or certified instrument technician	Select Metals; CA-608
ICP-OES	Interference Check Solutions (ICS) (also called Spectral Interference Checks)	After ICAL and prior to sample analysis.	ICS-A: Absolute value of concentration for all non-spiked project analytes < LOD (unless they are a verified trace impurity from one of the spiked analytes); ICS-AB: Within ± 20% of true value. All analytes must be within the LDR. ICS-AB is not needed if instrument can read negative responses.	Terminate analysis; locate and correct problem; reanalyze ICS, reanalyze all samples	Analyst or certified instrument technician	Select Metals; CA-608
ICP-MS	Linear dynamic range or high-level check standard	Every 6 months	Within ± 10% of true value	NA	Analyst or certified instrument technician	Select Metals; CA-627

Instrument	Calibration Procedure	Calibration Frequency	Acceptance Criteria	Corrective Action	Personnel Responsible for Corrective Action	Analyte Group; Method/ Lab SOP
ICP-MS	IDL Study	At initial set-up and after significant change in instrument type, personnel, test method, or sample matrix	IDLs shall be ≤ LOD	Samples may not be analyzed without a valid IDL.	Analyst or certified instrument technician	Select Metals; CA-627
ICP-MS	Tuning	Prior to ICAL	Mass calibration ≤ 0.1 amu from the true value; Resolution < 0.9 amu full width at 10% peak height.	Retune, then verify.	Analyst or certified instrument technician	Select Metals; CA-627
ICP-MS	ICAL for all analytes	Daily ICAL prior to sample analysis	If more than one calibration standard is used, $r^2 \geq 0.99$	Correct problem, then repeat ICAL.	Analyst or certified instrument technician	Select Metals; CA-627
ICP-MS	ICV (second source)	Once after each ICAL, prior to beginning a sample run	All reported analytes within ± 10% of true value	Correct problem and verify second source standard. Rerun ICV. If that fails, correct problem and repeat ICAL	Analyst or certified instrument technician	Select Metals; CA-627
ICP-MS	CCV	After every 10 field samples and at the end of the analysis sequence	All reported analytes within ± 10% of true value	Correct problem, rerun calibration verification. If that fails, then repeat ICAL. Reanalyze all samples since the last successful calibration verification.	Analyst or certified instrument technician	Select Metals; CA-627
ICP-MS	LLCCV	Daily	LLCCV ≤ LOQ; all reported analytes within ± 20% of true value	Correct problem, then reanalyze.	Analyst or certified instrument technician	Select Metals; CA-627
ICP-MS	Internal Standard	Every standard, field sample, and QC sample	IS intensity in the samples within 30-120% of intensity of the IS in the ICAL blank.	For field samples (but acceptable in QC), matrix effect; re-analyze sample at 5-fold dilution.	Analyst or certified instrument technician	Select Metals; CA-627

Instrument	Calibration Procedure	Calibration Frequency	Acceptance Criteria	Corrective Action	Personnel Responsible for Corrective Action	Analyte Group; Method/ Lab SOP
				For failed QC samples, correct problem and rerun all associated samples.		
ICP-MS	ICB/CCB	Immediately after the ICV and immediately after every CCV (every 10 samples)	The absolute values of all analytes must be < ½ LOQ or < $1/10^{th}$ the amount measured in any sample	ICB: Correct problem, return ICV/ICB. If still fails, terminate analysis; recalibrate and reanalyze the samples.	Analyst or certified instrument technician	Select Metals; CA-627
ICP-OES	ICS	After ICAL and prior to sample analysis.	ICS-A: Absolute value of concentration for all non-spiked project analytes <1/2 LOQ (unless they are a verified trace impurity from one of the spiked analytes); ICS-AB: Within ± 20% of true value. ICS-AB is not needed if instrument can read negative responses.	Terminate analysis; locate and correct problem; reanalyze ICS, reanalyze all samples	Analyst or certified instrument technician	Select Metals; CA-627

1 # QAPP WORKSHEET #25: ANALYTICAL INSTRUMENT AND EQUIPMENT MAINTENANCE, TESTING, AND
2 INSPECTION

Instrument/ Equipment	Maintenance Activity	Testing Activity	Inspection Activity	Frequency	Acceptance Criteria	Corrective Action	Personnel Responsible	Analyte Group; Method/ Lab SOP
HPLC	Change guard cartridge, inlet filter and PTFE frit	NA	Review pressure profile	As needed, based on pressure profile	NA	Replace them and check often	Analyst or certified instrument technician	Explosives; CA-402
HPLC	Change analytical column	NA	Check peak tailing, decreased sensitivity, retention time changes, etc.	When chromatography indicates	NA	NA	Analyst or certified instrument technician	Explosives; CA-402
HPLC	Replace mobile phase daily	NA	NA	Daily	NA	NA	Analyst or certified instrument technician	Explosives; CA-402
ICP-OES	Check instrument connections, gas flow, and pressure.	Conduct leak test.	Visually inspect for wear or damage and indicator from computer controls.	Daily and annual maintenance from manufacturer.	Intensity of spectrum is within manufacture's recommendation.	Call for maintenance service.	Analyst or certified instrument technician	Select Metals; CA-608
ICP-OES	Clean the torch in Aqua Regia solution and align the torch.	Conduct leak test and adjust alignment.	Inspect for leaks and align the torch and ensure that it is in the center.	Each week (minimum every 2 weeks).	Torch is centered and no leaks.	Replace or call for maintenance service.	Analyst or certified instrument technician	Select Metals; CA-608
ICP-OES	Clean the chamber and nebulizer.	NA	Visually inspect for foreign objects.	Each week.	Make sure chamber and nebulizer are clean.	Replace or call for maintenance service.	Analyst or certified instrument technician	Select Metals; CA-608

Instrument/ Equipment	Maintenance Activity	Testing Activity	Inspection Activity	Frequency	Acceptance Criteria	Corrective Action	Personnel Responsible	Analyte Group; Method/ Lab SOP
ICP-OES	Clean the lens and optimize the detector sensitivity.	NA	Clean up the dust from the lens.	Every 6 months.	In accordance with manufacturer’s recommendation or lab SOP.	Install new lens	Certified instrument technician	Select Metals; CA-608
ICP-MS	Check instrument connections, gas flow, and pressure.	Conduct leak test.	Visually inspect for wear or damage and indicator from computer controls.	Daily and annual maintenance from manufacturer.	Intensity of spectrum is within manufacture’s recommendation	Call for maintenance service.	Analyst or certified instrument technician	Select Metals; CA-627
ICP-MS	Ion source cleaning; filament replacement	NA	NA	Annual maintenance from manufacturer	NA	Replace as needed.	Analyst or certified instrument technician	Select Metals; CA-627
pH Meter	Check electrode and probe for problems	NA	Visual inspection	As needed when indicated by performance	Appropriate performance	Perform additional maintenance	Analyst or certified instrument technician	pH; CA-709

QAPP WORKSHEETS #26 & 27: SAMPLE HANDLING, CUSTODY, AND DISPOSAL

Sampling Organization: Tetra Tech
Laboratory: Katahdin
Method of Sample Delivery (shipper/carrier): FedEx
Number of days until sample disposal: 30 days from invoice

Activity	Organization and Title or Position of Person Responsible for the Activity	SOP Reference
Sample collection	Tetra Tech field sampling technician	MC SOP 1 and MC SOP 4
Sample labeling	Tetra Tech field sampling technician	MC SOP 1 and MC SOP 4
Chain-of-custody form completion	Tetra Tech field sampling technician	MC SOP 1
Packaging	Tetra Tech field sampling technician	MC SOP 1
Sample storage (in field)	Tetra Tech field sampling technician	MC SOP 1
Shipping coordination	Tetra Tech field sampling technician; Tetra Tech Project Chemist	MC SOP 1
Sample receipt and log-in	Katahdin sample receipt personnel	SD-902
Sample preparation	Katahdin analyst	CA-605, CA-604
Sample extract/digest storage (in laboratory)	Katahdin sample custodian	CA-605, CA-604
Sample extraction of nitroaromatics and nitroamines (in laboratory)	Katahdin sample custodian	CA-548
Sample disposal	Katahdin sample custodian	SD-903
Sample waste minimization (in laboratory)	Katahdin sample custodian	SD-903

1 # QAPP WORKSHEET #28A: ANALYTICAL QUALITY CONTROL AND CORRECTIVE ACTION FOR EXPLOSIVES

2 **Matrix:** Soil/Groundwater
3 **Analytical Group:** Explosives
4 **Analytical Method (SOP Reference):** SW-846 Method 8330B (CA-402)

QC Sample [1]	Frequency/ Number	Method/SOP QC Acceptance Limits[1,2]	Corrective Action	Person(s) Responsible for Corrective Action	Project-specific MPC	Validation Action [2]
Soil drying procedure	Each sample, LCS, and Method Blank.	Laboratory must have a procedure to determine when the sample is dry to constant mass. Entire sample must be air dried at room temperature. Record date, time, and ambient temperature on a daily basis while drying samples. Drying may introduce a bias and is not recommended for certain compounds.	NA	Laboratory Analyst	NA	Validation as per DoD General Data Validation (DV) Guidelines (Revision 1)[3]
Soil sieving procedure	Each sample, LCS, and Method Blank.	Weigh entire sample. Sieve entire sample with a #10 mesh sieve. Breakup pieces of soil (especially clay) with gloved hands. Do not intentionally include vegetation in the portion of the sample that passes through the sieve unless this is a project-specific requirement. Collect and weigh any portion unable to pass through the sieve	NA	Laboratory Analyst	NA	Validation as per DoD General Data Validation (DV) Guidelines (Revision 1)[3]

QC Sample [1]	Frequency/ Number	Method/SOP QC Acceptance Limits[1,2]	Corrective Action	Person(s) Responsible for Corrective Action	Project-specific MPC	Validation Action [2]
Soil grinding procedure	Initial demonstration	Initial demonstration of grinding equipment: The laboratory must initially demonstrate that the grinding procedure is capable of reducing the particle size to < 75 µm by passing representative portions of ground sample through a 200 mesh sieve (ASTM E11).	NA	Laboratory Analyst	NA	Validation as per DoD General Data Validation (DV) Guidelines (Revision 1)[3]
Soil subsampling process	Each sample, LCS, and Method Blank.	Entire sample is mixed and spread out evenly on a large flat surface (e.g., baking tray), and 30 or more randomly located increments are removed from the entire depth and breadth to obtain the appropriate subsample size.	NA	Laboratory Analyst	NA	Validation as per DoD General Data Validation (DV) Guidelines (Revision 1)[3]
Soil sample triplicate (laboratory)	At the subsampling step, performed on one sample per batch (up to 20 samples)	The RSD for results above the LOQ must not exceed 20%.	Examine the project-specific requirements. Contact the client as to additional measures to be taken.	Laboratory Analyst	NA	Validation as per DoD General Data Validation (DV) Guidelines (Revision 1)[3]
Aqueous sample preparation	Each sample and associated batch QC samples.	Solid phase extraction using resin-based solid phase disks or cartridges are required	NA	Laboratory Analyst	NA	Validation as per DoD General Data Validation (DV) Guidelines (Revision 1)[3]

QC Sample [1]	Frequency/ Number	Method/SOP QC Acceptance Limits[1,2]	Corrective Action	Person(s) Responsible for Corrective Action	Project-specific MPC	Validation Action [2]
Method Blank (MB)	1 per preparatory batch (up to 20 samples)	No analyte > ½ LOQ or > 1/10th amount measured in any sample or 1/10th regulatory limit, whichever is greater	Correct problem; if required, re-prep and re-analyze MB and all associated samples If re-analysis cannot be performed, apply "B" qualification to specific analyte(s) in all samples in associated preparation batch	Laboratory Analyst	No analyte > ½ LOQ or > 1/10th amount measured in any sample or 1/10th PSL (WS 15), whichever is greater	Validation as per DoD General Data Validation (DV) Guidelines (Revision 1)[3]
Grinding Blank	1 per preparatory batch (up to 20 samples); Processed after LCS or client-identified sample with known contamination or end of batch.	No reported analytes must be detected > 1/2 LOQ	Blank results must be reported and the affected samples must be flagged accordingly if blank criteria are not met. If required, re-prep and reanalyze blank and all QC samples and field samples processed with the contaminated blank.	Laboratory Analyst	No reported analytes must be detected > 1/2 LOQ	Validation as per DoD General Data Validation (DV) Guidelines (Revision 1)[3]
LCS	1 per preparatory batch (up to 20 samples)	Limits as per DoD QSM Appendix C, Table C-37 (solids) or Table C-36 (aqueous); otherwise, use in-house control limits	Correct problem, re-prep and reanalyze LCS and all associated samples, if sufficient material available. If re-analysis cannot be performed, apply "Q" qualification to specific analyte(s) in all samples in associated preparation batch	Laboratory Analyst	Recoveries within DoD QSM Table C-37 limits (solids) or Table C-36 limits (aqueous). If not provided in QSM v5.3, use laboratory inhouse control limits provided [which may not be greater than ±3 times the SD of the mean recovery]	Validation as per DoD General Data Validation (DV) Guidelines (Revision 1)[3]

QC Sample [1]	Frequency/ Number	Method/SOP QC Acceptance Limits[1,2]	Corrective Action	Person(s) Responsible for Corrective Action	Project-specific MPC	Validation Action [2]
MS, MSD [aqueous samples]	1 per preparatory batch (up to 20 samples)	Limits as per DoD QSM Appendix C, Table C-36 (aqueous); otherwise, use in-house control limits	Examine the project-specific requirements. Contact the client as to additional measures to be taken. For specific analyte(s) in the parent sample, apply "J" qualification if acceptance criteria are not met and explain in the case narrative.	Laboratory Analyst	Recoveries within DoD QSM Table C-36 limits (aqueous). If not provided in QSM v5.3, use laboratory inhouse control limits provided [which may not be greater than ±3 times the SD of the mean recovery]	Validation as per DoD General Data Validation (DV) Guidelines (Revision 1)[3]
MS/MSD [aqueous samples for initial round only. If subsequent rounds/statistical approach, MSDs not performed]	1 per preparatory batch (up to 20 samples)	Limits as per DoD QSM Appendix C, Table C-36 (aqueous); otherwise, use in-house control limits	Examine the project-specific requirements. Contact the client as to additional measures to be taken. For specific analyte(s) in the parent sample, apply "J" qualification if acceptance criteria are not met and explain in the case narrative.	Laboratory Analyst	≤ 20% RPD	Validation as per DoD General Data Validation (DV) Guidelines (Revision 1)[3]

QC Sample [1]	Frequency/ Number	Method/SOP QC Acceptance Limits[1,2]	Corrective Action	Person(s) Responsible for Corrective Action	Project-specific MPC	Validation Action [2]
Surrogate Compounds	All samples	Limits as per DoD QSM Appendix C, Table C-37 (solids) or Table C-36 (aqueous); otherwise, use in-house control limits	Correct problem, re-prep and reanalyze all failed samples, if sufficient material available, unless obvious chromatographic interferences are present Apply "Q" qualification to associated analytes	Laboratory Analyst	Recoveries within DoD QSM Table C-37 limits (solids) or Table C-36 limits (aqueous). If not provided in QSM v5.3, use laboratory inhouse control limits provided [which may not be greater than ±3 times the SD of the mean recovery]	Validation as per DoD General Data Validation (DV) Guidelines (Revision 1)[3]
IStd	All samples	RT within ± 30 seconds from RT of initial calibration midpoint standard; IStd signal within -50% to +100% of initial calibration midpoint standard	Check instruments, reanalyze affected samples Apply "Q" qualification to analytes associated with noncompliant IS	Primary/QA Laboratory Analyst	RT within ± 30 seconds from RT of initial calibration midpoint standard; IS signal within -50% to +100% of initial calibration midpoint standard	Validation as per DoD General Data Validation (DV) Guidelines (Revision 1)[3]
Second Column Confirmation	All positive results must be confirmed	Limits as per DoD QSM Appendix C, Table C-37 (solids) or Table C-36 (aqueous).	Report from both columns. Apply "J" qualification if RPD>40%.	Primary/QA Laboratory Analyst	≤ 40% RPD (for results between primary and secondary columns)	Validation as per DoD General Data Validation (DV) Guidelines (Revision 1)[3]

Notes:
[1] Calibration samples are outlined in WS #24.
[2] Further discussion on analytical data validation is provided in WS #36.
[3] As of April 2021, there is not a specific module for data validation for incremental sampling and/or organic analysis by HPLC (such as explosives via 8330B). If such a module is developed, discussion as to use will be performed with the PDT. USACE concurrence will be obtained prior to proceeding.

QAPP WORKSHEET #28B: ANALYTICAL QUALITY CONTROL AND CORRECTIVE ACTION FOR SELECT METALS

Matrix: Soil/Groundwater
Analytical Group: Select Metals
Analytical Method (SOP Reference): SW-846 Method 6010D (CA-608)/6020A (CA-627)

QC Sample [1]	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Project-specific MPC	Validation Action [2]
Soil drying procedure	Each sample, LCS, and Method Blank.	Laboratory must have a procedure to determine when the sample is dry to constant mass. Entire sample must be air-dried at room temperature. Record date, time, and ambient temperature on a daily basis while drying samples. Drying may introduce a bias and is not recommended for certain compounds.	NA	Laboratory Analyst	NA	Validation as per DoD General Data Validation (DV) Guidelines (Revision 1)[3]
Soil sieving procedure	Each sample, LCS, and Method Blank.	Weigh entire sample. Sieve entire sample with a #10 mesh sieve. Breakup pieces of soil (especially clay) with gloved hands. Do not intentionally include vegetation in the portion of the sample that passes through the sieve unless this is a project-specific requirement. Collect and weigh any portion unable to pass through the sieve	NA	Laboratory Analyst	NA	Validation as per DoD General Data Validation (DV) Guidelines (Revision 1)[3]

QC Sample [1]	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Project-specific MPC	Validation Action [2]
Soil subsampling process	Each sample, LCS, and Method Blank.	Entire sample is mixed and spread out evenly on a large flat surface (e.g., baking tray), and 30 or more randomly located increments are removed from the entire depth and breadth to obtain the appropriate subsample size.	NA	Laboratory Analyst	NA	Validation as per DoD General Data Validation (DV) Guidelines (Revision 1)[3]
Soil sample triplicate (laboratory)	At the subsampling step, performed on one sample per batch (up to 20 samples)	The RSD for results above the LOQ must not exceed 20%.	Examine the project-specific requirements. Contact the client as to additional measures to be taken.	Laboratory Analyst	NA	Validation as per DoD General Data Validation (DV) Guidelines (Revision 1)[3]
Method blank	1 per preparatory batch (up to 20 samples)	The absolute values of all analytes must be < ½ LOQ or < 1/10th the amount measured in any sample or < 1/10th the regulatory limit, whichever is greater	Correct problem; if required, re-prep and re-analyze MB and all associated samples If re-analysis cannot be performed, apply "B" qualification to specific analyte(s) in all samples in associated batch	Laboratory Analyst	The absolute values of all analytes must be < ½ LOQ or < 1/10th the amount measured in any sample or < 1/10th the PSL, whichever is greater	Validation as per DoD DV Guidelines Module 2, Section 4.1 (May 2020)

QC Sample [1]	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Project-specific MPC	Validation Action [2]
LCS	1 per preparatory batch (up to 20 samples)	Limits as per DoD QSM Appendix C, Table C-3/ Table C-5 (soil) and Table C-4/Table C-6 (aqueous)	Terminate analysis; correct problem; re-digest and reanalyze LCS and all samples associated with failed LCS, if sufficient material available. If re-analysis cannot be performed, apply "Q" qualification to specific analyte(s) in all samples in associated preparation batch.	Laboratory Analyst	Recoveries within DoD QSM Table C-3/Table C-5 (soil) and Table C-4/ Table C-6 (aqueous) limits. If not provided in QSM v5.3, use laboratory inhouse control limits [which may not be greater than ±3 times the SD of the mean recovery]	Validation as per DoD DV Guidelines Module 2, Section 4.2 (May 2020)
MS [aqueous samples]	1 per preparatory batch (up to 20 samples)	Recoveries within DoD QSM Table C-4/Table C-6 (aqueous) limits. If not provided in QSM v5.3, use laboratory inhouse control limits [which may not be greater than ±3 times the SD of the mean recovery]	Examine the project-specific requirements. Contact the client as to additional measures to be taken. Apply "J" flag if acceptance criteria are not met and explain in the case narrative.	Laboratory Analyst	Recoveries within DoD QSM Table C-4/Table C-6 (aqueous) limits. If not provided in QSM v5.3, use laboratory inhouse control limits [which may not be greater than ±3 times the SD of the mean recovery]	Validation as per DoD DV Guidelines Module 2, Section 4.2 (May 2020)

QC Sample [1]	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Project-specific MPC	Validation Action [2]
MD [aqueous samples for initial round only. If subsequent rounds/statistical approach, MDs not performed]	1 per preparatory batch (up to 20 samples)	≤ 20% RPD	Examine the project-specific requirements. Contact the client as to additional measures to be taken. Apply "J" flag if acceptance criteria are not met and explain in the case narrative.	Laboratory Analyst	≤ 20% RPD	Validation as per DoD DV Guidelines Module 2, Section 4.2 (May 2020)

Notes:
[1] Calibration samples are outlined in WS #24.
[2] Further discussion on analytical data validation is provided in WS #36.
[3] As of April 2021, there is not a specific module for data validation for incremental sampling (such as via 8330B Appendix A). If such a module is developed, discussion as to use will be performed with the PDT. USACE concurrence will be obtained prior to proceeding.

QAPP WORKSHEET #29 – DATA MANAGEMENT, PROJECT DOCUMENTS AND RECORDS

Part 1: Data Management Specifications

Computer Files and Digital Data: All final document files, including reports, figures, and tables, will be submitted in electronic format. Documents that can be emailed will be sent as attachments. Data packages, documents, and deliverables too large to effectively email will be posted to a secure Tetra Tech or DoD site for retrieval by USACE. In addition, large data packages may be delivered to USACE on CD-ROM or portable hard drives. Data management and backup will be performed IAW Tetra Tech's DAGCAP-accredited Quality Management System.

TOI Library: Tetra Tech will use the DoD TOI library current as of the date of the final QAPP approval as the initial starting point for development of the site-specific library. If the DoD library is updated during the course of the project, the updates will be reviewed for applicability to the site-specific library developed for the SCAAF BGR. Tetra Tech will develop a site-specific library in accordance with AGC SOP 8 and through consultation with the USACE QA Geophysicist prior to performing classification.

Part 2: Control of Documents, Records, and Databases

Table 29-1. Minimum Required Documents and Records

Document/Record	Purpose	Completion/ Update Frequency	Format/ Storage Location/ Archive Requirements
Quality Control Status Report (QCSR)	Record of the Three Phase of Control (TPC) Process	The rates defined in Worksheets #31, 32 & 33	Hard copy or electronic/ field office or SharePoint site/ project file
Preparatory Inspection Checklist	Documents completion of the preparatory phase of the TPC process	Each DFW or combination of DFWs inspected	Electronic copy/ SharePoint site/ project file
Initial Inspection Checklist	Documents resolution of outstanding items from preparatory phase; documents completion of the initial phase of the TPC process	Each DFW or combination of DFWs inspected	Electronic copy/ SharePoint site/ project file
Daily field production report	Record daily field events, personnel on-site, tasks performed, weather conditions	Daily	Hard copy or electronic/ field office or SharePoint site/ project file
Daily field QC report	Documentation of inspections, instrument QC checks, and nonconformances	Daily	Hard copy or electronic/ field office or SharePoint site/ project file
Weekly DGM/AGC QC report	Document achievement of MQOs in Worksheet #22 for geophysical survey data; also serves as ongoing inspection phase of TPC process	Weekly; addresses each DFW or combination of DFWs inspected	Electronic copy/ SharePoint site/ project file

Document/Record	Purpose	Completion/ Update Frequency	Format/ Storage Location/ Archive Requirements
Field logs	Record of UXO Team's activities (analog instrument checks, clearance, MEC/MD/other debris identified, targets excavated)	Daily	Hard copy or electronic/ field office or SharePoint site/ project file
Photographs documenting vegetation removal in sensitive areas	Document vegetation removal (before and after) in sensitive areas	Daily, during vegetation removal activities	Electronic copy/ SharePoint site/ project file
SOP checklists	Verify completion of specific tasks governed by SOPs	As tasks are completed IAW governing SOP	Hard copy or electronic/ field office or SharePoint site/ project file
Personnel qualifications certification	Documentation that required certifications and training have been completed	Prior to mobilization/upon renewal of certifications or training/new personnel on-site	Hard copy or electronic/ field office or SharePoint site/ project file
Daily safety meeting attendance log	Site-specific training and safety documentation	Daily	Hard copy or electronic/ field office or SharePoint site/ project file
Safety inspection logs	Site is properly equipped with safety equipment, and operations are being performed in compliance with the APP/SSHP	Prior to field operations kickoff and weekly at a minimum	Hard copy or electronic/ field office or SharePoint site/ project file
Hours-worked record (included on daily SUXOS report)	Record maintained to comply with EM 385-1-97 and for contractor manpower reporting	Daily	Hard copy or electronic/ field office or SharePoint site/ project file
DGM/AGC field team daily notes/ log	Record of geophysical survey operations	Daily for each day DGM/AGC operations are performed on-site	Hard copy or electronic/ field office or SharePoint site/ project file
Land survey subcontractor report (as applicable)	Documents establishment of site-specific control points established on-site and confirms that geodetic accuracy meets project requirements	Once after control established; updated for new temporary control points that may be added	Electronic copy/ SharePoint or server/ archived electronically
IVS technical memorandum (including amended memoranda)	Documents completion of IVS construction and initial validation of DGM and AGC systems; amended versions document validation of additional sensors or modified deployment/use of previously-validated sensors	Once after completion of IVS; amended after completion of IVS for AGC cued surveys	Electronic copy/SharePoint or server/ archived electronically
Surface clearance technical memorandum	Documents completion of the surface clearance operations and findings in planned mini-grids	Once after completion of surface clearance operations	Electronic copy/SharePoint or server/ archived electronically

Document/Record	Purpose	Completion/ Update Frequency	Format/ Storage Location/ Archive Requirements
Blind QC Memorandum	Documents locations and burial details for QC seeds emplaced within mini-grids; blind seed registry provided with memorandum	Once after completion of seeding; updated with any new seed locations added in the field	Password-protected (i.e. firewalled) electronic copy/ SharePoint or server/ archived electronically
Running DGM/AGC QC summary	Tracks DGM/AGC performance relative to criteria established in Worksheet #22	Updated daily for QC tests performed on a daily basis as well as with each processed data set	Electronic copy/ SharePoint or server/ archived electronically
DGM/AGC data package deliverables	Digital Record of DGM/AGC raw, processed and final data	DGM/AGC data deliverables for each week's field effort submitted by the following Friday unless otherwise communicated in advance with USACE QA Geophysicist.	Digital data files and electronic copies/ SharePoint or server/ archived electronically
Site-specific TOI library	Includes TOI based on current project-specific CSM for use during classification (or appropriate, agreed-upon representatives in absence of polarizabilities for munitions in the CSM)	Provided with delivery of initial MM2x2 cued validation results from IVS and amended IVS technical memorandum; provided each time updated thereafter in consultation with USACE QA Geophysicist	Digital data files and electronic copies/ SharePoint or server/ archived electronically
Master database	Record of field data, raw and processed data, findings, and information collected (e.g., surface clearance, intrusive investigation) to date	Database deliverable for each week's field effort submitted by the following Friday	Electronic copy/ SharePoint or Server/ archived electronically
DUAs (preliminary, updated, final)	Documents usability of data to meet MPC in Worksheet #12 for completed tasks through date of DUA issuance	As specified in Table 17-1	Electronic copy/ SharePoint or Server/ archived electronically
MEC accountability log	Record of MEC identified (date, team, type, location, disposition)	When MEC is identified	Hard copy or electronic/ field office/ project file
Disposal operations checklist	Demolition Supervisor Checklist to be followed and documented during disposal operations	As required	Hard copy or electronic/ field office/ project file
Explosives usage record	Record of shots performed (time, date, MEC item, donor explosives)	As required (when shots are performed)	Hard copy or electronic/ field office/ project file

Document/Record	Purpose	Completion/ Update Frequency	Format/ Storage Location/ Archive Requirements
Sample collection forms	Record of samples collected (date, time, identification, type, location, analyses to be performed)	As required	Hard copy or electronic/ field office/ project file
Sample chains of custody	Record of sample custody, control, transfer, analysis, and disposition	To be completed upon sample collection and shipment	Hard copy or electronic/ field office/ project file
Sample Log-in	Record of sample received at the laboratory, including condition	To be completed upon receiving sample at laboratory	Hard copy or electronic/ laboratory/ project file
Sample Prep Logs	Provide documentation of achievement of analytical method requirements	As required	Hard copy or electronic/ laboratory/ project file
Instrument Calibration Logs	Provide documentation of achievement of analytical method requirements	As required	Hard copy or electronic/ laboratory/ project file
Instrument Raw Data	Provide documentation of instrument raw analytical data	As required	Hard copy or electronic/ laboratory/ project file
Sample Run Logs	Provide documentation of achievement of analytical method requirements	As required	Hard copy or electronic/ laboratory/ project file
Analytical Review Checklists	Describe checklist assessment and discuss corrective actions.	As required	Hard copy or electronic/ laboratory/ project file
Data Validation Reports	Describe validation analyses and findings, discuss qualifications and provide documentation.	As required	Hard copy or electronic/ project file
Non-hazardous MDAS demilitarization chain of custody, DD 1348-1A	Certification that MDAS is free of explosives	As required	Hard copy or electronic/ field office/ project file
NCR	Documentation of nonconformance and applicable response	As required (when nonconformance is identified)	Hard copy or electronic/ field office or SharePoint site/ project file
RCA/CA	Documents identification of the root cause of a nonconformance and the proposed corrective action	For each nonconformance where RCA/CA is the required response (Worksheet #22)	Hard copy or electronic/ field office or SharePoint site/ project file

Document/Record	Purpose	Completion/ Update Frequency	Format/ Storage Location/ Archive Requirements
Field change request form	Record of modifications to approach implemented in the field, and documentation of client approval	As required	Hard copy or electronic/ field office or SharePoint site/ project file
GIS native files	Digital record of all field activities and information.	As required.	Electronic copy/ SharePoint or server/ archived electronically

QAPP WORKSHEET #31, #32, & #33 – ASSESSMENTS AND CORRECTIVE ACTION (CA)

For this project, related activities are grouped as follows:

1. Site preparation (DFWs 1 and 2)
2. Preliminary MRS Characterization (DFWs 3 and 4)
3. HD/LD Characterization (DFWs 5 - 8)
4. Intrusive Investigation and MC Sampling (DFW 9 - 11)

For each group of related activities, assessment activities will occur during the following phases:

Preparatory Phase: Comprises the planning and design process leading up to field activities. The UXOSO/QCS will perform a Preparatory Phase assessment before beginning each group of activities. The purpose of this assessment is to review applicable specifications and plans to verify that the necessary resources, conditions, and controls are in place and comply with specifications before fieldwork begins.

Initial Phase: Occurs at the startup of field activities. The purpose of this phase is to check preliminary work for compliance with specifications, check for omissions, and resolve differences of interpretation.

Follow-up Phase: Covers the routine, day-to-day activities at the site. One or more follow-up assessments will be conducted during each related group of activities, depending on the duration of field activities, and the nature of any assessment findings

Table 31-1. DFW Assessments (Three Phase of Control)

Assessment Type	Responsible Party	Schedule	Assessment Deliverable	Deliverable due date
Preparatory phase (DFW 1)	UXOSO/QCS	Once prior to arrival on-site for start of tasks under this DFW.	QCSR	Within 3 business days of completion of preparatory inspection
Initial phase (DFW 1)	UXOSO/QCS	First time Task is performed.	QCSR	Within 3 business days of completion of initial inspection
Follow-up phase (DFW 1)	UXOSO/QCS	Daily, until all tasks under this DFW are completed. Changes in task-specific personnel are addressed in this phase.	Daily field QC report	Daily
Preparatory phase (DFW 2-8)	QC Geophysicist	Once prior to beginning tasks under each DFW. Multiple DFWs may be combined in a single inspection event.	QRIR (Tetra Tech QP-06); preparatory inspection completion form (Tetra Tech QP-01)	Within 3 business days of completion of preparatory inspection

Assessment Type	Responsible Party	Schedule	Assessment Deliverable	Deliverable due date
Initial phase (DFW 2–8)	QC Geophysicist	Once at the beginning of tasks under each DFW. Changes in task-specific personnel are addressed in this phase. Multiple DFWs may be combined in a single inspection event.	Initial inspection completion form (Tetra Tech QP-01)	Within 3 business days of completion of initial inspection
Follow-up phase (DFW 2-8)	QC Geophysicist	Weekly. Multiple DFWs may be combined in a single inspection event.	Weekly AGC QC report	Throughout field and data processing activities; refer to Project Schedule
Preparatory phase (DFW 9)	UXOSO/QCS	Once prior to arrival on-site for start of tasks under this DFW.	QCSR	Within 3 business days of completion of preparatory inspection
Initial phase (DFW 9-10)	UXOSO/QCS	First time Task is performed.	QCSR	Within 3 business days of completion of initial inspection
Follow-up phase (DFW 9-10)	UXOSO/QCS	Daily, until all tasks under this DFW are completed. Changes in task-specific personnel are addressed in this phase.	Daily field QC report	Daily

1
2 **Table 33-2. Assessment Response and Corrective Action**

Assessment Type	Responsibility for responding to assessment findings	Assessment Response Documentation	Timeframe for Response	Responsibility for Implementing Corrective Action	Responsible for monitoring Corrective Action implementation
All phases (DFW 1)	SUXOS	Daily field QC report; NCR if required by Worksheet #22	Within 3 working days of notification	Tetra Tech PM; SUXOS	UXOSO/QCS
All phases (DFW 2–8)	Project Geophysicist	Daily field QC report; weekly AGC QC report; NCR if required by Worksheet #22	Within 3 working days of notification	Site Geophysicist; AGC Data Processor	QC Geophysicist; AGC PM
All phases (DFW 9-10)	SUXOS	Daily field QC report; NCR if required by Worksheet #22	Within 3 working days of notification	Tetra Tech PM; SUXOS	UXOSO/QCS

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QAPP WORKSHEET #34 – DATA VERIFICATION, VALIDATION, AND USABILITY INPUTS

Requirements/Specifications:

Contract: W912DY-16-D-002, Task Order W9123819F0069

Quality Assurance Surveillance Plan: *Date to be added when completed by USACE*

Tetra Tech SOPs are contained in Appendix E

Table 34-1. Data Verification, Validation and Usability Inputs

Item	Description	Verification (completeness)	Validation (conformance to specifications)	Usability (achievement of DQOs and MPCs)
Field Records				
1	QC seeding records	X	X	
2	Photographs	X		
3	Analog geophysical instrument function test results	X	X	X
4	AGC sensor function test results	X	X	X
5	IVS construction details	X	X	
6	SOP checklists	X	X	X
7	Daily field notes	X		X
8	Daily field production and QC reports	X	X	
Electronic Data				
9	QC seed registry	X	X	X
10	Raw MM2x2 data files and RTS point files (as applicable)	X	X	
11	Geosoft databases (processed dynamic survey and QC data)	X		X
12	Cued survey target list	X	X	
13	Geosoft map files (QC tests, gridded data, target locations)	X	X	X
14	Geosoft databases (processed cued data), inversion results, background validation results, QC statistics, classification results and diameter predictions	X	X	X
15	Dig list	X	X	X
16	Updated project GIS	X	X	X
17	Updated master project database	X		X
18	Final data archive (for each delivered subset)	X	X	
MC Data				
19	Laboratory Report – Cover Sheet / Identifying Information	X	X	X

Item	Description	Verification (completeness)	Validation (conformance to specifications)	Usability (achievement of DQOs and MPCs)
20	Laboratory Report – Case Narrative	X	X	X
21	Laboratory Report – Communications Records	X	X	X
22	Laboratory Report – Sample Receipt Records / Internal Laboratory Chains of Custody / Sample Chronology	X	X	X
23	Laboratory Report – Results Reporting Forms	X	X	X
24	Laboratory Report – Definition of Qualifiers	X	X	X
25	Laboratory Report – QC Reporting Forms	X	X	X
26	Laboratory Report – Instrument Calibration Forms	X	X	X
27	Laboratory Report – Raw Data	X	X	X
28	Laboratory Report – Corrective Action Reports	X	X	X
29	Laboratory Electronic Data Deliverable (EDD) – FUDS Chemistry Database (FUDSChem)	X	X	X
30	Data Validation Report	X	X	X
Interim & Final Reports/Deliverables				
31	SOP checklists	X	X	X
32	IVS Technical Memorandum	X	X	X
33	Preliminary MRS Characterization Memorandum	X	X	X
34	Revised CSM	X		X
35	MSD Reduction Memorandum	X	X	
36	RI Report including final data usability assessment	X		X

QAPP WORKSHEET #35 – DATA VERIFICATION AND VALIDATION PROCEDURES

Table 35-1. Data Verification and Validation Procedures

Activity and Records Reviewed	Requirements/ Specifications	Process Description/Frequency	Responsible Person	Documentation
Field Logbook/Field Forms/Running QC Summary	QAPP, SOPs	All information is complete for each day of field activities. Any changes/exceptions are documented and have been reported IAW requirements. Required signatures are present.	Tetra Tech PM	Daily Field Reports
Instrument Assembly	AGC SOP 1a, WS #22	Instrument Assembly has completed according to SOPs. MQOs have been achieved, with any exceptions noted. If appropriate, corrective actions have been completed. Signatures and dates are present.	Project Geophysicist	SOP Checklists Daily QC Report
IVS Technical Memorandum	AGC SOP 4, WS #22	Initial IVS Survey has been conducted according to SOPs. Checklists has been completed. All specifications have been achieved, or exceptions noted. If appropriate, corrective actions have been completed. Signatures and dates are present.	Project Geophysicist	SOP Checklists Daily QC Report
Chain of Custody forms	QAPP, laboratory SOPs	Verify the completeness of chain-of-custody records. Examine entries for consistency with the field logbook. Check that appropriate methods and sample preservation have been recorded. Verify that the required volume of sample has been collected and that sufficient sample volume is available for QC samples. Verify all required signatures and dates are present. Check for transcription errors. To be conducted daily when collecting samples.	Tetra Tech Project Chemist	Daily QC Report Revised Chains-of-Custody (as applicable) Laboratory QC report
Electronic Data	QAPP, laboratory SOPs, FUDSChem	Electronic data will be reviewed for consistency with the hardcopy information and electronic data format requirements. To be conducted upon receipt of laboratory EDD upload to FUDSChem.	Tetra Tech Project Chemist	Communication documentation with laboratory Data validation report Revised laboratory EDD (as applicable)

Activity and Records Reviewed	Requirements/ Specifications	Process Description/Frequency	Responsible Person	Documentation
Laboratory analytical data package	QAPP, laboratory SOPs	Verify the data package contains all records specified in the QAPP. Check sample receipt records to ensure sample condition upon receipt was noted, and any missing/broke containers were noted and reported according to plan. Compare the data package with the chain-of-custody forms to verify results are provided for all samples. Review narrative to ensure all QC exceptions are described. Check for evidence that any required notifications were provided to project personnel as specified in the QAPP. Verify necessary signatures and dates are present. To be conducted upon receipt of laboratory data package.	Tetra Tech Project Chemist	Communication documentation with laboratory Data validation report Revised laboratory analytical data package (as applicable)

QAPP WORKSHEET #36: DATA VALIDATION PROCEDURES

Validation of analytical MC data determines whether the available project results satisfy the project's DQOs and data use requirements. It includes the process of comparing the laboratory analytical data against established criteria after the laboratory has completed its own in-house QC checks. Validation determines if the data are acceptable by evaluating, at a minimum, the following categories:

- Data package completeness
- Laboratory performance
- Error checks

Table 36-1. Data Validation Approach

Item	Description
Analytical methods	SOP CA-402; SOP CA-608; SOP CA-627
Data deliverable requirements	Hardcopy data package (as portable document format [PDF] file) compatible with a Stage 4 data validation Electronic data deliverable compatible with upload to the project database in the FUDSChem portal
Validation procedure	DoD General Data Validation Guidelines, Revision 1, September 2019 (US Department of Defense, Environmental Data Quality Workgroup) and associated modules
MPC requirements	Worksheets #12, #15 and #28
Percent of data to be validated	90% Stage 2B 10% Stage 4
Percent of raw data reviewed	10%
Percent of results to be recalculated	10%
Type of validation	Electronic and manual
Electronic validation program	FUDSChem/ADR
Validation code	S2BVEM (Stage 2B Validation Electronic / Manual) S4VEM (Stage 4 Validation Electronic / Manual)

Refer to MC SOP #3 for additional details on the data validation approach.

Validation will be performed by an independent third-party subcontractor:

HSW Engineering, Inc.
15711 Mapledale Blvd., Suite B
Tampa, FL 33624
Project Manager: Cindy Lee Westergard
Email: cwestergard@hsweng.com
Phone: (813) 549-1015 and (813) 943-8831

During validation, qualifiers may be assigned to the data affected by QC outliers. Qualifiers indicate to the data user that analyte concentrations were estimated due to possible bias and/or reduced confidence in the results or were affected by serious deficiencies. The following qualifiers may be assigned during the validation process (DoD General Data Validation Guidelines Revision 1, 2019): The following qualifiers may be assigned during the validation process:

U	The analyte is not detected, reported as less than the LOD. The LOD may have been adjusted for any dilution of the sample.
UJ	The analyte is not detected, reported as less than the LOD. However, the associated numerical value is approximate.
J	The reported result is an estimated value with an unknown bias.
J+	The result is an estimated quantity, and the result may be biased high.
J-	The result is an estimated quantity, and the result may be biased low.
N	The analysis indicates the presence of an analyte for which there was presumptive evidence to make a "tentative identification."
NJ	The analyte is “tentatively identified” or “presumptively” present, and the associated numerical value is the estimated concentration in the sample.
X	The sample result/non-detect is affected by serious deficiencies in the ability to analyze the sample and/or meet the published method and project QC criteria (MPCs). The presence or absence of the analyte cannot be substantiated by the data provided. Acceptance or rejection of the data will be decided by the Project Team, but exclusion of the data is recommended.

The usability of the data qualified “X” by the validators will be assessed by the Project Team, and a decision made whether to accept or reject (qualify as unusable, “R”) the data.

QAPP WORKSHEET #37 – DATA USABILITY ASSESSMENT (DUA)

Personnel Responsible for Performing DUA:

- Tetra Tech PM – Jennifer Harlan, PMP
- Project QA Manager – Eugene Mikell, CQA
- Project Geophysicist – Matthew Barner, PG
- QC Geophysicist – Jeff Gamey, PGp
- UXOSO/QCS – Scott Nichols
- Chemist – Lynn Arabia, CHMM
- Project Risk Assessor – Hannah Neeley
- USACE PM – Julie Rupp, PG
- USACE TM – Todd Beckwith

Throughout the RI field investigation, Tetra Tech will perform periodic assessments of data quantity and quality as a means of verifying the appropriateness of the data in supporting the overall RI objectives. Table 17-1, together with individual DFW descriptions in Worksheet #17, identify when within the overall workflow these assessments occur and the supporting documentation generated to each point. Interim assessments will culminate in a final data usability assessment of the work completed for inclusion with the RI report. This final assessment will follow the four steps outlined in the table below.

Step 1	**Review the project's objectives and sampling design** Review the data quality objectives. Are underlying assumptions valid? Were the project boundaries appropriate? Review the sampling design as implemented for consistency with stated objectives. Was the sampling design appropriate for achievement of the project objectives? Were sources of uncertainty accounted for and appropriately managed? Summarize any deviations from the planned sample design.
Step 2	**Review the data verification/validation outputs and evaluate conformance to MPCs documented on Worksheet #12** Review available QA/QC reports, including weekly QC reports, assessment reports, corrective action reports, and the data verification/validation reports. Evaluate the implications of unacceptable QC results. Evaluate conformance to MPCs documented on Worksheet #12. Summarize the impacts of non-conformances on data usability.
Step 3	**Document data usability, update the CSM, and draw conclusions** Determine if the data can be used as intended, considering implications of deviations and corrective actions. Assess the performance of the sampling design, apply decisions rule, and Identify any limitations on data use. Update the conceptual site model and document conclusions.
Step 4	**Document lessons learned and make recommendations** Summarize lessons learned and make recommendations for changes to DQOs or the sampling design for future similar studies. Prepare the data usability summary report to be provided in the RI report.

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USEPA Region IV Ecological Screening Values (https://www.epa.gov/risk/regional-ecological-risk-assessment-era-supplemental-guidance)

USEPA Ecological Soil Screening Level (Eco-SSL) Guidance and Documents Ecological Soil Screening Level (Eco SSL) (https://www.epa.gov/risk/ecological-soil-screening-level-eco-ssl-guidance-and-documents)

APPENDIX A
Figures

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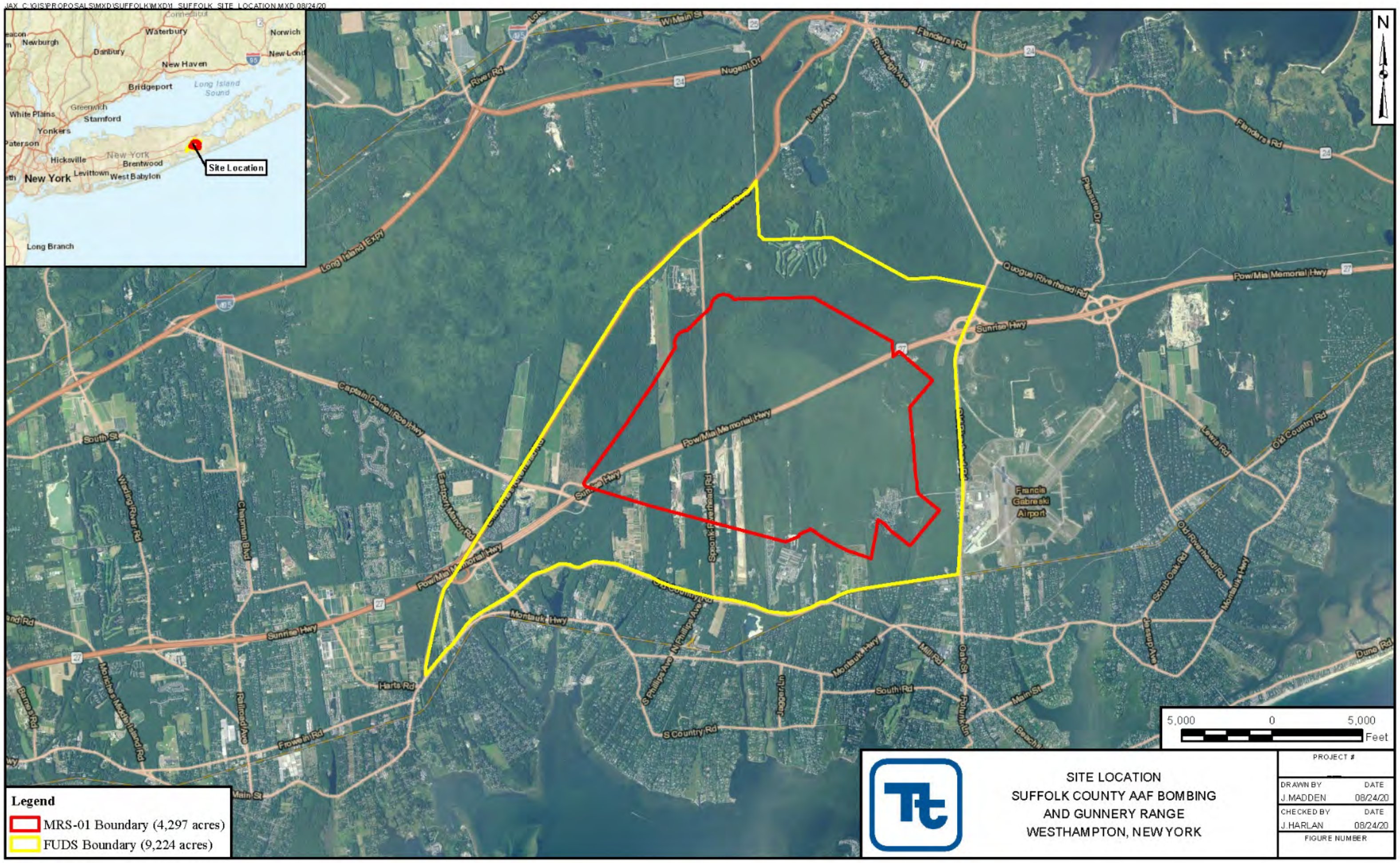

Figure A-1. Site Location

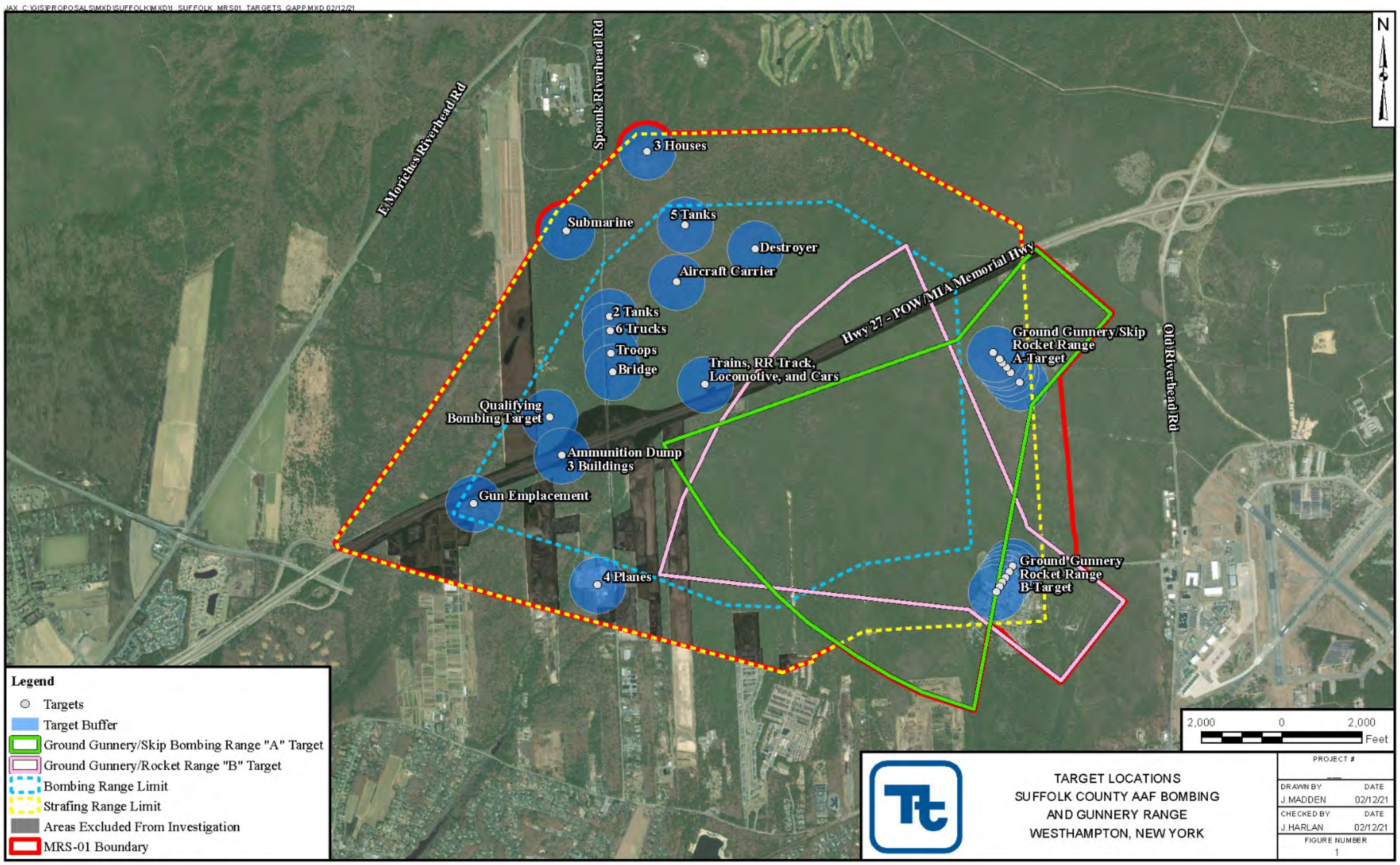

Figure A-2. MRS-01

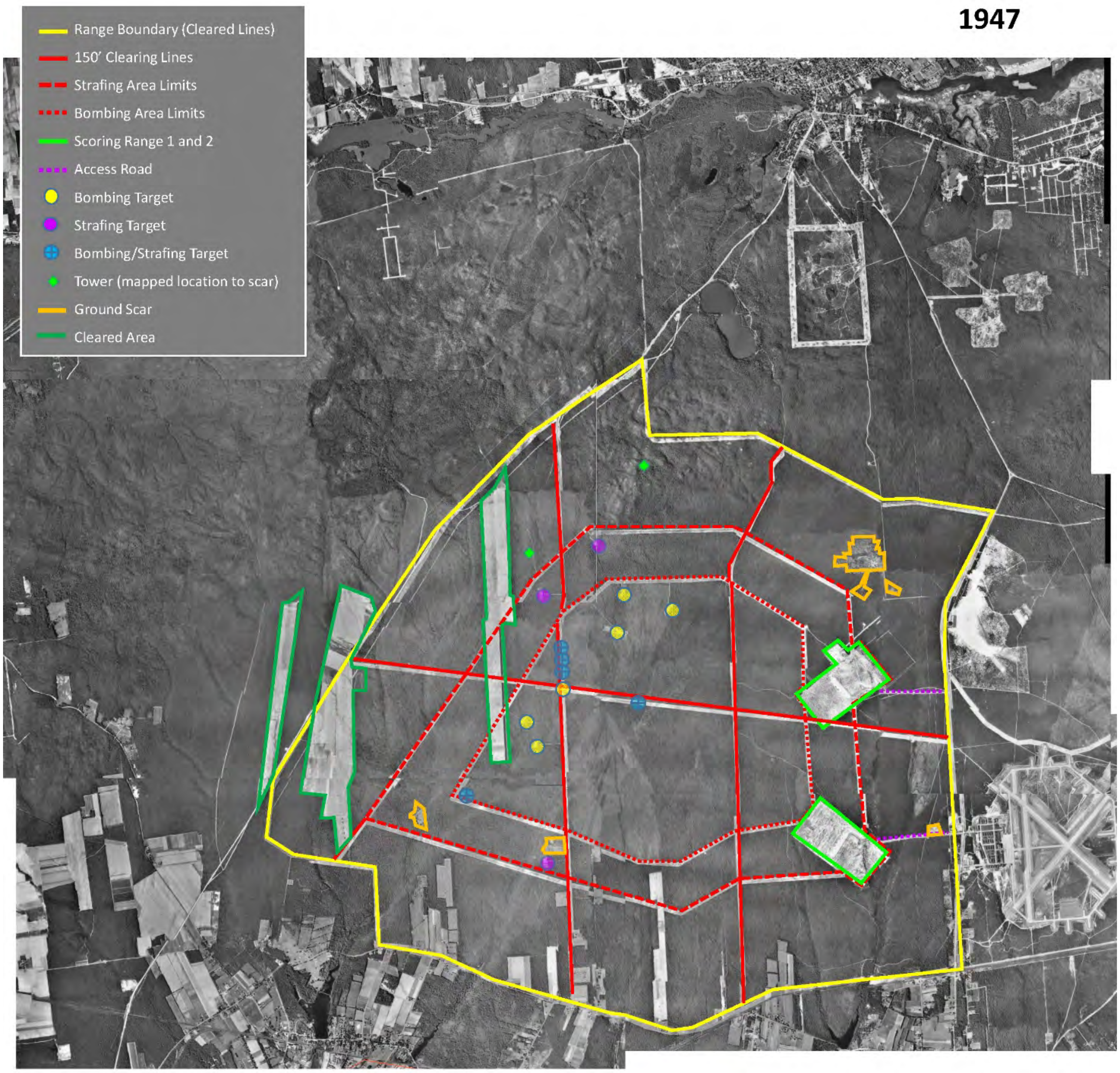

Figure A-3. 1947 Historical Aerial Photograph of MRS-01

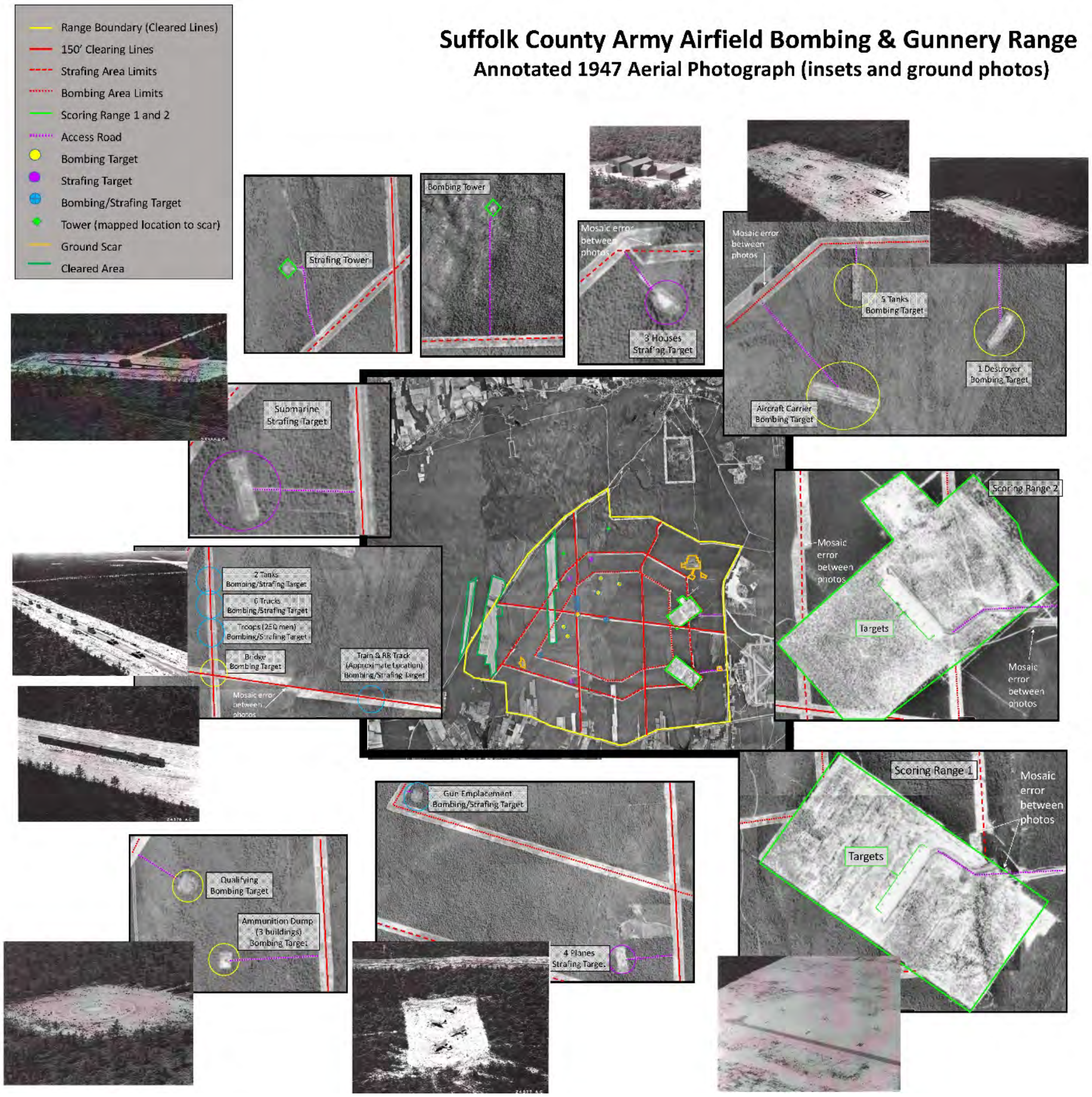

Figure A-4. Annotated 1947 Historical Aerial Photograph

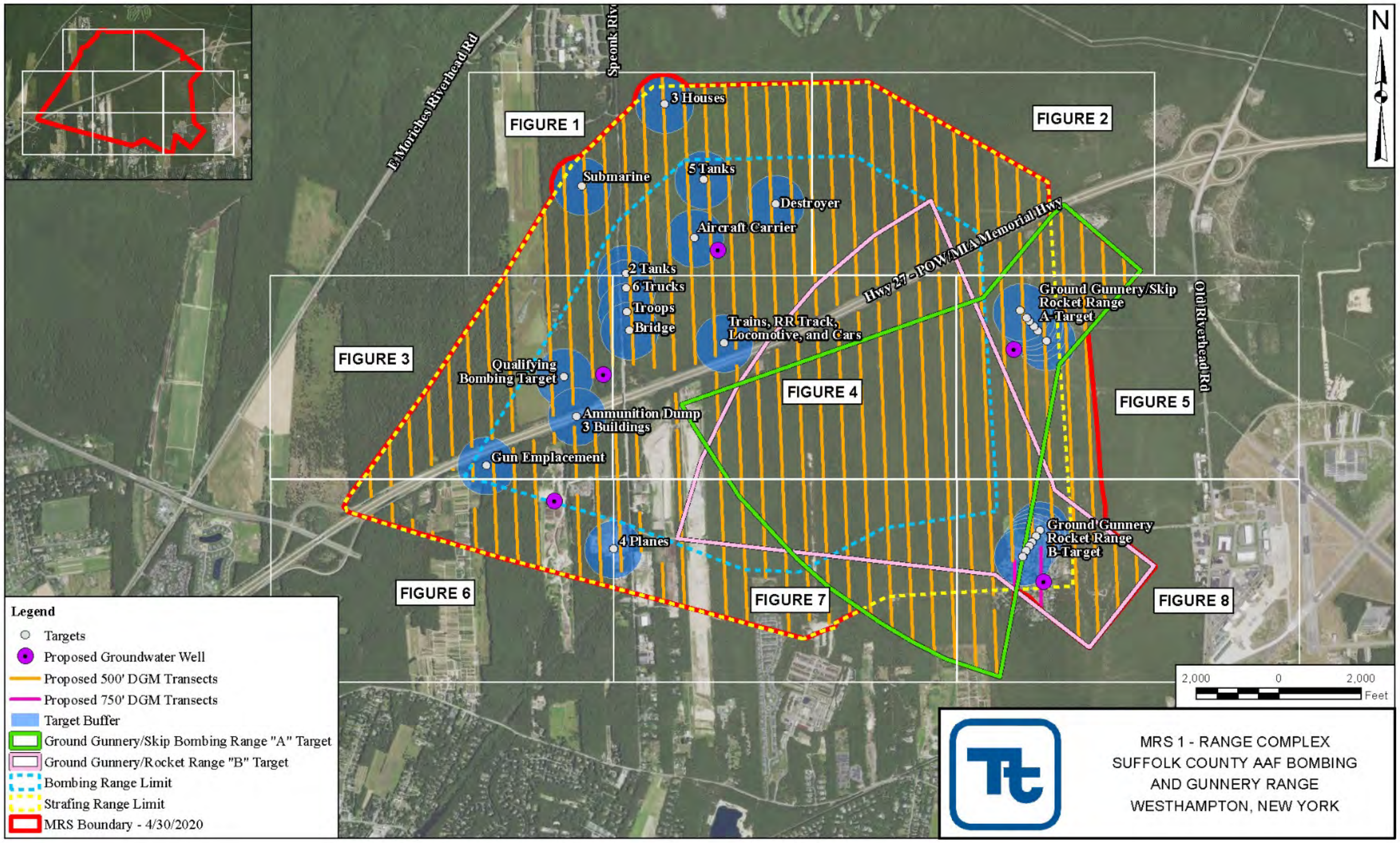

Figure A-5. MRS-01 Proposed Transects

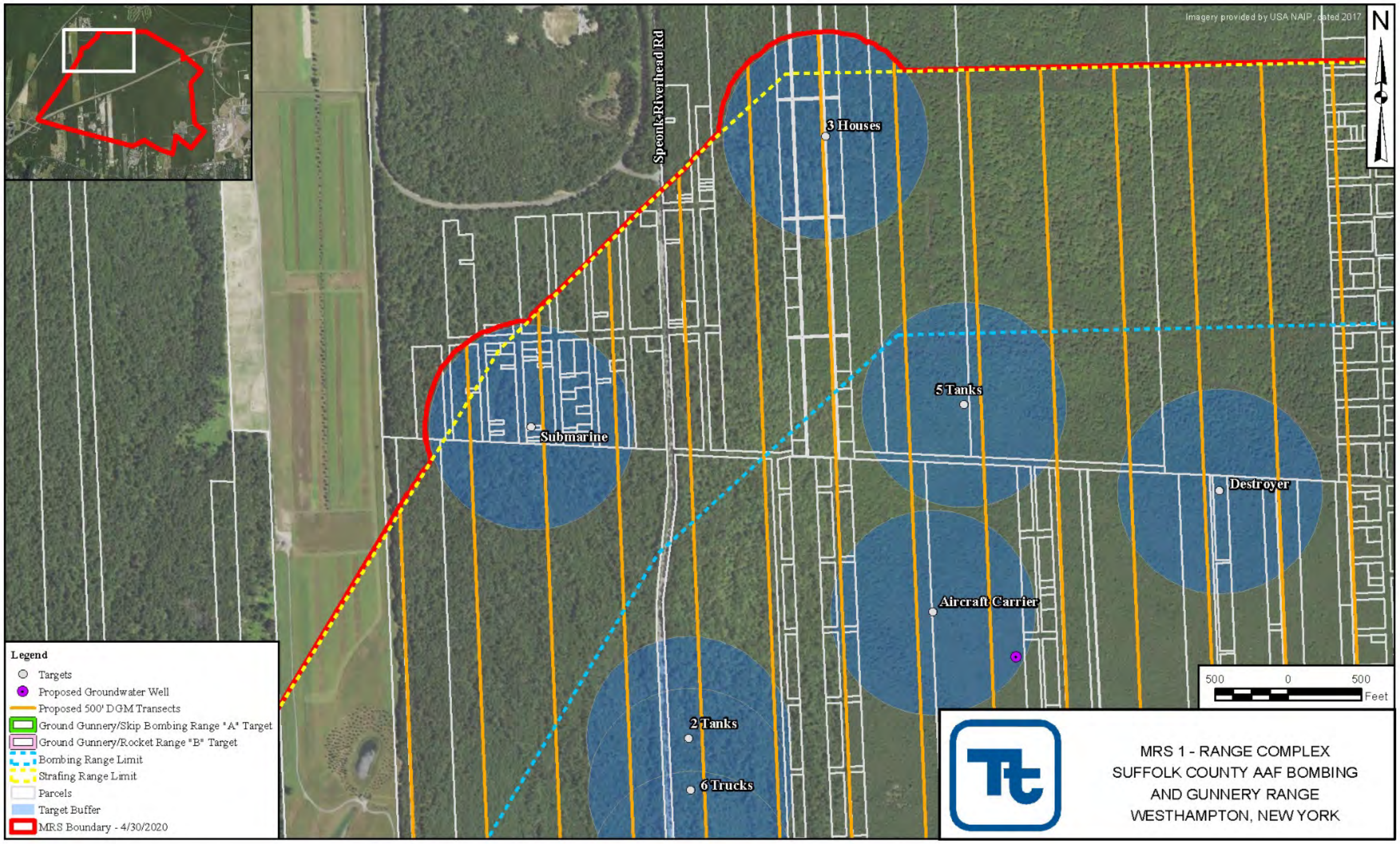

Figure A-6. MRS-01 Section 1

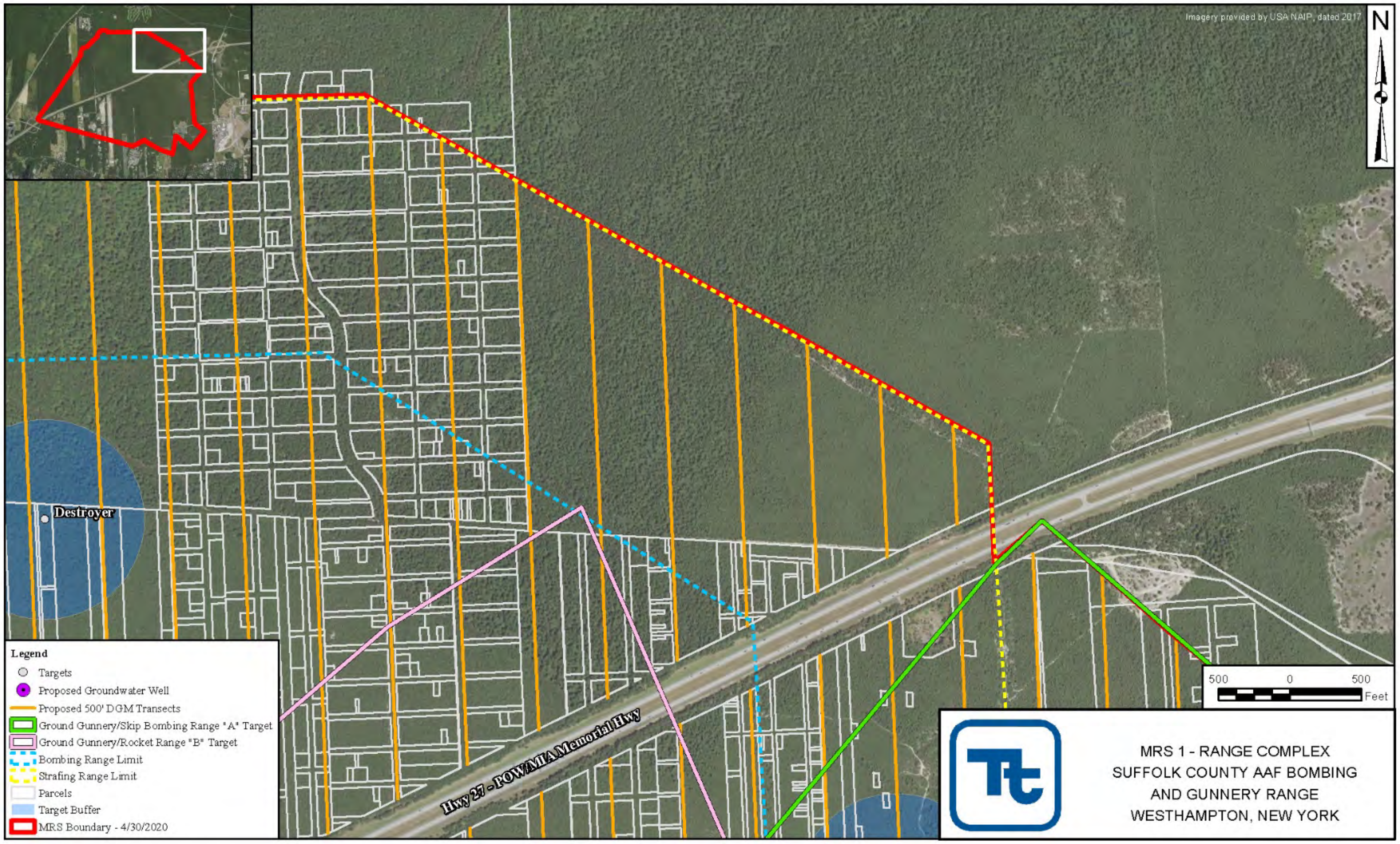

Figure A-7. MRS-01 Section 2

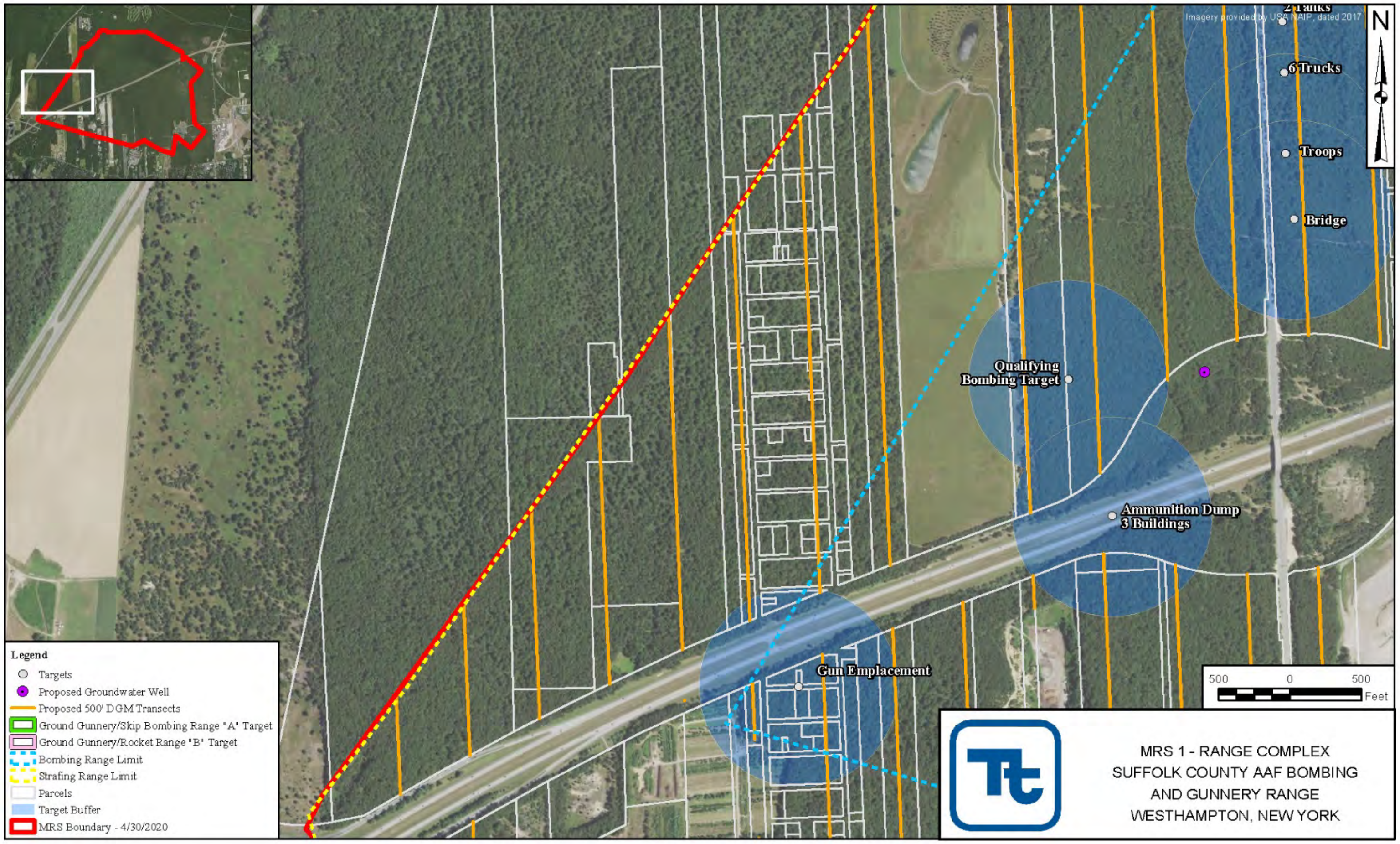

Figure A-8. MRS-01 Section 3

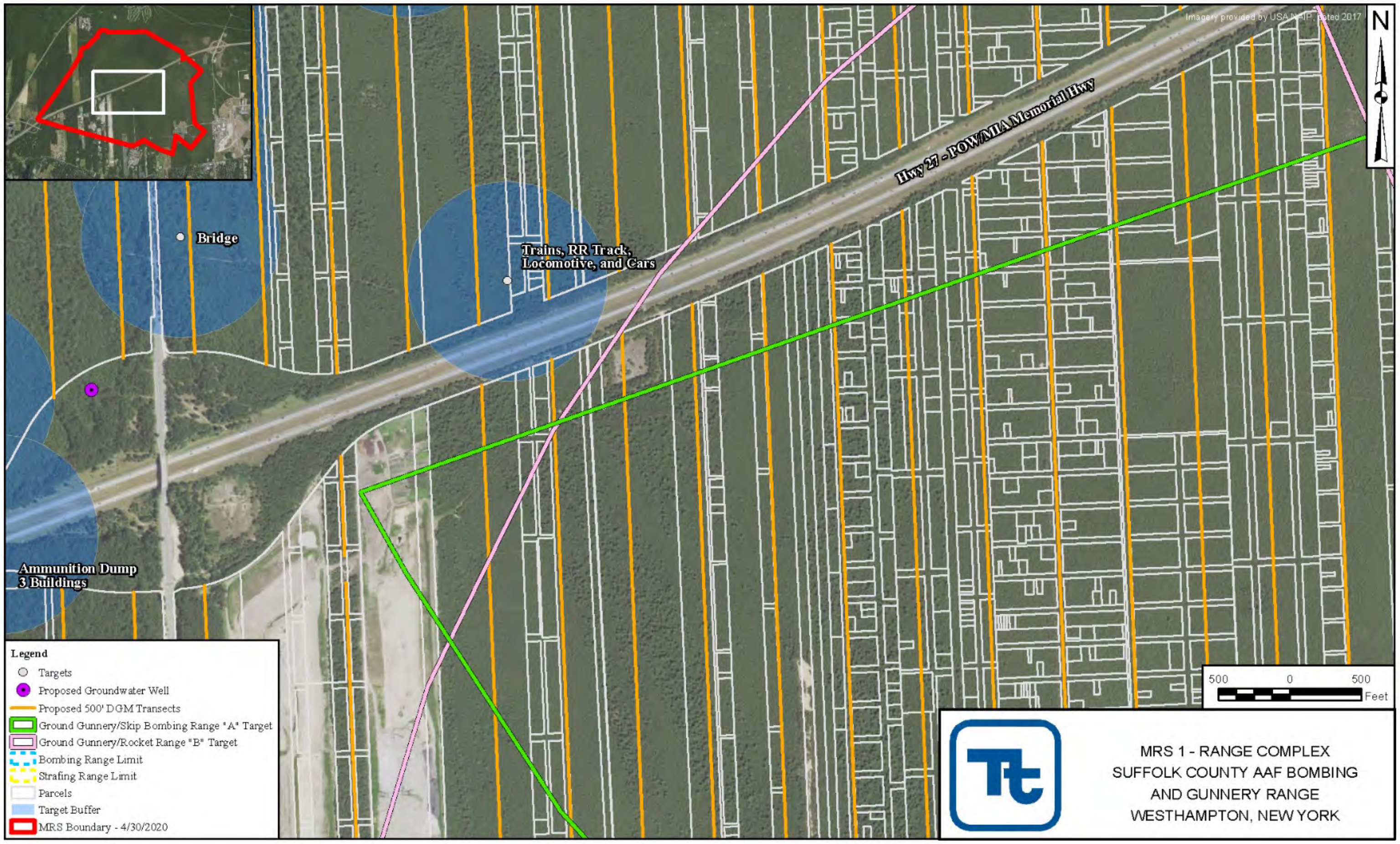

Figure A-9. MRS-01 Section 4

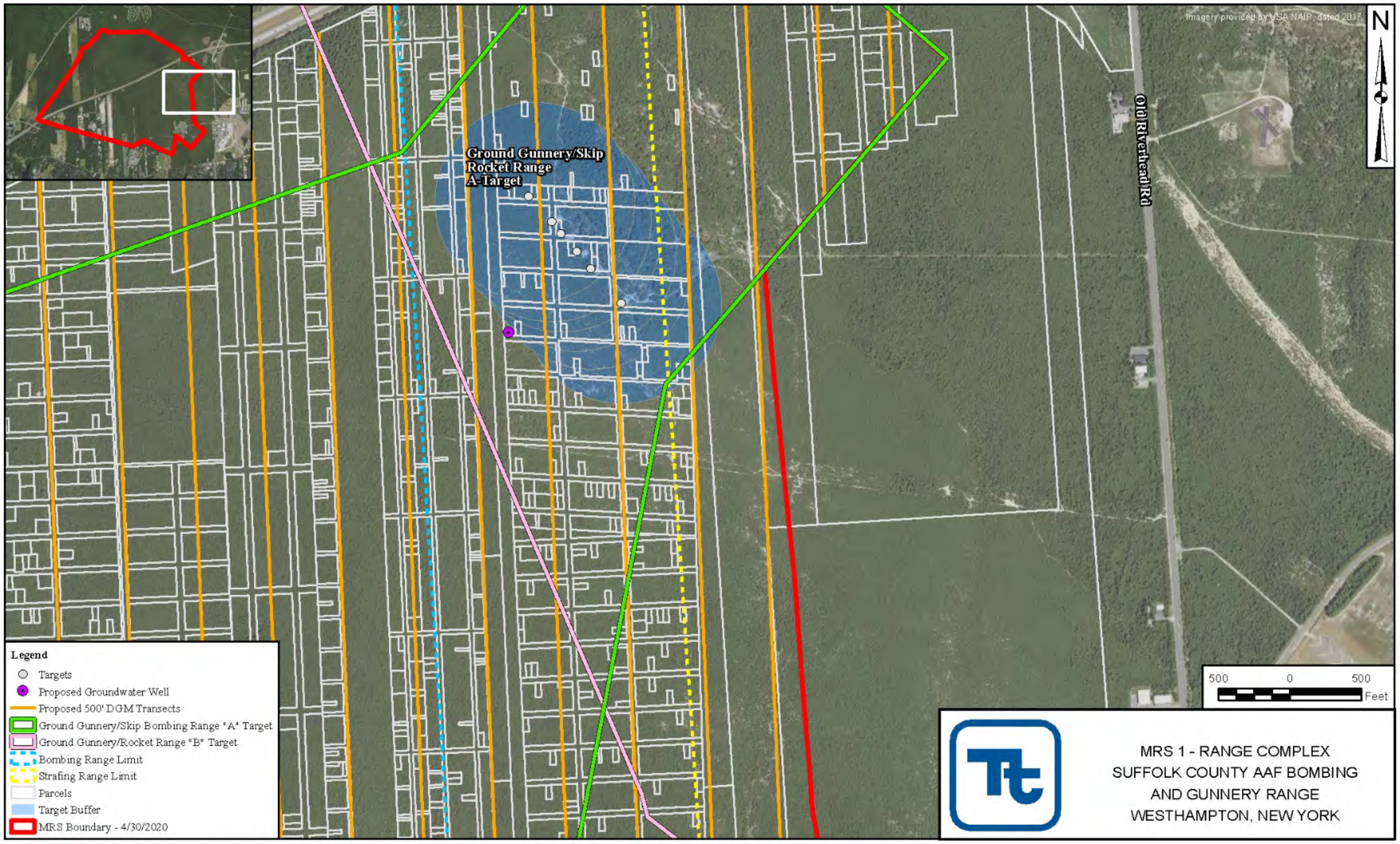

Figure A-10. MRS-01 Section 5

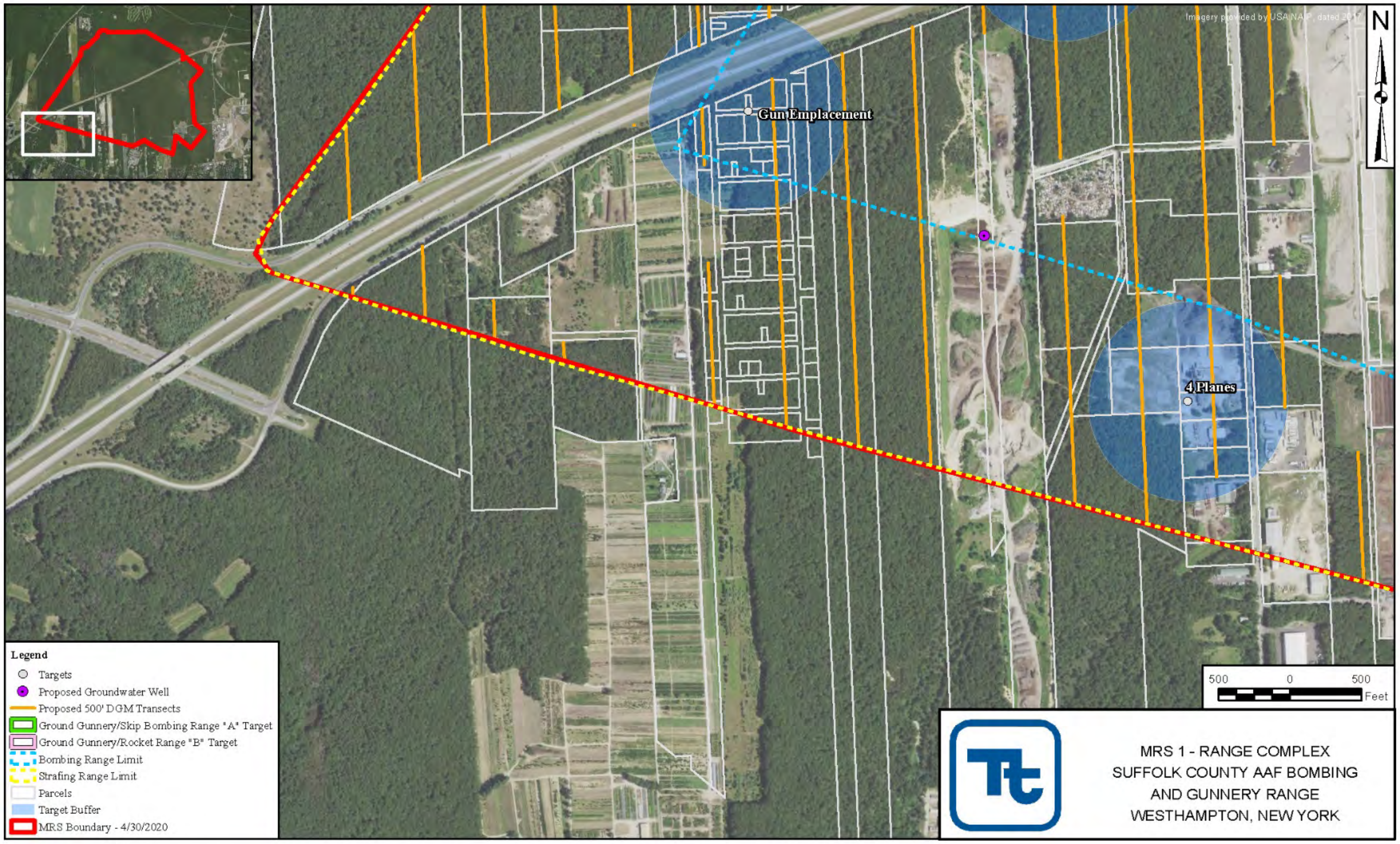

Figure A-11. MRS-01 Section 6

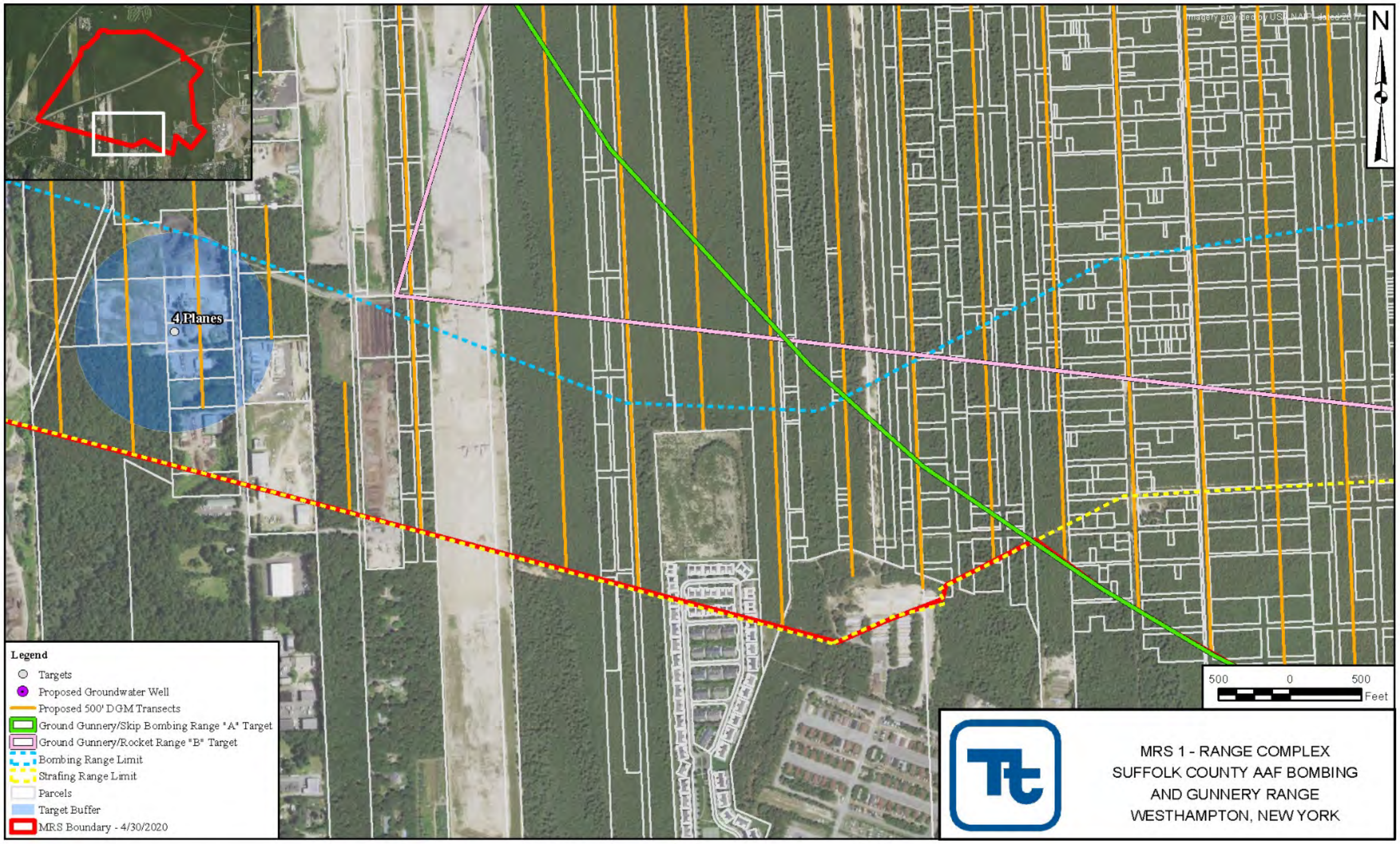

Figure A-12 MRS-01 Section 7

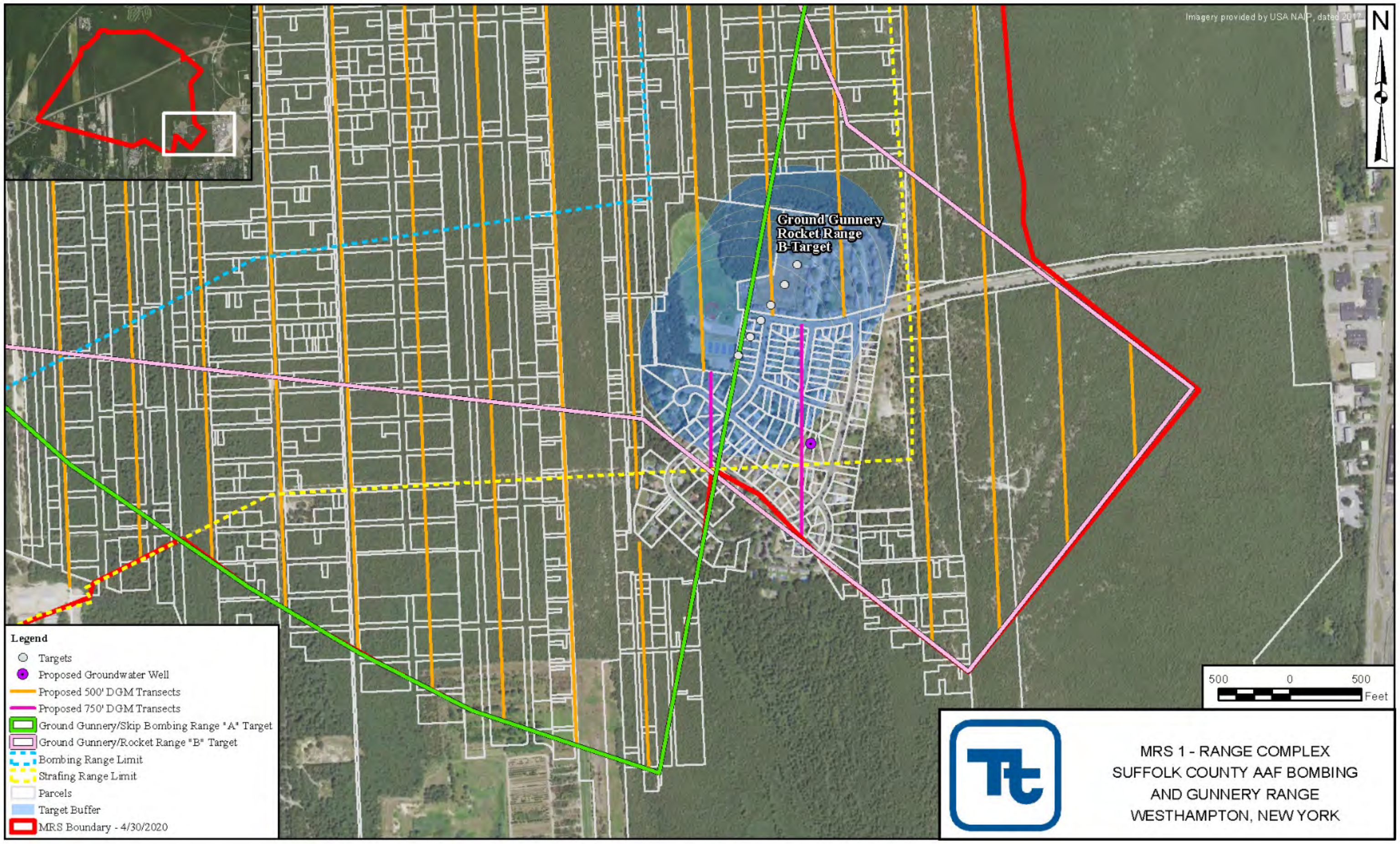

Figure A-13. MRS-01 Section 8

APPENDIX B
Project Planning Meeting Minutes

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TETRA TECH

Geophysical Discussion Meeting Minutes
Suffolk County Army Airfield (AAF)
Bombing and Gunnery Range Munitions Response Site (MRS)-01

Task Order: W912DR20F0374
Thursday, September 10, 2020 @ 1 PM ET
DCN: F0374.003

Participants:

Name	Organization	Role	Email
Julia Rupp	USACE	New England District Project Manager	Julia.M.Rupp@usace.army.mil
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David King	USACE	Geophysicist	David.V.King@usace.army.mil
Jennifer Harlan	Tetra Tech	Project Manager	Jennifer.Harlan@tetratech.com
Matt Barner	Tetra Tech	Project Geophysicist	Matt.Barner@tetratech.com

Action Items:

USACE:

- Todd to discuss with Marty Holmes the new information on use of AGC in ESP.

Tetra Tech:

- Provide a meeting summary.
- Determine amount of additional transect length for accessing north/south transects.
- Model change of direction of transects to be parallel to the highway.
- Review residential approach and how many ROEs would be needed for the initial transect approach.

Meeting Summary:

Introductions: Mr. John Jackson, EMCX, was introduced as a member of the PDT, as this is one of the projects that headquarters is interested in for the MR-QAPP implementation. Mr. Todd Beckwith, USACE Technical Manager, opened the meeting, noting this is a discussion of the geophysics and MEC investigation approach and turned the meeting over to Ms. Jennifer Harlan, Tetra Tech Project Manager (PM).

Suffolk Army Airfield (AAR) Bombing and Gunnery Range (BGR) MRS-01 Site Information: Jennifer provided a summary of the site information noting that the FUDS site is 9,224 acres and the Bombing and Gunnery Range MRS-01 is 4,297 acres. The MRS was used from 1943 to 1946 for bombing, strafing, and rocket fire training exercises at four (4) different sub-ranges. The majority of the training exercises appear to have been .50 caliber machine guns, practice bombs, and practice rockets. However, from May 1943 to January 1944, 100-lb and 500-lb high explosive (HE) bombs, incendiary bombs, and 4.5-inch HE rockets were reportedly used. No military structures remain on-site except for two target silhouettes made from painted rocks. Todd added that reportedly a surface clearance was completed in 1946 when the range operations ceased. This consisted of twenty personnel walking 5-10 yards apart doing surface clearance. Jennifer provided a figure showing the locations of the targets (slide 3). The targets are based on a 1947 historical photograph. John asked if the buffers were the standard 640 ft bombing targets. Todd replied, yes, 640 ft radius. Jennifer referenced the list of known or suspected MEC. She noted that the AN-M54 4lb incendiary bomb identified in RFP as the smallest target of interest, which Tetra Tech used as a basis for the technical approach. Todd noted the MGFD is the 500 lb bomb, which has an exclusion zone of around 650 feet.

Summary of Technical Approach: Jennifer provided a general overview of the technical approach.

Site Preparation: We are currently looking at areas to rent for storage, etc., which will be easier once we know where our ROEs are. We will establish site controls using a NY registered Professional Land Surveyor and install an analog instrument test strip. The majority of the site is part of the Pine Barrens and is extremely vegetated and challenging to move through. A significant amount of vegetation reduction will be required along the transects using mechanical equipment. We will not remove trees greater than 4 inches in diameter. No surface clearance is planned along the transects, as part of the Preliminary MRS Characterization. The plan is to do MEC avoidance as part of vegetation reduction, addressing any MEC as it is found.

Preliminary MRS Characterization (Phase 1): Once site preparation is complete, Tetra Tech will install an instrument verification strip (IVS) and prepare and submit the IVS Technical Memorandum.

Tetra Tech used Visual Sample Plan (VSP) based on the AN-M54 4lb incendiary bomb as the smallest target of interest (TOI) per the RFP. Jennifer noted that we used the input for the TOI as surface-launched, and the target diameter came out to 674 feet. Based on VSP, Tetra Tech is planning on conducting an EM61-MK2 transect survey at a conservative 500 ft spacing throughout the entire MRS, covering 374,355 linear feet or 28.2 acres. This number may change based on ROEs. The quarry and highway are excluded from the investigation area. Transects are currently planned to go through the residential areas. Once transects are complete, the data will be processed, and we will submit a Preliminary MRS Characterization Memorandum. This memorandum will detail our findings, identify high density (HD) and low density (LD) areas, and provide recommendations on where we should put the mini grids for the next phase.

Changing the TOI to air-dropped would increase the target diameter and allow transect spacing to be 1,028 feet. Jennifer asked for input on using air-dropped instead of surface-launched. Matt clarified that part of the basis for using 500 ft transect spacing is to minimize doing follow-up interleaved transects given the effort involved in laying out and conducting vegetation clearing on additional transects.

Todd asked for input from John and David about the appropriate buffer radius. John indicated that he is leaning toward the current, more conservative number (500 ft) based on the size of the historical targets, that this approach will get 2 or 3 transects through each buffer area, and the fact that some of the munitions are incendiary rather than HE. Though the local stakeholders were initially given a 1,000 ft transect spacing, Todd didn’t think they would object to 500 ft spacing, but it’s possible they might and this subject needs to be approached with them.

Julie brought up the fact that due to the involvement of the Central Pine Barrens Joint Planning and Policy Commission there will be increased scrutiny regarding vegetation clearance and that these decisions need to be made early on with their input. The Commission seems to be willing to cooperate, and Julie offered to continue to dialogue with them about this. Julie indicated that the vegetation clearance could be a benefit to the area by potentially creating a fire break and to incorporate that idea into the layout of the transects. She also wondered if the transects should be parallel to the highway in order to avoid crossing it repeatedly. David agreed with that, and Julie emphasized that having the transects parallel to the highway would create a better fire break for the Westhampton Beach community, especially if there is no overriding reason for North/South transects. This might ease the change from 1,000 ft to 500 ft spacing for the Commission and show them that we are also thinking about their needs.

Matt agreed that the transect orientation doesn’t affect the data quality but that the rationale for north/south orientation was to take advantage of the way that the targets naturally line up with that orientation and can cover a few targets with a single transect. Matt also mentioned that the teams would map each side of the highway separately so they wouldn’t be crossing the highway regularly. An east/west or southwest/northeast orientation would also be less efficient on the western side of the MRS, where the transects would have to be in short sections in some of the areas, such as the quarry. Minimizing the number of tiny segments of transects makes data collection easier. Matt emphasized that break lines would be cut between the ends of the transects to allow teams to access adjacent transects more easily.

Julie asked what the total vegetative clearance area would be in order to let the stakeholders know in light of the change from the wider transect spacing in the original preliminary estimate, including the cut lines between the transects. Jennifer noted that in looking at the presentation previously provided to the stakeholders by USACE, with both the initial transects and interleaved transects, the area to be disturbed/investigated was about 40 acres. Right now, we're at about 28 acres and should still be under the original estimate with access lines cut in. There are an additional 12 acres of grids in the presentation, and Tetra Tech is only looking at around 6 acres of grids being cleared. Therefore, we are still under the original estimate of acres to be impacted with the smaller spaced transects. Matt added that though critical thinking went into the determination of the north/south transect orientation/approach, we are open to making changes for the good of all parties involved. John agreed that the direction shouldn't matter that much, and we can look at the pros and cons of each approach, and if it would affect vegetation clearance amounts. Todd said the difference should be minimal for vegetation reduction, as anything outside of the developed areas has to receive vegetation reduction.

Matt offered that the GIS folks can come up with a more accurate measure of the total vegetative clearance involved, and if that infringes on the limit, then some of the break lines connecting transects could be removed. Jennifer said that a more detailed analysis could be made of the transect orientation and vegetative removal acreage in order to have a more informed discussion. Julie said that the Pine Barren Commission is interested in a fire break in the southeastern section of the MRS. Matt added that any extra cutting for a fire break would enhance the navigability of the area when grids are placed so it wouldn't be wasted. Still, we do not want to go above what is needed to get our investigation completed. John suggested that while not ideal, we could have different segments with different directions of traversal as a compromise.

<u>High Density/Low Density (HD/LD) Area Characterization (Phase 2)</u>: Jennifer moved into Phase 2, noting that we proposed approximately ~50 mini grids (100 x 50ft, 5.7 acres total) for Phase 2. Once it is determined where we will place the mini grids, we will do additional vegetation reduction and surface clearance of the mini grids before collecting data. The mini grids will receive QC seeding from Tetra Tech and then Government QA seeding. Tetra Tech will then validate the IVS with the Metal Mapper and submit a tech memo addendum for the IVS. We will use the Metal Mapper to conduct the dynamic AGC survey with 100% coverage, followed by a cued AGC survey on 50% of the mini grids. We will evaluate the clutter rejection rates, which is an integral part of the FS in determining the density. If we can identify what is in the mini grids in the residential and commercial properties and along the highway, we may be able to decrease impact to property owners during intrusive operations.

John asked if any of the grids are movable to address more of the LD areas. Todd said there has been discussion about that and that he's not clear on exactly where the grids will be and that a good portion of these will be located in the boundary areas for HUA and LUA. Matt answered that the proposal addressed the number of grids per HD area and the distribution of those grids relative to the center and perimeter of the HD are to help establish the buffer zone. Matt added that he would not be opposed to redistributing the grids if there was evidence to support the value of doing so. Jennifer said they estimated where the grids would be placed relative to the HD areas with 5 grids per each HD area with 2 in the center, and 3 grids along the perimeter to help determine the boundary. Jennifer noted that we haven't determined exactly where the grids will go, but we can be flexible and change the distribution to reflect project objectives. John said that with this site, we need to be concerned with having a handle on the LD areas if signs of MEC are found. Matt responded that with the total number of grids proposed, there shouldn't be any problems with flexibility.

Jennifer asked if there was any more discussion on grids. John asked Todd if the majority of this site would go NEU. Todd said he wasn't sure but thought that a good portion of it would be LUA or NEU. John asked if the stakeholders have been informed of this and the difference between LUA and NUE. Todd answered that it had not been addressed, and John asked if Todd thought the stakeholders would take our word for it if we determine there's no evidence of use. Todd said it depends on the location that we're talking about. There may be some pushback in certain areas but not others. Todd said that the central area of the MRS would probably be treated as an LUA due to the lack of targets.

Matt offered that being more conservative on the transect spacing will help bolster the argument for areas being declared an LUA or NEU. Todd added that the central area is a conservation area, so the characterization of LUA or NUE is irrelevant. Julie agreed that the majority of the open spaces are required to remain the same, and therefore land use will not change. She noted there are recreational uses of the area, including hunting and trails. She added that even the private property located in the conservation area is required to meet stringent qualifications to make changes to their properties. Todd said that this MRS is strange because there are hundreds of property owners within the conservation area and that they won't be able to develop their properties in the future based on the Pine Barren Commission's guidelines. We will need ROEs from each property owner.

Intrusive Investigation (Phase 3): Jennifer moved on to Phase 3 and explained we would intrusively investigate 100% of the targets in all mini grids as defined during the dynamic survey. Exceptions can be made in light of any issues near highways or in residential areas to limit evacuation and property restoration. Otherwise, everything will be dug, and any MEC or MPPEH will be dealt with. Jennifer noted we will use on-call explosives and that there will not be a magazine on-site. We will guard if necessary and handle all MDAS.

John said that there is recent progress on using AGC to have a flexible maximum separation distance for the ESP. The Army has recommended to DoD to use this approach. The process would be to put in a DARAD, and both USATCES and DDESB will accept it. He noted they were in the process of getting it into USACE explosive safety guidance, but he's not sure how long it will take to update the guidance. Todd said that he brought that up with Marty Holmes, the OESS, but that he didn't think that would be viable. Todd said he would bring that up with him again. John offered to provide more information as needed, as this is very new. Jennifer added that recently she had a project in California where we tried that, but it was not allowed.

Todd thought that near the highway and in the residential areas, we would cue items and only dig items that are TOI. This would apply within 650 feet of the highway or in residential areas where we should think about doing it this way. He added that this is a major highway, and we need to minimize shutting it down.

Jennifer moved on to the next slide to highlight some of the project issues that have previously been discussed. Jennifer said that we are avoiding doing fieldwork during the Summer tourist season, but we are looking at doing a site visit in October. She reiterated that there is a lot of ROE coordination that needs to be done. After ROEs are obtained, coordination with the individual homeowners will be required. MC sampling will also be conducted but is not included in this discussion. We will be looking for background sampling locations. We will need to do vegetation reduction coordination. No work can occur from June 1 to July 31 due to the Northern Long-Eared Bat, which was part of the completed US Fish and Wildlife consultation. Hunting and wildfire dangers are also things to be considered. Coordination with the nearby airport will be necessary during intrusive operations. Public relations will be an essential part of this project.

Todd asked John if there should be a different approach to doing transects in the southeast corner of the MRS, where there are approximately 150 residences. He added that the critical anomaly density is assumed to be 50 per acre and will probably be higher in the residential area. It will be tedious to obtain an ROE for each short section of transect running through each property. Todd wondered if we should use a mini grid approach for specific properties in this area. John replied that he had used both methods, but it is difficult either way. He added that it is more difficult to run short sections of a transect across multiple properties than to use focused mini grids. If this is the problem/concern in the residential area, he recommends mini grids in this area.

Matt inquired if we should just get ROEs for all the properties and then make decisions about mini grid locations or obtain ROEs for specific parcels, and what is the basis for how we do this? Julie recommended that we should seek to obtain all the ROEs necessary to meet the technical approach with the understanding that we won't get them all. We would then investigate where we have permission and also look for secondary properties where we can gain access to investigate as well. Todd said if we were looking at 10% of the properties (15 properties or so), we should come up with properties that are our first choice and then move on to secondary choices as necessary if ROEs can't be obtained.

John said there is industry movement towards not writing a Decision Document for an area where you don't have an ROE. If you have ROE for the RI, you can assume you'll have it for the Decision Document. Todd added that only applies if the property owner doesn't change.

Matt is flexible with whichever option works the best. Still, he is concerned about how this section of the MRS will be characterized if there are significant data gaps using mini grids only, and he encouraged everyone to be thinking about this issue for future discussion. Matt wants to make sure that the data collected meets the objectives of the RI, and we gather meaningful data. Matt asked John what his experience was using only mini grids and no transects.

John replied that the best approach would be to use transects, but if we didn't in the Preliminary Characterization phase, we would assume it is an HD area. Then we have to do a lot more work to determine it is not an HD area when placing the mini grids, which would be the absence of MD.

These would need to be non-cued grids, and Todd asked for additional explanation. John noted that we couldn't dig only TOI in those grids, but would need to dig non-TOIs to ensure no MD in is that area. John noted the alternative would be that we did find anomalies, assume they may be associated with munitions use, and use land use controls. Todd asked if we were digging non-TOIs what is the application of the exclusion zone? John responded that if we classify an anomaly as non-TOI and we have a DARAD in place, we can use the smallest exclusion zone for the site. Once we have confirmed and concluded there are no TOI and verified it, anything done under validation digging does not need an exclusion zone.

Jennifer affirmed the importance of being flexible and asked if anyone had a topic for further discussion. John inquired about the schedule for the immediate future. Jennifer replied that there would be an SPP meeting at the end of October or the beginning of November. She noted the EMCX review of the MR-QAPP would be in January or February. She asked if the EMCX review would be combined with the USACE review since John is part of the PDT now. Todd asked if John wants to review the Preliminary Draft QAPP or just the Draft QAPP? John replied that he'd get back to them about that, though if they have a preference, he will honor that. Julie asked John how involved he wants to be in the risk assessment/MC discussion. John answered that he would like to be very involved in MEC risk (RMM), but not MC. Jennifer noted there would be meeting minutes sent out. Julie said that due to training next week, she won't be available for the scheduled call but will be checking her email. Todd offered to cancel Tuesday's call and have the next call on the 22nd.

MC/DQO Discussion Meeting Minutes
Suffolk County Army Airfield (AAF)
Bombing and Gunnery Range Munitions Response Site (MRS)-01
Task Order: W912DR20F0374
Thursday, October 1, 2020 @ 10:30 AM ET
DCN: F0374.008

Participants:

Name	Organization	Role	Email
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Lynn Arabia	Tetra Tech	Project Chemist	Lynn.Arabia@tetratech.com

Action Items:
USACE:

- Julie will re-engage Kevin (USACE biologist) and New York Natural Heritage Group to see if she can get more information for how to proceed. A draft-final map with transect locations will be required to move forward with approvals.
- Julie agreed to follow up with the USGS Long Island field office on monitoring wells.
- Amy check with Cynthia Auld on status of IS Guidance updates related to triplicates and any revisions to the guidance that is forthcoming.
- Todd to check on Iona Island project for NY remedial program soil cleanup numbers to see if they were used, and if not, rationale why.

Tetra Tech:

- Confirm if SI soil samples were taken at the target areas *(Completed).*
- Develop and send to the team proposed exposure decision unit sizes for the various receptors *(Completed – attached to this meeting summary email).*

Meeting Summary:

Introductions: Ms. Jennifer Harlan (Tetra Tech) started the meeting with a review of the agenda, noting this call would be for discussion of MC sampling and risk assessment data quality objectives (DOQs). There have been separate geophysical discussions which are going well.

Suffolk Army Airfield (AAR) Bombing and Gunnery Range (BGR) MRS-01 Site Information: Jennifer provided a summary of the site information noting the range is ~4,300 acres, part of the larger FUDS boundary of ~9,200 acres. The MRS was used from 1943 to 1946 for bombing, strafing, and rocket fire training exercises at four (4) different sub-ranges. The majority of the training exercises used .50 caliber machine guns, practice bombs, and rockets. However, some high explosive (HE) bombs and rockets, and incendiary bombs were used early on. There are no military structures on-site except for two target silhouettes of a destroyer and aircraft carrier made from painted rocks.

Jennifer displayed a figure for BGR MRS-01 to show the overall site. Gray dots are targets with a typical buffer around them. We have a 1947 aerial photograph that shows these targets. There is a residential area in the southeast corner, most of which is associated with the Central Pine Barrens Conservation and

Groundwater Protection Area, a quarry, nearby airport, and highway, which runs through the center of the MRS. These are some of the things that will need to deal with when out in the field. Slide 5 provides a list of the known or suspected MEC.

SI Results: Jennifer provided a summary of the SI. The soil sample results showed that antimony and iron exceeded background and human health screening levels. Antimony, iron, and lead exceeded the groundwater screening criteria. The SI soil sampling was limited and may not have been located in the HUAs.

Mr. Todd Beckwith (USACE) responded he did not compare the SI directly, but we are fairly sure we know where the targets were, so were soil samples taken where the targets were? Jennifer responded she would need to look as this statement was pulled from background information in the RFP. Todd added that we do not know if the target will turn out to be a HUA as defined by the geophysical investigation, but we should know if SI soil samples were collected within the target locations. Jennifer responded she will follow up on this. Todd said the locations were mixed up a little in the SI Report; the actual MRS boundaries were off, so that could be a factor as well. It is not hugely important, but we should be aware of the SI results, with Jennifer agreeing that any data limitations will be listed in the QAPP. *(Note: upon further review of the SI Report MC sampling locations figure, the majority of the samples were not collected in prior target areas; the Ground Gunnery/Skip Rocket Range A-Target area did have 3 soil samples collected from it. The other samples were not collected in target areas).*

Preliminary CSM: Jennifer displayed the MC Preliminary CSM information from Worksheet 10 in the RFP. The current land use is mostly undeveloped conservation land that includes hiking trails and recreational uses with light industrial, commercial, and residential land. Future land use is not expected to change. A large portion of the site is part of the Central Pine Barrens Groundwater Conservation District. Hundreds of landowners have signed an agreement not to do any development and were provided monetary funds as part of the agreement. We will have to get ROEs from each individual property owner.

Our potential MC list is aluminum, antimony, barium, copper, iron, lead, nickel, and explosives. Locations and distribution will be where survey results and investigation identify where MEC exists or where it could have occurred. We will be sampling soil and groundwater. The current and future receptors are residents, visitors/trespassers, employees, construction workers, and biota. In surface and subsurface soils, the presence of explosives or select metals above background could result in potentially complete exposure pathways and potential risks for humans and biota. In groundwater, if the exposure pathway is complete, the presence of MC including explosives and select metals above background could result in potential risks for humans.

Todd asked if it would be better to more specifically state what the visitors entail, such as recreational users, hunters, etc.? Jennifer asked Ms. Hannah Neeley (Tetra Tech) and Ms. Amy Rosenstein (USACE) if this changes the risk assessment or is it the same exposure. Amy responded the only problem if you add hunters you might need to include how often people are hunting. Julie said the Pine Barrens Commission has confirmed hunting is a common activity during hunting season, and we discussed logistics and safety concerns on the geophysical call. Amy agreed with Todd that we can do more when get into the QAPP. Hannah agreed we can address this question and be more site-specific with types of visitors.

Worksheet 11 DQOs: Jennifer noted she pulled out the MC specific DQOs from Worksheet 11 provided with the RFP. Step 1 includes collecting MC data within each HUA (including areas with significant quantities of small arms) in sufficient quantities to determine the horizontal and vertical extent to evaluate for human health and ecological risk. Step 2 includes developing a background for metals, determining the horizontal and vertical boundaries of MC contamination, and ensuring we know who the current and future receptors are and what they are doing. Step 3 includes determining presence or absence of MC associated with MEC, any other types of media impacted beyond soil, and any other sources of contamination in the area.

For Step 4 the horizontal boundary is the MRS boundary, while the geophysical investigations will determine the vertical boundary. If we only find something in the top 6 inches, we will sample that interval, and if not contaminated we will not need to do subsurface sampling. However, if munitions are down 2 or 3 feet, we will want to do subsurface sampling as well, based on actual geophysics and intrusive investigation results.

Todd addressed the statement of MC's presence or absence associated with MEC, stating that it does not have to be MEC. MC can be from munitions debris and/or small arms, even with practice rockets with no explosives there still could be metals MC. Jennifer will add this to the USACE provided DQOs for future discussions/presentations.

MC Approach: Jennifer confirmed we would be collecting surface and subsurface soil samples using incremental sampling based on geophysical and intrusive results. We will collect background soil samples at locations to be determined. One thought was to go to the state or county-owned land as part of the FUDS boundary and obtain access to use those locations, or nearby, for sampling as part of the ROE requests. Julie agreed this made sense. We will do select metals analysis by 6010 and explosives by 8330 plus NG and PETN. Amy addressed the statement we might need to go back out if we haven't determined full extent. Jennifer agreed and said this was part of the phased approach. Amy wanted to make sure the decision parameters for doing this were clear in the QAPP and provide the plan parameters/goals if a second round of samples are needed. Jennifer agreed.

Ms. Yixian Zhang (USACE) clarified that we might not limit it to the method 6010; it will depend on the screening criteria or project action limits. We might need to go to 6020 for more sensitive detection limits. Ms. Lynn Arabia (Tetra Tech) agreed for the groundwater, if need 6020 MS limits, we would use that. The 6010 would be the soils because they typically have no issue meeting the requirement. We will ensure this is addressed.

The HUAs will be defined as areas with sufficient MEC density or significant quantities of small arms in a limited area, based on the geophysical and intrusive investigation results. Each HUA will be a separate decision unit (DU). Each sampling unit (SU) within the DU will be 0.25 acre, unless the HUA/DU is greater than 0.25 acres and then it will be divided into multiple SUs. Each SU will be divided into 30 discreet soil increments, and 10% of samples will be collected in triplicate. If we have a HUA in a residential area, for parcels up to 0.25 acres, the DU will be the same as SU and collected in triplicate. If a parcel is over 0.25 acres, then we will have multiple SUs, and at least one of those SUs will be collected in triplicate to address any concerns with the residential area and risk assessments requirements.

Todd added that from a risk assessment standpoint, our DU in the residential area seems appropriate to be 0.25 acre. However, in the recreational areas or out in the conservation area, he was not sure what the appropriate DU size is for visitors, recreational users, hunter scenario, etc. He suggested at least an 1.0 acre or bigger, and that we might have multiple SUs within that area. The suggested the DU size should be greater than 0.25 acres in the conservation area.

Hannah responded that is the plan for the conservation area, as the limit of the HUA is the DU, so if it is a larger area, and it will be broken into SUs, but the entire area would be the DU. The DU will not be limited to the 0.25 acre unless a HUA happens to be a 0.25 acre. Lynn asked Todd if was saying the SU in the HUA was say 1.5 acres in the conservation area we could do two SUs for up to an acre for a SU or a DU. Todd responded we could do it several ways, so we need to decide first what is the appropriate size of DUs from a risk assessment standpoint; then, if we need to break out into multiple SUs we can do that. Todd stated that if we have a HUA that is only a 0.25 acres at a target location, yet we think the appropriate risk exposure area is 1.0 acre, then we probably still want to sample the 1.0 acre so that we can draw a conclusion about what the exposure point concentration (EPC) is on the entire acre, not just the 0.25 acre. Hannah agreed, and per what Jennifer said, if the future land use will not change and remain a conservation area, and we decide the appropriate exposure area is 1.0 acre or 0.25 acre, we agree we would want to do the DU over that area.

Jennifer asked Hannah and Lynn if we need to go back and look at our 0.25-acre SUs, and asked Amy if she had thoughts on what she or CX expects to see in these areas.

Amy agreed with Todd that if someone is walking around they will not be just exposed to that 0.25 acres. Still, if that is where you think the concentration of contaminants might be, as long as they have it as a SU, you will be able to tell if the concentration in that smaller area is what is causing the higher exposure concentration for the DU. Someone might say if you change from 0.25 acre to 1.0 acre, you are diluting what might be the higher concentrations in the HUA, but if kept as a separate sampling unit, you can avoid that problem. She does agree that the DU could be larger. Todd suggested sampling first focus on the HUAs, and maybe there is no contamination. Todd does not believe we would decide to clean up a 0.25 acre if the exposure unit size is 1.0 acre. We would then need to have the information on the EPC 1.0-acre area. Hannah suggested we could do that if we have the DU as the 1.0 acre with several SUs within it that are the smaller 0.25 acre, then as Amy said, spatially figure out if it is just one of the SUs that is causing the issue. We could tell that spatially but also be able to calculate an EPC across the entire DU.

Amy reminded the group we would need to keep in mind ecological receptors; the 0.25 acre might be a realistic exposure area. Ms. Julie Rupp (USACE) confirmed she was also thinking about the ecological receptors from the standpoint that we do not have final information from the New York Natural Heritage Group, which is a requirement. We usually would do just a USFWS consultation. Because the land is under the Pine Barren Conservation District’s control, we are still waiting for input from New York; we cannot finalize until we know more from an eco-risk standpoint. Julie just wanted to put this out there for consideration and remind people of this other piece of required information. Julie confirmed they received their consultation from USFWS, which is limited to the northern long-eared bat. Jennifer and Todd are aware that we cannot conduct fieldwork or vegetation reduction between June 1 and July 30. New York State received preliminary information, but they stated they can’t finalize recommendations until they know where we will be working and plan to clear. It will be another few months before we have final information. Julie will follow up with Kevin (USACE Biologist). Jennifer responded that while we would have the transect locations, we will need to develop a concept for the grids as we do not know where those will go until we determine the HD areas. Julie agreed to re-engage Kevin and the natural resource personnel from New York State on how we should proceed for our Work Plan.

Amy addressed Jennifer’s statement of not knowing where grids are, and asked is this not to be proposed in the QAPP? Jennifer responded no with the new MR-QAPP process. We will put the transects in and process them to show where the high-density areas are. We will then submit a memo after we do the transacts, and decide where we want to put grids. We will go to the PDT and say here are the geophysical grids to determine if an area is HUA or LUA. Once we have those results, we will say where we want to sample per the DQOs where MC sampling will be in HUAs only, not LUAs or NEU areas. Amy agreed that makes it clearer, so maybe we need to explain to New York, or perhaps they will want to wait until we get transects done. She is not sure why we have to wait as it seems they could provide general guidance on species that are there. Julie agreed we could ask. She believes the only map they have seen is one with a general boundary. Jennifer and Julie agreed we are getting far enough along to finalize the geophysical approach and transect locations. We can then have a map showing all transects that the PDT has agreed to and then we re-engage New York.

Todd suggested we have a position on what we think are appropriate exposure unit sizes are for our know receptors. Jennifer asked do we need the ecological information first, so we are not doing 2 sets of samples for ecological and human. Todd agreed, and noted we may not be able to pin it down but should flush out a little better what we think our appropriate DU sizes from a risk assessment standpoint. Hannah agreed and stated for the human health in the conservation area, it is not likely to be redeveloped, so the receptors will be visitors of various types and trespassers. Exposure areas would be larger than 0.25 acre. The ecological receptors might be too large for some of them. Julie referred to the last communication from New York, confirming the northern long-eared bat and the frosted elfin butterfly. It also says no freshwater wetlands exist on the site. Todd asked Tetra Tech to come up with proposed exposure decision unit sizes for the various receptors. Jennifer agreed.

Todd referred to the statement of 10% of samples collected in triplicate. He noted he does not know what the current thinking on this subject. The MC Work Group is working on this. Triplicate samples is a question Tom Georgian raises frequently. Lynn responded yes, Tom would like to see all samples done in triplicate, but the issue with this comes down to whether the samples show that much difference in matrix to believe the triplicate would provide more information per DU, and then there is the cost. Todd confirmed cost is a major factor and it seems a bit much to do all in triplicate, but he has gotten this comment. The ISM guidance does talk about whether or not it is appropriate to extrapolate from one DUs to another, and suggests it is usually not appropriate. Lynn stressed we need to remember it is the SUs we would be doing at 10% triplicate. If we are still talking the risk assessment DUs being upward of 1.0 acre, however, still looking at SUs of smaller size, we could be saying instead of 10% across the board, maybe we say the DU will include a triplicate depending on the number of SUs, the same as if over a 0.25 acre for residential would do multiple SUs where one would be triplicate. We could say this for all of the DUs. Hannah agreed that would eliminate the need to extrapolate variance from one DU to the next. Lynn confirmed not every SU would be in triplicate, it would be every DU would include a triplicate, which might be more palatable to Tom and CX. You do have potential if DU is the SU it is automatically a triplicate, so you would be increasing the number of triplicates, which gets into the cost issue.

Todd confirmed this might be an acceptable approach, asking Julie and Amy what New England thinks about this approach and, has this been discussed with the MC Work Group? This is something to talk about with Cynthia Auld. Amy confirmed she is not in that Work Group and will reach out to Cindy but thinks 10% is what the Work Group recommended. She agreed that Lynn’s suggestion might work as well. Todd confirmed if the Work Group says 10%, he is good with it. Jennifer noted it would be good to start at 10% if you can get through CX and believes this is the current guidance for contractors, and if New York wants to bump that up, it is a different story.

Todd stated we would need to develop more specifics on how we will do the background sampling and compare it to the site data. Jennifer agreed and will ensure we have DUs and SUs similar for background sampling so we can make that comparison. Todd asked what approach would be used, confirming to Hannah he was asking about the statistical comparison between the background ISM and the site ISM. Hannah noted the comparison and the tests that will be used will be detailed in the Risk Assessment Work Plan.

Jennifer moved on to the LUAs. For example, if we go out and are not in HUA, and find an individual MEC item visible showing a potential release, such as soil staining, we would want to initially sample the small area under the item as an SU, to determine presence or absence. If it is determined there is a presence and screening levels are exceeded, we would do additional sampling in DU appropriate sizes.

Jennifer noted that post-detonation sampling is very similar. We will focus on where we did the detonation to confirm we are not impacting the area. This sampling is not part of the risk assessment. If we determine there is a presence, then becomes part of the additional sampling at the appropriate DU size. Todd responded that if going to decide to clean up or not on a 1.0 acre DU, seems impossible you would ever have a problem with just 1 individual suspect MEC item. However, he noted has seen this approach before. Jennifer replied if the team feels we don’t need to do this type of sampling, Tetra Tech is in support of this. But she understands that regulators typically ask what happens if you find something in the field that shows a potential release that is not in a HUA you are already sampling. Todd said yes if a 500 lb. bomb with high explosives in it is found we might have a different opinion about sampling compared to a small incendiary bomb. Hannah replied that part of the intention was to say we would collect data from a smaller DU size, but would not necessarily be appropriate for use in the risk assessment since it is a presence/absence. There may need to be decision step in-between implemented to determine if we actually need to do a larger sampling over the appropriate exposure unit based on results. Todd agreed with the approach suggested for LUAs and post-detonation sampling.

Jennifer explained that if we do geophysical studies and find no evidence of munitions in an area, we will not sample that area. One thing brought up in the Kickoff Meeting was that we know where some of the known target areas are. They may have been cleaned up in 1946, when a surface clearance was done. If we do not find anywhere to sample, we should look at those target locations unless it has been completely redeveloped, such as a road, the soil has been moved around, and the area is no longer indicative of prior use by DoD. This would be one of our decision rules in the QAPP. If there is a HUA associated with target areas, great, but if we don't find one we will probably still want to do some sampling there. Todd agreed this is appropriate and asked what the New England folks think about it. Amy has seen it done this way before, and it makes sense. Todd asked if we went through and did not identify known target areas as high-density areas, then would you still put at a minimum a 0.25-acre SU centered on the known target area? Jennifer agreed, depending on the area conditions. Todd agreed and wondered if you put in a number of SUs or do a single unit and determine presence/absence first. Jennifer noted that we'd have an internal discussion on that, and Todd is good with either approach, whatever Tetra Tech feels is best.

Todd asked what kind of vegetation clearance will need to be done to do incremental sampling if sampling in an area where there was not already a grid cleared, etc. Lynn responded that we don't have to do too much because we are only taking small cores. We just need to make sure we are getting to the soil. It would just be a spot but officially would not have to mow everything down. Todd responded that it depends on how dense the vegetation is, and we might not get through in certain areas. Jennifer agreed, and some thought is if we have a grid cleared for the geophysical investigation and munitions were found there, it is a good place to sample since we can correlate MC and munitions/MEC directly. Todd replied, at a minimum, will have to do some hand clearing (machete, etc.) in the background areas, so we should be prepared to explain what level of vegetation clearance is needed for MC sampling. Lynn confirmed that doing the monitoring wells would take more clearing to get the rig into an area as necessary.

Jennifer provided a summary of how the temporary groundwater monitoring wells, including background wells. We will use 2-inch pre-packed screened monitoring wells via DPT, will allow the well to settle for 24 to 48 hours and then will develop the wells. Sampling will be conducted using low-flow methodologies. We want to put the wells in HUAs; therefore, we must wait for results of the geophysical investigation. There will be a separate memo with recommendations of where to put the soil samples and well samples to get everyone's buy-in.

Julie added that Long Island has a sole source aquifer and USGS has networked the island with monitoring wells, and conducts island-wide monitoring on a subset of their wells. She is working on another project working with them and they are thinking about using some of those wells. We might be able to use their wells to determine local conditions. Julie agreed to reach out to the USGS Long Island field office to find wells that might be in our area. She noted we would need to ensure the correct depth but these might be a possibility. Julie noted we talked about using EDR to determine other sources nearby at a small cost for the EDR Report. There are also maps of wells so we can drill down into the USGS database and discuss if they exist. Jennifer agreed we should check the database to see if findings found during SI are part of the Long Island groundwater chemistry and determine what they screened against. If we do not find anything in the soil when we do our sampling, there would not be a release profile that would suggest contaminated groundwater without contaminated soil. Julie stressed we need to be very cautious, as we are aware of naturally occurring metals in groundwater on other Long Island projects where arsenic, iron, and manganese are in excess of the MCLs. Other projects have had to collect more data than initially planned to form a statistically defensible data set to demonstrate that metals detected were naturally occurring and not related to DoD activities. If there is not an indication of DOD impacts to groundwater, we should discuss and revisit this issue before we start sampling. Jennifer concurred and agreed it would be great to find out if there are any wells in that area that could be used.

Jennifer described the potential screening criteria as the RSLs, the ESSLs, New York promulgated remedial program soil cleanup numbers, and site-specific backgrounds. Todd asked about the New York numbers and if they were higher than the EPA screening levels. Jennifer noted they had not done this comparison yet. Lynn stressed that New York doesn't have much in the way of explosives, more just metals, and she does not remember anything significantly different from the EPA screening levels; the New York numbers are reasonable. Todd asked if they were recently promulgated, and Lynn responded the numbers have been around for at least 10 years. Todd will check his Iona Island project to see if they included the NY numbers, and if not, if there was a reason not to include that we would use for this project as well. Lynn noted that since we were doing background samples, this should be more relevant to the regulators than the NY criteria.

Jennifer explained Microbac would be doing the laboratory analysis, and HSW will do the data validation. We will also be working with FUDSChem, so we will need to get Lynn and her team access to Suffolk's FUDSChem database.

Open Discussion:

Todd asked if it would be beneficial to get input from CX on any of this before submitting the QAPP for review, particularly if there are any issues we need to talk through before submission. Jennifer asked if anyone knew when the ISM guidance will be rolled out to use as a starting point to verify we are following any new guidance. Todd responded he could not answer, but Cindy probably could. Amy agreed to follow up with Cindy, but she was not entirely in agreement with reaching out to Tom prior to regulator discussions as long as we have a solid approach and proposal but can discuss further with Todd. Todd just wanted the team to think on this option if we had concerns or needed clarification prior to finalizing our approach.

In closing, Jennifer thanked everyone for the good discussion and will follow up on action items and send out a meeting summary. She will also send out an email to flush out some of the potential exposure units. If the discussion can't be completed by email, she will schedule a call.

Geophysical Discussion Meeting Minutes
Suffolk County Army Airfield (AAF)
Bombing and Gunnery Range Munitions Response Site (MRS)-01
Task Order: W912DR20F0374
Thursday, October 6, 2020 @ 10 AM ET
DCN: F0374.007

Participants:

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Action Items:
Tetra Tech:
- Update GIS database/figures to line up the targets into a straight line.
- Update the technical approach per discussions once the DOI parcel is confirmed.
- Provide similar figures for other portions of the MRS to show a higher level of detail.
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USACE:
- Reach out to GIS contact at the Town of Southampton when provided information from Tetra Tech.
- Marty and John to determine which District Commander should sign the DARAD.

Meeting Summary:
Original Design: Jennifer provided PowerPoint slides with the original design map of the site plan. Todd stated the targets are not in a straight line compared to the original aerial photos provided; this was based on the GIS provided by the government. Aerials were a little off, so the target location can be a little speculative based on the original aerial imagery. Jennifer asked if it would be better to have the targets lined up using the most southern and most northern targets as reference. Todd agreed to this suggestion. Todd stated the reason for the 1947 aerial imagery being speculative is due to the mosaic error between the different photos. Todd brought up that it is good that the some of the targets reside in the open field based on the image; however, it looks like there might be playgrounds in that area.

Alternative 1: The first alternative would be to make the residential area an HD area. Which would mean the 4 transects that go through this area would not be collected. Tetra Tech would add a transect to the northern section at the top of the residential area to bound the area. Mini grids would be placed in the residential area and sample those. Jennifer stated that the mini grids shown on image provided in the PowerPoint slides are conceptual and can be moved around. ROEs would consist of primary locations and some alternative locations if ROEs to the primary locations are not granted. Jennifer stated that additional grids could be added from other HD areas to the residential area. Jennifer brought up would we hopefully be able to use the same mini grids for MC sampling based on decision unit size and if the area indicts a high use area (HUA). Matt stated that the alternatives were developed not to just remove survey coverage to ease the burden of the ROE process, but also think towards the QAPP development and the decision rules that need to be followed with respect to the data we gather.

John stated with the new knowledge of the DOI parcel and the park, he would like to see those transects extended down until we get to the residential area. He also noted for the first decision rule bullet that if there are no geophysical anomalies other than QA/QC seeds, then the area would be labeled as a low use area (LUA). Jennifer stated for confirmation the transects in the open areas north of the road above the residential would still be collected, and the mini grids would be focused inside the residential area. John confirmed with Jennifer on this assessment. Todd was concerned about the DOI parcel information, as there are a number of residential houses in this area based on the aerial. Jennifer noted she did a quick search and that there is a USCG housing office in the area, and potentially those houses are part of a USCG complex. The site originally had Air Force housing. Julie noted the GIS contact with the Town of Southampton was very helpful, and we can reach back to them with questions on this parcel.

Alternative 2: Alternative 2 would include transects going through the residential area; however, the spacing between these transects would be changed from 500 ft spacing to approximately 750 to 800 ft. This spacing is still within the VSP modeled required spacing of less than 1,028 ft. These transects can be moved around as well. Instead of 4 transects going through this area, there would be 2 transects. This would reduce the number of ROEs from the original design, but we would still need approximately 20. Mini grids would be placed based on transect data and where ROEs are provided; the mini grids shown are conceptual.

John brought up a molding of alternative between 1 and 2, and that extending the transects where possible is best. Stated that at least one mini grid should be placed in the southern area of the residential area where the blue buffer zones are (not just focusing on the target locations). ROEs need to be focused on T-2 and attempt to get a mini grid somewhere in the southern residential area.

Todd asked if Tetra Tech would attempt to place a 50 by 100 ft mini grid or have a target acreage? Matt answered that depending on physical space grids size may change, and we may have to divide mini grids. 50 by 100 ft areas may not be achievable but will be attempted based on physical space and lack of interference to gather usable, quality data that will be acceptable by the regulators.

Matt asked John for his thoughts on one of the assumptions, which is that based on potentially not getting all the ROEs on transects would there be concerns on usability of data if there are localized gaps in the transects? John stated that if ROEs for parcels along the transect are not granted, then that would be counted as a localized gap that should not affect data usability depending on the size of the gap.

Todd asked if transects would be collected along the streets? Matt answered that streets would be collected, but no cued interrogation or digging will be done in the street. Jennifer stated that transects shown are conceptual and can be moved to avoid certain areas such as roads; the goal of these were to show the various options before digging into the specific details. This increases the number of ROEs, but road concerns are decreased.

Todd asked about increasing the transects in the northern area due to ease of access. John agreed and noted this was his statement about combining alternatives 1 and 2. John stated that having transects 2 and 3 to collect transect data through the residential would be useful; he noted the team needs to understand we need to be flexible depending on ROEs.

Julie added that the Pine Barrens Commission, who has control over the majority of the site, are interested in the fire break and the transect running east-west along the northern section is of interest to them. Jennifer responded that if the northern section of the residential area had transects at 500' spacing and transect through the residential area at a greater spacing then that would negate the need for the east-west transect. Julie stated that it would be good to consider adding that transect line in to show support to Commission as long as it supports the technical approach for this area. Jennifer noted that if we change the direction of the transects to parallel with the highway it increases the total transect lengths and creates data management issues on the western side due to many small transects. Jennifer also noted that the fire break will be considered, and access routes between transects will need to be cut, so incorporating that is a possibility. Jennifer noted that as a follow up to our prior discussion, approximately 5 extra miles of access clearance between the transects is needed to allow teams to traverse between the transects, which is still less than the original acreage provided to the stakeholders.

Matt asked if there is a certain width to be considered a fire break? Julie wasn't sure and noted we could ask. Matt brought up that when these access paths are cleared, they will only be big enough for the team to move equipment and personnel to another transect, which is about 4 to 5 ft wide. Julie agreed and said we would only cut what was needed, but potentially the Commission can use our initial cuts and finish the fire break as needed. This is something to keep in mind, in order to work with them and make the project go as smoothly as possible.

Jennifer summarized the meeting. We want to confirm the one property is owned by the DOI, and Julie will reach out to her GIS contact. If this is DOI property than we will do the 500 ft transect spacing across the northern properties shown and then do 2 transects at a wider spacing in the residential areas. Everyone was in agreement with the plan moving forward.

John brought up if there was going to be a site visit. Jennifer stated a potential site visit after the first SPP meeting in early November. Julie responded that early November was a good target, but if Tetra Tech needs to do a site visit earlier there's no issue with that. Jennifer asked if there are any additional thoughts.

Todd introduced Marty Holmes, the OESS, to talk about the ESP and the use of AGC to reduce the exclusion zone. Marty stated that he spoke to Walter Zang, and that this procedure is still being processed and has not been signed. John noted that the technical memo has been revised to DDESB at request of the Army and has not been approved. He stated that is will be complicated for other services, but JC King has said to do a DARAD. Several DARADs have gone through, and if you want to use that for this it is beneficial to get that process started. Todd asked what is the DARAD process, and if it is incorporated into the ESP or is it a separate document? John responded that it is a separate document that replaces the risk assessment document. Todd's Commander will need to sign the document, and Marty and John will prepare the document. The document would state the reasons this additional risk on the site deviates from explosive safety policy.

Todd asked if this document wouldn't influence the ESP, and would it only need the Commander to sign the document? Marty responded agreed that if the Commander is willing to sign then you would use the exclusion zone based on the AGC data instead of using the ESP-defined exclusion zone. John confirmed that the ESP and DARAD would need to be completed and turned in at the same time. Todd asked if the DDESB needs the document before or after the Commander signs the document. John responded that it needs to be sent in after the Commander signs the DARAD. The DARAD is more for DDESB information, and John and Marty have not seen them reject a DARAD. Marty and John will confirm which District Commander should sign the document in order to meet the mission of the FUDS Program.

Jennifer confirmed that there were no comments on the summary from our prior meeting. Both Julie and Todd noted they were fine with those minutes.

Geophysical Discussion Meeting Minutes
Suffolk County Army Airfield (AAF)
Bombing and Gunnery Range Munitions Response Site (MRS)-01
Task Order: W912DR20F0374
Monday, November 16, 2020 @ 12:30 PM ET
DCN: F0374.005

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Meeting Summary:

Introductions: Ms. Julia Rupp (USACE PM) started the meeting, noting that several on the call were participants in previous discussions before Tetra Tech came on board. With Tetra Tech, we have had time to go through the technical approach and data quality objectives. The objective of today's call to delve into our technical approach for the project. Previously we had a larger group of stakeholders on a call and included logistics; this will be more focused on our study and approach. Julia thanked all for their participation.

Ms. Jennifer Harlan (Tetra Tech) started the meeting by ensuring all could see or had access to the meeting discussion presentation, Systematic Project Planning Meeting #1 for the Suffolk County Army Airfield Bombing and Gunnery Range Formerly Used Defense Site (FUDS). Jennifer gave an overview of the meeting agenda. The presentation provides a list of acronyms and a glossary for participant reference.

Jennifer reviewed the overall project team.

USACE: Project Manager, Julie Rupp; Technical Team Lead, Todd Beckwith; Ordnance and Explosives Safety Specialist, Marty Holmes; Risk Assessor, Amy Rosenstein; Geophysicist, David King; EMCX Geophysicist, John Jackson; Chemists, Yixian Zhang and Constance Lapite; Geologist, Olivia Beaulieu; Biologist, Kevin Foster; Archeologist, Marcos Paiva

Tetra Tech, Prime Contractor: Project Manager, Jennifer Harlan, PMP; Project Geophysicist, Matt Barner, PG; QC Geophysicist, Jeff Gamey, PGp; Senior Chemist, Lynn Arabia, CHMM; Risk Assessor, Hannah Neeley; Biologist, Richard Delahunty; SUXOS, Don Schwalback

Stakeholders: Some stakeholders are the phone and others will be added as the project progresses. This call is focused on the technical approach and follow on logistical coordination will occur.
NYSDEC – Heather Bishop and John Swartwout
Pine Barrens Commission – Julie Hargrave
Town of Southampton - John Bouvier, Ross Baldwin, and David Wilcox

Process Overview for Formerly Used Defense Sites (FUDS)

Jennifer conducted the meeting with a brief description of the property previously used by the Department of Defense (DoD) but has since changed hands; however, they are still responsible for cleaning up the sites. The goal is to reduce any risk to human health and the environment resulting from past DoD activities and is performed under the CERCLA process.

We are in the investigation stage of CERCLA. Tetra Tech is doing the Remedial Investigation (RI). If we find risks or hazards, we will do a Feasibility Study (FS), which goes into the Proposed Plan and gets a public review, then there will be the final Decision Document. If risks or hazards were identified, we would move to a response or clean-up action.

Our goals for the RI will gather enough information to determine the nature and extend of munitions and explosives of concern (MEC) and munitions constituents (MC) and assess any hazard or risk to the public or environment to support if needs remedial action or if is a “no further action” site. The overall objective of the RI is to conduct a field investigation to characterize the Munitions Response Site (MRS). We are looking for the type, density, and distribution of any MEC, then determine the concentration and extent of MC. We will assess risks/hazards to human health, safety, and the environment, and evaluate the MRS boundaries. The current boundary is based on historical information, and if depending on what we find during the RI we may suggest changing the alignment of the boundary of the site.

Requirements and Guidance Summary

There is a Munition Response Quality Assurance Project Plan, developed by the Intergovernmental Data Quality Task Force consisting of state and federal regulators, USACE, DoD, chemists, and geophysicists. They took the UFP-QAPP and used the Optimized Worksheets but transferred it to how we would do an RI for an MRS, focusing on the geophysics, performance criteria, data quality objectives. The MR-QAPP is very detailed and formatted and will be used for this project. It also talks to the systematic project planning (SPP) process that ensures everyone understands what we will do when we go into the field and agrees, so at the end, we have defensible data.

Jennifer showed the 7-step Data Quality Objectives as listed in the MR-QAPP. There are some terminology changes from the UFP-QAPP.

Suffolk County AAF BGR MRS-01 Site Information:

Suffolk AAF FUDS boundary is over 9,224 acres. The MRS we are focused on is 4,297 acres. The site was used from 1943 through 1946 for bombing, strafing, and rocket fire training exercises at 4 sub-ranges.

Most of the training exercises we believe are .50 caliber machine guns, practice bombs, and practice rockets. There was an early period when they did 100lb - 500-lb high explosive (HE) bombs, incendiary bombs, and rockets. There are no military structures remaining except for two target silhouettes. Records indicate a surface clearance was conducted in 1946; approximately 20 people walked over the site and cleaned up munitions found on the surface.

Jennifer displayed a slide with the site layout for discussion. Jennifer showed a 1947 aerial photograph taken just after operations ceased. The Army Geospatial Center was able to research the photographic and develop a mosaic from multiple sources showing of the target details to show what was there on the site at the end of operations. Jennifer described the site layout figure, boundaries for the MRS and FUDS, showing targets and typical DoD buffer areas. We have very strong identified targets, but we will be ground truthing the entire MRS.

Preliminary Conceptual Site Model (CSM)

Most of the land is undeveloped with light industrial, commercial, and residential land. A large portion is part of the Central Pines Barrens Groundwater Conservation District. There are a lot of property owners, but no development and future land use is not expected to change substantially. The known or suspected MC include aluminum, antimony, barium, copper, iron, lead, nickel, and explosives.

Potential or suspected location and distribution of MEC or MC include where survey results and investigation identify areas where MEC existed or currently exists and/or a potential MEC release could have occurred. We will be sampling soil and groundwater as part of the study. Current and future receptors include residents, recreational users, trespassers, commercial/industrial workers, municipal workers, construction workers, and biota (ecological receptors).

The way we will come in contact with potential MEC or MC is through surface and subsurface soils. If these are above the background and screening levels, could result in potential human health and biota risk. Again, the same thing for groundwater, if we find the exposure pathway is complete, but we will not know until we have done sampling. For MEC, current and future human receptors with direct contact at the surface and subsurface. For MC, current and future human receptors will be more of the incidental ingestion, inhalation of particulates, and dermal absorption of surface and subsurface soil, and ingestion and dermal absorption of groundwater. For ecological receptors pathways include incidental ingestion, dermal absorption, and indirect exposure by ingestion of biota that has been exposed to MC.

Jennifer displayed the Preliminary Conceptual Exposure Site Model to be updated once the RI is completed, which summarizes the CSM of the prior two slides. Ms. Hanna Neeley (Tetra Tech) noted on the figure appears when copied to the slide, the MEC open and potentially complete circles did not show up when copied to the slide. Hanna described the arrows going all the way to the MEC and surface soil, and MEC and subsurface soil are to be partially complete, and the bottom non-intrusive activity is an open and complete circle. These will be visible in the figure included in the QAPP.

Mr. John Bouvier (Town of Southampton) added that the town had a spill study done throughout the town by Toxic Targeting and hopes that data can be made available to the team. John noted there was a known plume in the Speonk Area, which and the MRS boundary overlaps the area. It has always been a question about the contributory source and asked if it would be part of Tetra Tech's study. Mr. Todd Beckwith (USACE) believes this was brought up previously and that the spill was petroleum-related. John Bouvier responded it is mainly VOCs at different levels making their way south through the watershed, which is a concern of citizens in the area. We have never been able to understand the point of origin and may be multiple source points. John Bouvier stressed he just wanted to ensure Tetra Tech was aware of the study. Todd agreed he had heard of it and would be good to get that information although it was clearly not related to military munitions, asked John to provide the report so we can confirm. David Wilcox responded it was chlorinated solvents not petroleum-related. Todd confirmed even chlorinated solvents would not have been anything that was part of WWII munitions and would not be covered by our investigation. John Bouvier stated the concern was they might have been using dummy bombs when doing the bombing run, and the rumor was they were using glycerin and anti-icing fluids in the bombs. John Bouvier agreed to get Todd the report.

Data Quality Objectives (DQOs) 1 – 7

Step 1 – State the Problem

Human receptors may come into contact with MEC hazards, so there is a potential for an explosive safety risk. We do not understand if there is any or the extent of MC contamination out there and at what level, which may be associated with human health or ecological risks. Previous investigations have found MEC and MD, but we do not know the extent. There were limited soil and groundwater samples were collected during 2009 Site Inspection. They found a potential ecological risk from select metals in surface soil, but there was no unacceptable risk identified for subsurface soil or groundwater. Again, the Site Inspection was limited. We will need to confirm target locations and delineate the high-density (HD) and low-density (LD) areas, based on geophysical results. Then we will characterize to determine if any anomaly sources are munitions related or not, and establish high use areas (HUAs), low use areas (LUA)s, and no evidence of use (NEU) areas. Jennifer asked Mr. John Jackson (EMCX) for his input on the geophysical terminology.

John Jackson explained that as part of the MR-QAPP team we looked at what was working around the country rather than reinvent the wheel as to how to systematically plan for these remedial investigations. The concept came up with has a phased approach, the first phase preliminary characterization which delineates between high density and low density and is just a number of metallic pieces assessment at the site. Once we find an increase in metallic pieces above expected for that background, we do the detailed characterization, was it munitions related and if so that generally makes it a HUA. If we did not find very much munitions evidence but can't rule it out, making it a LUA. Due to this site's sheer size and the spread between targets, we may have NEU in the northeast part of the site between targets and potentially a few other parts of the site. Generally, HUAs go to physical removal, LUA is more generally land use controls, and NEU generally no further action. By the end of today, it is hoped we will have a good concept agreed to by the team for this project.

Jennifer continued with the presentation noting we will characterize the type, nature, and distribution (horizontal and vertical) of munitions within each HUA and LUA and identify whether it is consistent or inconsistent with the preliminary Conceptual Site Model (CSM). We will collect MC data within each HUA so we can determine horizontal and vertical extent and to evaluate risk. We can then evaluate human health and ecological risk for MEC and/or MC, support determinations of areas with NEUs, and if necessary, collect data to support a FS.

Step 2 – Identify Project Goals

The principal study questions include: What is the nature and extent of MEC and MC, and the potential future threats to human health and the environment? What current and potential future threats may be posed to human health and the environment by MEC and/or MC remaining at the site?

Jennifer explained the outcomes, as John Jackson discussed, either the entire MRS or only portions of the MRS would be determined to be HUA, LUA, or NEU. We need to determine no unacceptable risk, or there is a risk, and we will use remedial alternatives to evaluate and mitigate unacceptable risk in the FS.

Step 3 – Identify Information Inputs

Jennifer described this step is to determine if there is MEC and/or MC on the site and characterize the potential hazards and risks. For MEC, we will look at our background anomaly density (i.e., what is at the site); average target area density above background; horizontal and vertical boundaries of high-use and low-use areas; anticipated depth of reliable detection for munitions known to be present (see list in the presentation); map anomaly locations and anomaly sources; and identify types of munitions on the site.

For MC, we will gather analytical data if associated with MEC, MD, and/or small arms ammunition. If there are impacts beyond soil, other sources of contamination in the area, and we will look at the public and private drinking water sources in the area.

We will establish exposure potential, the current and future land uses, receptors, and exposure scenarios in the CSM. For the FS, we are looking at the effectiveness of various alternatives, different types of geophysical equipment, advanced sensors and how they would work, and data support costing. For instance, if we have to remove soil, what soil types are out there, are there any groundwater issues, etc.

Step 4 – Define the Boundaries of the Project

The horizontal boundary is 4,297-acres. The vertical boundaries for each munition is the munition-specific maximum depth of detection. For example, the smallest TOI is the 4lb M54 incendiary round, and the maximum depth of detection is 1.5 feet. The maximum detection depth is for the 500lb HE bomb at 155.98 inches (~13 feet). This is the type of information we use to design the project.

We will need rights of entry (ROE) required for each parcel we will be investigating, and vegetation clearance will be required along the transects, grids, and access points. We are consulting with the NY Natural Heritage Division and coordinating with Pine Barrens Commission. Tetra Tech will not be doing work June 1–July 31, 2021 due to northern long-eared bat restrictions, and we will not conduct work during the summer tourist season.

Jennifer presented the list of known or suspected MEC on the site. She noted that the 4lb incendiary bomb (smallest TOI) is what we used to design our field study to ensure we find that. The 500lb bomb is what will lead our explosive safety requirements and exclusion zones we have to put in to dig safely. The team had no questions related to DQOs 1 through 4.

Step 5 – Develop the Project Data Collection and Analysis Approach

Jennifer pointed out that Steps 5, 6, and 7 for this presentation have been laid out sequentially so it flows better for discussion. Some of the details presented in Step 7 in this presentation may be part of Step 5.

There are 3 phases of fieldwork for MEC. The preliminary MRS characterization data will give us the HD and LD characterization, which will be delineated into HUAs, LUAs, NEUs during phase 2, and the intrusive investigation is Phase 3 when we will dig to see what those anomalies are.

The sampling locations will be based on the geophysical survey and intrusive investigations once complete. Jennifer presented the flow chart of the RI Characterization Approach and how the 3 phases are broken out based on results.

Step 6 – Specify Project-specific Measurement Performance Criteria (MPCs) and Performance/ Acceptance Criteria

We will use QAPP Worksheet #12 to determine if our data meets what we want. For MEC these include completeness, sensitivity, precision, bias, accuracy, comparability, and representativeness. For MC, the same type of metrics will be used. We will develop measurement performance criteria for every RI field process.

Jennifer displayed an example table for both AGC and MC sampling of what might be included in the MR-QAPP. The tables in the QAPP will detail how we ensure we are meeting the performance criteria to get that defensible data.

Step 7 – Develop the Sampling Design and Project Workflow

We will layout the definable features of work in Worksheet #17. Each process in the RI fieldwork will be detailed in this worksheet. As part of this process, we have used Visual Sample Plan to design the transects. The workflow will include activities and decision points, as well as any contingencies if field conditions are different than expected, and if we will need additional planning sessions.

Finally, this is where we engage with the USACE and stakeholders to interface for decision making. We will be doing a preliminary characterization memo, dig list, usability assessment, etc. We would like input from NYSDEC on how involved in the process you want to be.

MEC Technical Approach

Site Preparation and Phase I

Jennifer explained the first thing we will need is a site location for storage containers, portable toilets, etc.; the location is still to be determined. We will have a NY registered Professional Land Surveyor to establish site controls. We will have an analog instrument test strip for the handheld metal detectors to be used for MEC avoidance as part of site preparation.

Our first step will be to put in the transects as part of the Preliminary MRS Characterization. We will need to do vegetation reduction along those transects. Some of the conversations we have had are not to remove trees 4 inches or greater, we will leave stumps and roots in place to protect the soil, and all material will be chipped and left in place. We understand the potential for fires at the site and we will take the appropriate precautions to ensure activities do not cause wildfires, such as having a water truck on site, and if use handheld instruments will be electric, not gas, etc.

Once the site is set up, we will move to Phase I Preliminary MRS Characterization. As part of the QC process, we will install an instrument verification strip (IVS) in an area where there is nothing in the ground. We will put in industry-standard items (metallic) and run our equipment over it at a start to ensure we can detect it. A few times throughout each day we will run over the IVS to ensure the equipment is working and verifies the data is collected appropriately.

To determine that we are going to detect the smallest target of interest (TOI) 4lb incendiary bomb, there is a program called Visual Sample Plan (VSP) where you put specific information into to develop transect spacing. The spacing we will use is 500 ft throughout the MRS, approximately 28 acres. We may also have to do additional vegetation clearance between transects to move back and forth with the team. Our final coverage amount will depend on whether we have a ROE for those areas. Things like the quarry and highway are excluded from the investigation area. The transects in the residential areas are spaced farther apart, but once we run the transacts, we will have data that will be used to define the LD and HD areas and where we go for phase II. Jennifer then presented figures of the proposal transect approach for visual explanation and discussion. For the residential area, we have set the transects farther apart (~750 ft)to avoid impacting a significant number of residents if we can and still get us the data quality needed to make decisions.

Jennifer displayed an example for a different site to show what the data from the initial transects would look like and how the data will be presented. This data will show us where the HD and LD areas will be. Mr. Matt Barner (Tetra Tech) added for clarification that the color scale in the figure is not the intensity of response but is the variation in densities. Once we have this data and have completed the Preliminary Characterization Memo, Jennifer explained we move into Phase 2.

Phase 2

For the HD and LD area characterization, we use the data and establish mini-grids. There will be ~50 min-grids in the high-density areas, 50 x 100-foot rectangles covering ~5.7 acres. We will perform more vegetation reduction so we can move equipment throughout the grid. We will also do a surface clearance of the grids with our handheld metal detectors removing any surface metallic responses. If we find MEC we address it when we find it. As part of the QC process, we will bury seeds as well as the government. The goal is to ensure that we find the seeds as part of our QC/QA process.

Next, we will conduct a dynamic AGC survey covering the entire 50x100 foot grid with a Metal Mapper 2x2. Then we will do a cued AGC survey on 50% of the mini-grids to see what is out there. Our goal as part of FS is to evaluate clutter rejection rates, what is out there, and what is MEC. Jennifer explained (asking for clarification from John J or Matt as needed) that the cued AGC equipment is relatively new and is put over an anomaly location. It will tell you whether or not there is a MEC item or piece of metal or fits the target library of information we have that, for example says this type of response will be a 100lb bomb or this type of response will be a 4lb incendiary bomb. Matt responded this was a good summary, but for clarification, our approach is a 2-step classification approach, so we will do the dynamic survey using an AGC sensor, then will follow with a cued survey. Matt noted there is a new piece of equipment that allows for dynamic classification using a 1-step data collection pass.

Once Phase 2 is complete, we will then submit data packages and our target dig list for review and approval before moving into Phase 3.

Phase 3

Jennifer explained Phase 3 as our intrusive investigation. Once we have approval from USACE and stakeholders (if needed), we will go out and reacquire the target locations and start digging 100% of those targets identified in the dynamic survey. We need to coordinate the dig list in order to limit impacts to the community where possible such as residential areas, near major highways, etc. We want to ensure there are not conservation/species considerations. When excavating potential munitions, we will provide an exclusion zone up to a maximum of 638 ft around the dig area to ensure safety. If we are in a residential area or near a commercial area, we may have to conduct evacuations. Once we dig the item, we will do anomaly resolution, which details what we find (i.e., MEC, piece of metal, horseshoe, etc.). Then the team will manage those items that have an explosive hazard. We will contract out to have on-call explosives delivery if and when we find something. We will not store explosives or MEC on site. If we can't take care of MEC the same day it will be guarded overnight for explosive safety. Tetra Tech will be responsible for any property restoration (if needed) to ensure no impact to the property owners. Jennifer asked if there were any questions on the MEC approach, and there were none.

MC Sampling Design

We will be collecting surface soil samples using incremental sampling (IS), where you go to a sampling location and do a certain number of increments in that area. These locations will be selected based on the geophysical and intrusive investigation results. We will go to areas where we find MEC or a large quantity of ammunition and sample there. This will be a phased approach, so if we go out and collect initial samples on the surface and results come back exceeded our screening level, we may need to do more sampling to determine the extent. If we find something in the subsurface, which requires sampling in a HUA, we will collect a subsurface sample. Once we obtain all results, we will submit a Technical Memorandum for approval, detailing recommended sampling locations. If we determine we need to do additional sampling, we will submit an additional memo identifying those locations. We will also collect background soil samples, location still to be determined and will be based on the ROEs. We many look at collecting these background samples within the FUDS boundary, but outside of the MRS boundary. Samples will be analyzed for select metals and explosives.

Our HUAs are the areas with sufficient MEC density or significant quantities of small arms in a limited area. We will collect surface soil samples 0 to 0.5 feet below vegetation cover. Each sampling unit is comprised of 30 discreet soil increments, and in all cases, at least 1 sampling unit (SU) within the decision unit (DU) will be collected in triplicate. More details based on the type of site will be provided in following slides.

The exposure unit is based on our CSM. The residential areas potential receptors include residents, trespassers, construction workers, and potentially ecological. In the residential area, the exposure area will likely be equal to the parcel size. If you own a house on a ¼ acre that is the exposure unit, not the entire neighborhood.

In the non-residential areas which are industrial, possible receptors include commercial/industrial worker, construction workers, trespassers, and potential ecological receptors. Again, the exposure area will likely be equal to the parcel size. If there is a 12-acre industrial parcel, that will be the exposure unit.

Then we have non-residential areas which are conservation areas within the Central Pine Barrens. Potential receptors include recreational users (e.g., bird watchers, campers, hikers, hunters, horseback riders, and mountain bikers), construction workers, municipal workers, and ecological. We look at how to split this out as they will vary in size but will not likely not exceed between 2 and 5 acres for humans.

For ecological receptors, we could have some less than 0.25 acres and others more than 274 acres, depending on the critter. Therefore, we may need to consider both point estimates and aerial estimates of exposure depending on the home ranges of the various representative receptors.

Next, we move into the DUs based on exposures. In the residential areas we are looking at the parcel equaling the DU if the parcel is less than or equal to 0.25 acre in size. In this case, the DU is going to be SU and cover the entire parcel. If the residential parcels are between 0.25 acre and 1 acre in size; the parcel boundary will be the DU, which will then be subdivided into 0.25-acre SUs that would completely cover the DU. If that parcel is larger than 1 acre in size, the parcel boundary will again be the DU, we will do 0.25-acre SU representative locations. There will not be 100% coverage but will be covered based on the geophysical response. This will all be laid out as decision rules in the QAPP.

For the Central Pine Barrens recreational areas, if the HUA is less than 2 acres, the HUA will be the DU, and it will be subdivided into 0.25-acre SUs for 100% coverage. If the HUA is larger than 2 acres, the HUA will be divided into 2-acre DUs. Then we will do the stratified sampling approach based on the geophysical responses covering that DU but not have 100% coverage.

For the industrial areas, if a HUA is located across multiple industrial parcels, the HUA will be subdivided by the individual parcel boundaries. Then we do a DU of up to 2 acres in size. We will subdivide into approximately 0.25-acre SUs for 100% coverage. If larger than 2 acres will split out as discussed above.

The background sampling will be conducted after all MRS sampling. The goal is if you find something different within the parcels, we want to ensure we have background samples that relate to those areas. The SUs will be 0.25 acre with 8 background samples collected, and at least 1 background sample will be collected in triplicate. If needed, we will do subsurface sampling with background samples. Samples collected in each DU will be compared to the background dataset using statistical hypothesis testing, which will be detailed in the Risk Assessment Work Plan that is part of the QAPP.

If no munitions are found during geophysical surveys in certain areas, we will not do MC sampling as there would be no munitions source. The exception is known target areas. If MEC was removed during the surface clearance in 1947, there might still be a potential for MC. We would then take a soil sample unless the area was redeveloped, soil relocated/brought in, a highway or other that would suggest no DoD based contamination there.

Jennifer stressed that the sampling discussion so far has been for the HUAs. For the LUAs, when talking about MC sampling, these would be breached MEC with soil staining under the item, that looks like potential contamination exists. We will take a small 10 ft x 10 ft SU centered on the item and stained the soil to determine presence or absence. If the results show screening levels are exceeded, we will do nature and extent sampling.

Jennifer confirmed we would also do presence and absence sampling for all post-detonation to ensure we are not impacting the area of the detonation of the MEC. This is not part of the risk assessment program at this point. We will do the presence and absence and, if needed, do nature and extent sampling.

If, based on our geophysical results, our soil sampling results, and our investigation results of the groundwater in the area, we may also need to do groundwater sampling. If needed, we will do additional vegetation clearance for drill rig access. We would also need to do background wells. The plan is to have 2-inch pre-packed screened monitoring wells put in with direct push technology (DPT). We will allow the wells to settle and then develop the wells and obtain groundwater level samples using low-flow methodologies for the same select metals as soil sampling.

The potential screening criteria for this project will be USEPA regional screening levels, USEPA ecological soil screening levels, and site-specific background. Tetra Tech is having laboratory analysis done by Microbac, and data validation by HSW. Jennifer asked if any questions or clarifications were needed on the MC sampling; none were put forth by the group.

Definable Features of Work (DFW) for RI Fieldwork

Jennifer did a quick review of the DFW list to include:

DFW 1 – Pre-mobilization Activities. Complete SPP process and prepare MR-QAPP, Community Relations Plan, and an Accident Prevention Plan/Site Safety & Health Plan.

DFW 2 – Site Preparation

DFW 3 – Field Quality Control (QC) Activities

DFW 4 – Preliminary MRS Characterization. Collect DGM data (EM61) along transects and process DGM data to identify high density (HD) and low density (LD) areas.

DFW 5 – HD/LD Characterization. Grid preparation with vegetation clearance and surface clearance, and conduct AGC (MM2x2) in follow-up grids.

DFW 6 – Cued AGC Investigation. Collect static AGC (MM 2x2) in grids placed within HD areas to characterize HUAs. This will give us the static AGC DUA/Target Dig List.

DFW 7 – Intrusive Investigation/Anomaly Resolution. Targets of interest (TOIs) and random selection of non-TOIs to sample population and verify classification.

DFW 8 – MC Sampling (based on results of geophysical and intrusive investigation)

DFW 9 – Material Potentially Presenting an Explosive Hazard Inspection, Verification, and Certification

DFW 10 – Demolition

DFW 11 – Material Documented as Safe Disposal and Demobilization

Potential Constraints/Coordination Issues

We will need a significant amount of ROEs and coordination required to conduct geophysical surveys. We will also have a lot of coordinate with property owners who provide ROEs. We will need to find locations for the background sampling.

There will be vegetation reduction coordination requirements and limitations discussed on the site preparation slides. We will be unable to work during the summer from June 1 to July 31 due to the northern long-eared bat and for the summer tourist season. We know there is hunting in the Central Pines area, so we will need to coordinate and wear orange. We understand the wildfire danger potential and have planned mitigation. The NY Natural Heritage consultation is in progress.

Work will be conducted in residential areas/near highways and we want to limit the project's impact as much as possible. We will coordinate with the airport during intrusive operations; if there is a plane going overhead, we will need to stop operations.

This is a high public visibility site, even in non-residential areas, with people all around using the trails and such, so there will be a lot of public coordination and communication. Jennifer asked if there was anything we were missing or needed to discuss on these issues, and no one had anything to add.

Project Schedule

Jennifer reviewed the general schedule and noted the plan is to provide the draft MR-QAPP to USACE to review in December for their 2 phases of review. By March, we anticipate the stakeholders will have the MR-QAPP for review.

We will then schedule the SPP Meeting 2 in May 2021 to discuss comments and resolutions. Although we may have the final MR-QAPP in May 2021, we will not start RI fieldwork until September 2021 following the summer season, which includes a 5-month process through January 2022. We will do the preliminary characterization and then demob from the site to prepare the technical memorandum, which will address grid locations. We mob back in to do the HD/LD characterization, then mob demob while processing the data and final agreement on the dig list. We will then mob back in for the intrusive investigation.

In March 2022 we will provide the first draft of RI Report and hope to finalize it in August 2022, followed by the FS. Some projects combine these 2 reports and we can do this if the team and all stakeholders agree. This will be followed by the Proposal Plan in 2023 and then the draft Decision Document in 2023 to 2024.

Safety Reminder

Follow the 3Rs of Explosives Safety:

Recognize: When you may have encountered a munition and that munitions are dangerous.

Retreat: Do not approach, touch, move, or disturb it, but carefully leave the area.

Report: Call 911 and advise the police about what you saw and where you saw it.

Questions/Open Discussions

Mr. John Jackson reiterated there are a lot of opportunities built into this process to look at decision points that are all documented in technical memorandums. He noted that as you review the QAPP if there are any decision points you want to be involved with, please alert us to that. He added some stakeholders like to be involved in every step of the process, while others just want to see the final report. He noted either way is fine, but we want to ensure that you are involved at the level you want to be.

Mr. John Swartwout was just curious for our own internal planning purposes, how many property owners will we need to contact for ROEs. Jennifer responded hundreds. Our goal is if all on this call are good with how we will do the transects and our approach, we will get a list of all parcel numbers and then the USACE will start the ROE process.

Jennifer stated that even the land in the conservation area is owned by many property owners, and this may impact where we are able to actually do the work. This would be detailed in SPP #2. John Swartwout asked why people would own a property in a conservation area. Todd added that a lot of the parcels are over 100 years old, and at one time would be developed, then was turned into a groundwater conservation area as they did not want development because of the sole source aquafer area. Todd confirmed John's question that they have a conservation easement that does not allow development. Jennifer responded there are 2 different areas, one area with no development at all, and areas that they could be developed but it is significantly limited, and they would have to jump through hoops to do it. Julie added that they attended a Pine Barrens hearing in May when they obtained official interpretation that our project is not considered development and is therefore so not subject to restrictions or denials that a development project would need in this area.

Todd asked John Swartwout and Ms. Heather Bishop (NYSDEC) what was their level of involvement or familiarity in MMRP projects. John responded most of his experience had been rifle ranges. He has not been involved with any that had bombing ranges like at this location. John commented that some states with large facilities with large ranges have a lot of state expertise in the munitions response. Much of their involvement in New York had been lead contamination from a shooting range and have been peripherally involved in the cleanup of ranges, but they do not get deep into the details of this type of investigation or clearance projects. Todd offered as they digest it all, understanding they will receive the QAPP in a few months, feel free to reach out to him and Julia with any questions. John Swartwout responded that the state health department counterpart will be looking at it and may have more questions. Julie asked if John knew who the state health department contact with be. John checked, but does not have a name. He will touch base with them to let them know the QAPP is coming to have someone lined up or wait until it arrives. Everyone agreed that that department was very busy with COVID things right now.

Jennifer thanked everyone for their attendance and the meeting adjourned.

SUFFOLK COUNTY ARMY AIRFIELD BOMBING AND GUNNERY RANGE FORMERLY USED DEFENSE SITE

Remedial Investigation through Decision Document

Systematic Project Planning Meeting 1

November 16, 2020

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AGENDA

- Introduction of U.S. Army Corps of Engineers (USACE) Project Team, Tetra Tech, and Stakeholders
- Process Overview for Formerly Used Defense Sites (FUDS)
- Requirements and Guidance Summary
- Systematic Project Planning (SPP) Meeting 1 Activities
  - Suffolk County Army Air Field (AAF) Bombing and Gunnery Range (BGR) Munitions Response Site (MRS) Site Details
  - Preliminary Conceptual Site Model (CSM)
  - Data Quality Objectives (DQOs) 1 – 7
  - MEC Technical Approach
  - MC Sampling Design
- Definable Features of Work (DFW) for RI Fieldwork
- Potential Constraints/Coordination Issues
- Project Schedule
- Safety Reminder, Closing Remarks, and Questions

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Acronyms

AAF	Army Air Field
AGC	Advanced Geophysical Classification
BGR	Bombing and Gunnery Range
CSM	Conceptual Site Model
DFW	Definable Feature of Work
DoD	Department of Defense
DQO	Data Quality Objective
DU	Decision Unit
EMCX	Environmental and Munitions Center of Expertise
FS	Feasibility Study
FUDS	Formerly Used Defense Site
HD	High Density
HE	High Explosive
HUA	High Use Area
IDQTF	Intergovernmental Data Quality Task Force
IS	Incremental Sampling
IVS	Instrument Verification Strip
LD	Low Density
LUA	Low Use Area
MC	Munitions Constituents
MD	Munitions Debris
MEC	Munitions and Explosives of Concern
MM2x2	MetalMapper 2x2
MPC	Measurement Performance Criteria
MPPEH	Munitions Potentially Presenting an Explosive Hazard
MR-QAPP	Munitions Response Quality Assurance Project Plan
MRS	Munitions Response Site
NEU	No Evidence of Use
NYSDEC	NY State Department of Environmental Conservation
RI	Remedial Investigation
ROE	Right of Entry
SAA	Small Arms Ammunition
SPP	Systematic Project Planning
SU	Sampling Unit
SUXOS	Senior Unexploded Ordnance Supervisor
TOI	Target of Interest
UFP-QAPP	Uniform Federal Policy for Quality Assurance Project Plan
USACE	US Army Corps of Engineers
VSP	Visual Sampling Plan

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Glossary

Geophysical:

- <u>High density (HD) area:</u> Area within a munitions response site (MRS) where the anomaly density has been determined to be ≥ critical density. HD areas will be presumed to result from munitions use unless and until it can be demonstrated otherwise.
- <u>High use area (HUA):</u> HD area where munitions use has been confirmed. Unexploded ordnance (UXO) and/or discarded military munitions (DMM) are anticipated to be present in HUAs.
- <u>Low density (LD) area:</u> Area(s) within an MRS where the anomaly density has been determined to be < critical density. LD areas can include both low use areas (LUA) and no-evidence-of-use areas (NEU).
- <u>Low use area (LUA):</u> LD area where the potential presence of munitions cannot be ruled out. Examples of LUA include buffer zones and maneuver areas.
- <u>No-evidence-of-use (NEU) area:</u> 1) LD area for which the Conceptual Site Model (CSM) contains no evidence munitions were used in the area, or 2) HD area determined to be not related to munitions use. All available and relevant lines of evidence supporting this delineation (e.g., historical records review, historical photo interpretation, visual observations, and interviews) must be considered.

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Glossary (con't)

Munitions Constituents:

- Decision Unit (DU) – the smallest volume of soil (or other media) for which a decision will be made based upon ISM sampling. A DU may consist of one or more sampling units (SUs). The use of multiple SUs within a DU provides information on the spatial distribution of analytes within the DU, and results from multiple SUs can be combined to produce weighted means for larger DUs to satisfy multiple project decisions
- Exposure Unit (or exposure area) – for purposes of risk assessment, a defined area throughout which a potential receptor may be exposed to a contaminant. The receptor is assumed to move randomly across the area, being exposed equally to all parts of the area. The assumption of equal exposure to any and all parts of the exposure area is a reasonable approach that allows a spatially averaged soil concentration to be used to estimate the true average concentration contacted over time.
- Incremental Sample (IS) – A collection of increments collected from a single sampling unit, which are combined, processed, and analyzed to estimate the mean concentration in that sampling unit
- Sampling Unit (SU) – The SU is the volume of soil represented by a single incremental sample. It defines the spatial resolution (the scale) of the data.

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Project Team

USACE

- Project Manager – Julie Rupp
- Technical Team Lead – Todd Beckwith
- Ordnance and Explosives Safety Specialist – Marty Holmes
- Risk Assessor – Amy Rosenstein
- Geophysicist – David King
- EMCX Geophysicist – John Jackson
- Chemists – Yixian Zhang and Constance Lapite
- Geologist – Olivia Beaulieu
- Biologist – Kevin Foster
- Archeologist – Marcos Paiva

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Project Team

Tetra Tech - Prime Contractor

- Project Manager – Jennifer Harlan, PMP
- Project Geophysicist – Matt Barner, PG
- QC Geophysicist – Jeff Gamey, PGp
- Senior Chemist – Lynn Arabia, CHMM
- Risk Assessor – Hannah Neeley
- Biologist – Richard Delahunty
- SUXOS – Don Schwalback

Stakeholders

- NYSDEC – Heather Bishop
- Pine Barrens Commission – Julie Hargrave
- Town of Southampton

Formerly Used Defense Sites (FUDS)

- **Definition:** Real property that was under the jurisdiction of the Secretary and owned by, leased by, or otherwise possessed by the U.S. and those real properties where accountability rested with Department of Defense (DoD) but the activities at the properties were conducted by contractors that were transferred from DoD control prior to October 17, 1986.

- **Goal:** “To reduce, in a timely and cost effective manner, the risk to human health and the environment resulting from past DoD activities at formerly used DoD properties.”

- FUDS cleanup is performed under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA)

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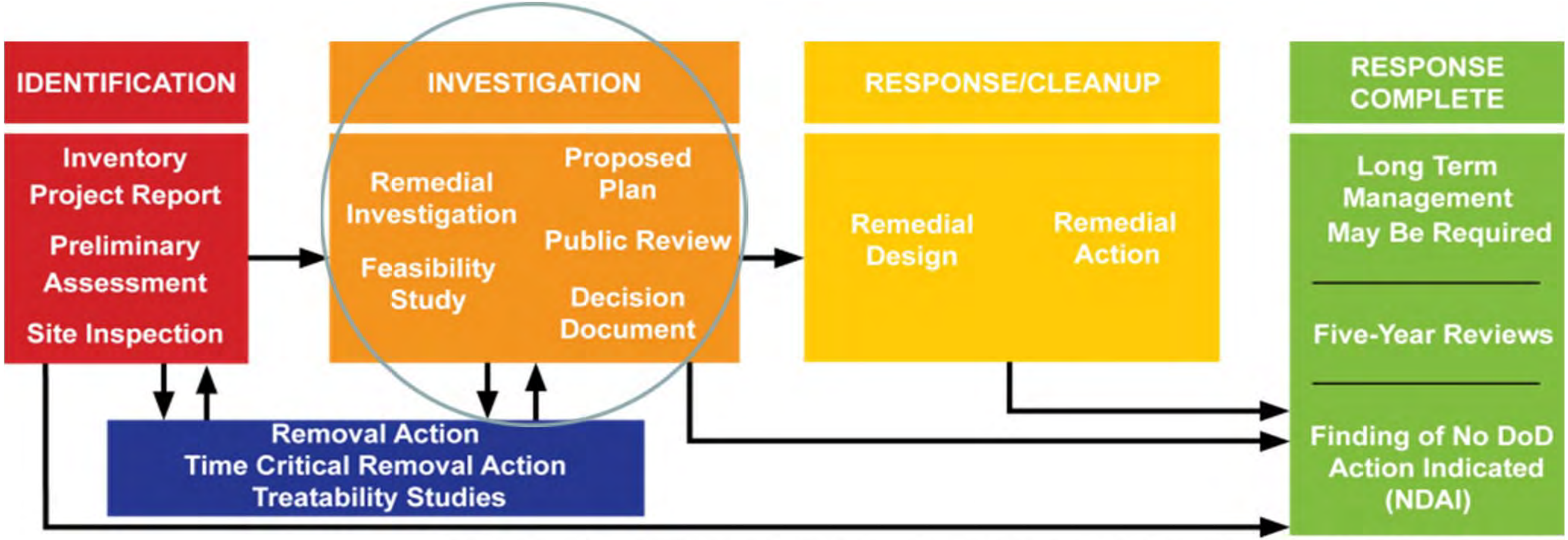
Process Overview for FUDS

Project is currently at this stage



(U.S. Army Corps of Engineers Environmental Regulation 200-3-1, FUDS Program Policy, May 2004)

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Goals for the Remedial Investigation (RI)

Overall Goal:

- Gather sufficient information to determine the nature and extent of munitions and explosives of concern (MEC)/munitions constituents (MC) and assess the potential risks/hazards to support the evaluation of a no further action or remedial action alternative

RI Objectives:

- Conduct field investigations to characterize the Munitions Response Site (MRS)
- Determine the type (nature), density, and distribution (extent) of MEC
- Determine the concentrations (if any) and extent of MC
- Assess potential risks/hazards to human health, safety and the environment
- Assess MRS boundaries

Requirements and Guidance Summary

Revised guidance for planning meetings and preparation of Quality Assurance Project Plan (QAPP)

- Munitions Response (MR)-QAPP Module 1 Toolkit (December 2018, Updated April 2020)
  - Developed by the Intergovernmental Data Quality Task Force (IDQTF) to assist project teams in planning for the characterization and remediation of MEC at DoD installations and FUDS
  - Based on requirements and guidance as follows:
    - Uniform Federal Policy for Quality Assurance Project Plans(UFP-QAPP) (IDQTF, 2005)
    - Makes use of the Optimized UFP-QAPP Worksheets (IDQTF, 2012)
    - Employs the Systematic Project Planning (SPP) process to illustrate scientifically sound approaches to site characterization and/or site remediation
- MR-QAPP Toolkit Webinar (February 2019)
  - Developed by USACE to provide an overview of process
  - Outlined SPP process

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Goals for Suffolk County Army Airfield (AAF) Bombing and Gunnery Range (BGR) SPP #1

Develop the seven-step Data Quality Objective (DQO) process for the MRS Investigation based on MR-QAPP Module 1

Step 1 – State the Problem

Step 2 – Identify the Goals of the Study

Step 3 – Identify Information Inputs

Step 4 – Define the Boundaries of the Study

Step 5 – Develop the Project Data Collection and Analysis Approach

Step 6 – Specify Project-specific Measurement Performance Criteria (MPC) and Performance/Acceptance Criteria

Step 7 – Develop Sampling Design and Project Work Flow

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Suffolk County AAF BGR MRS-01 Site Information

- Suffolk AAF FUDS – 9,224 acres
- Suffolk AAF BGR MRS-01 – 4,297 acres
  - Site used from 1943-1946 for bombing, strafing, and rocket fire training exercises at 4 sub-ranges
    - Ground Gunnery/Skip Bombing A
    - Ground Gunnery/Rocket Range B
    - Bombing Range
    - Strafing Range
  - Majority of the training exercises appear to have been .50 caliber machine guns, practice bombs, and practice rockets
  - From May 1943 through January 1944 100-lb and 500-lb high explosive (HE) bombs, incendiary bombs, and 4.5-in HE rockets were reportedly used on the numerous targets located throughout the MRS
  - No military structures remain except for two target silhouettes (a destroyer and aircraft carrier)
  - Records indicate a surface clearance was conducted in 1946

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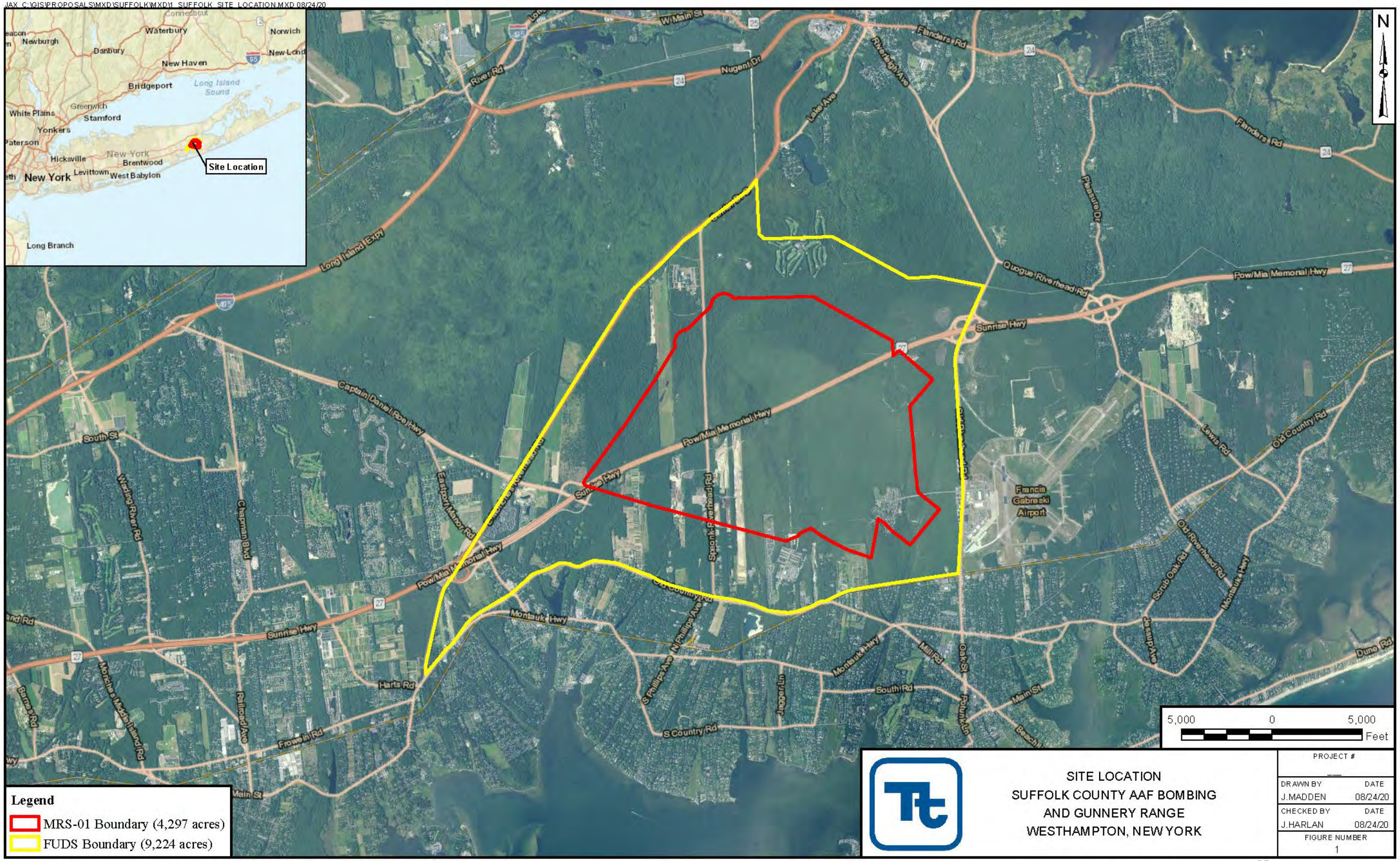
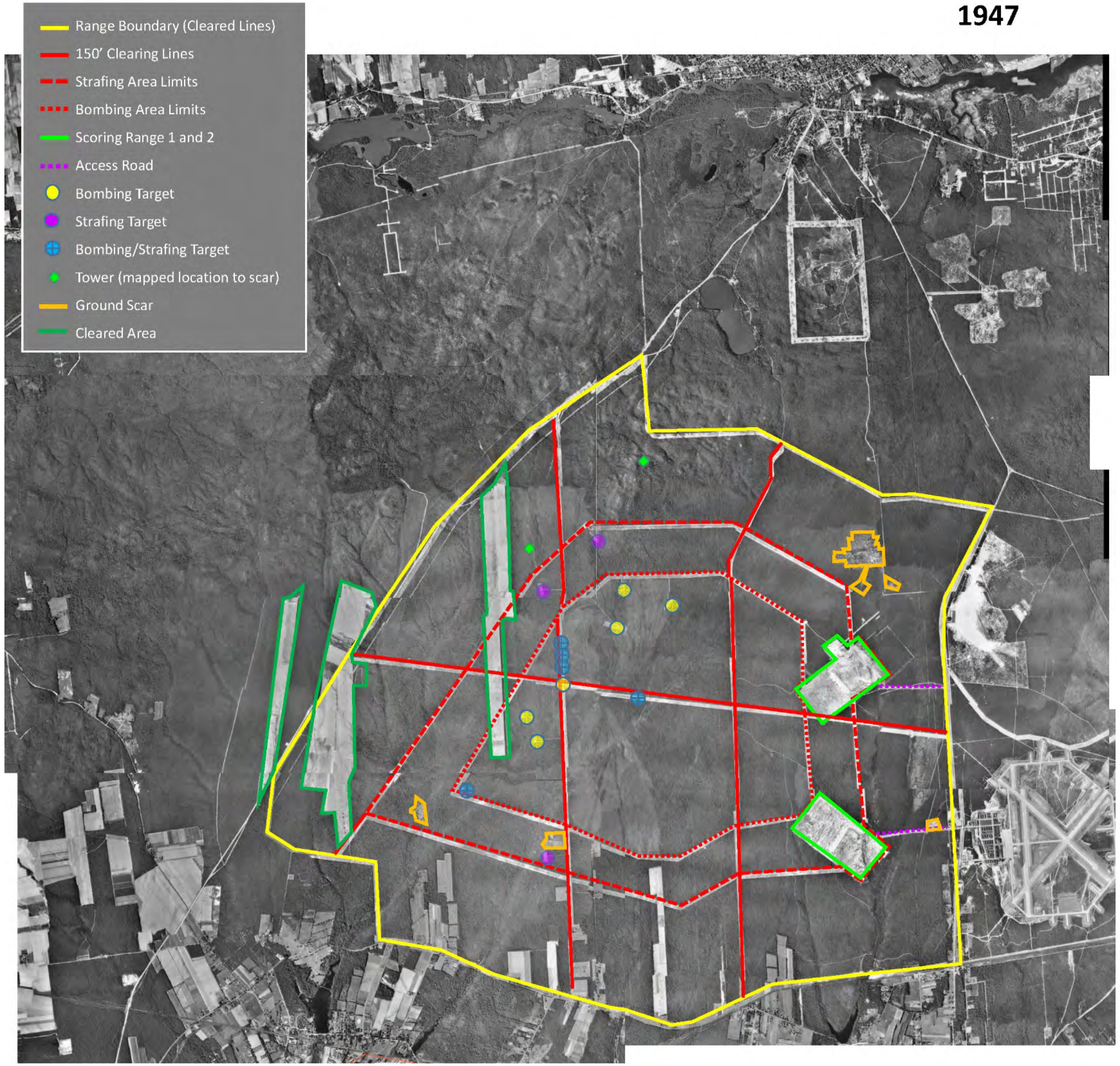
Suffolk County AAF BGR MRS-01

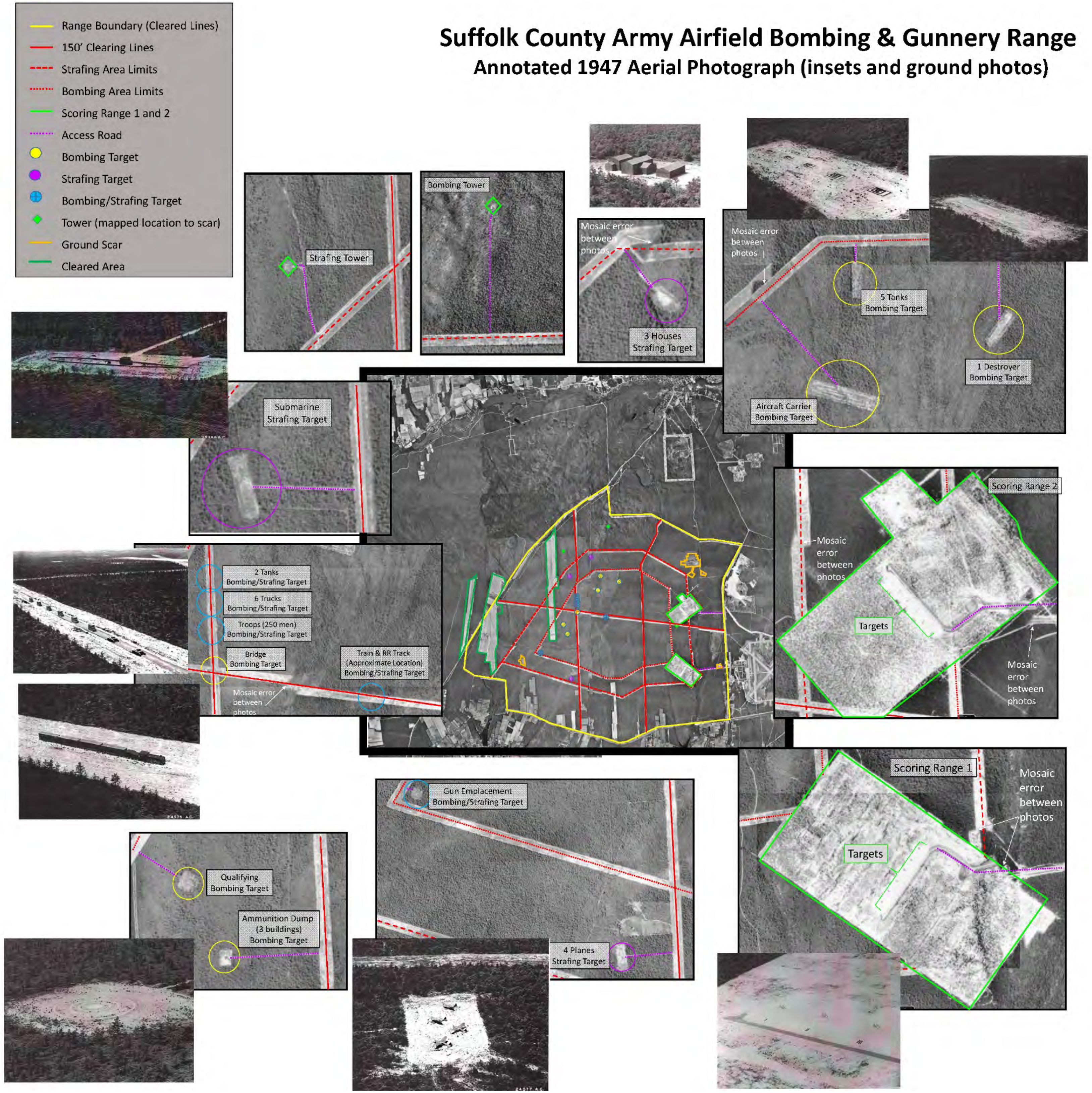


Suffolk AAF 1947 Photograph



Suffolk County Army Airfield Bombing & Gunnery Range

Annotated 1947 Aerial Photograph (insets and ground photos)



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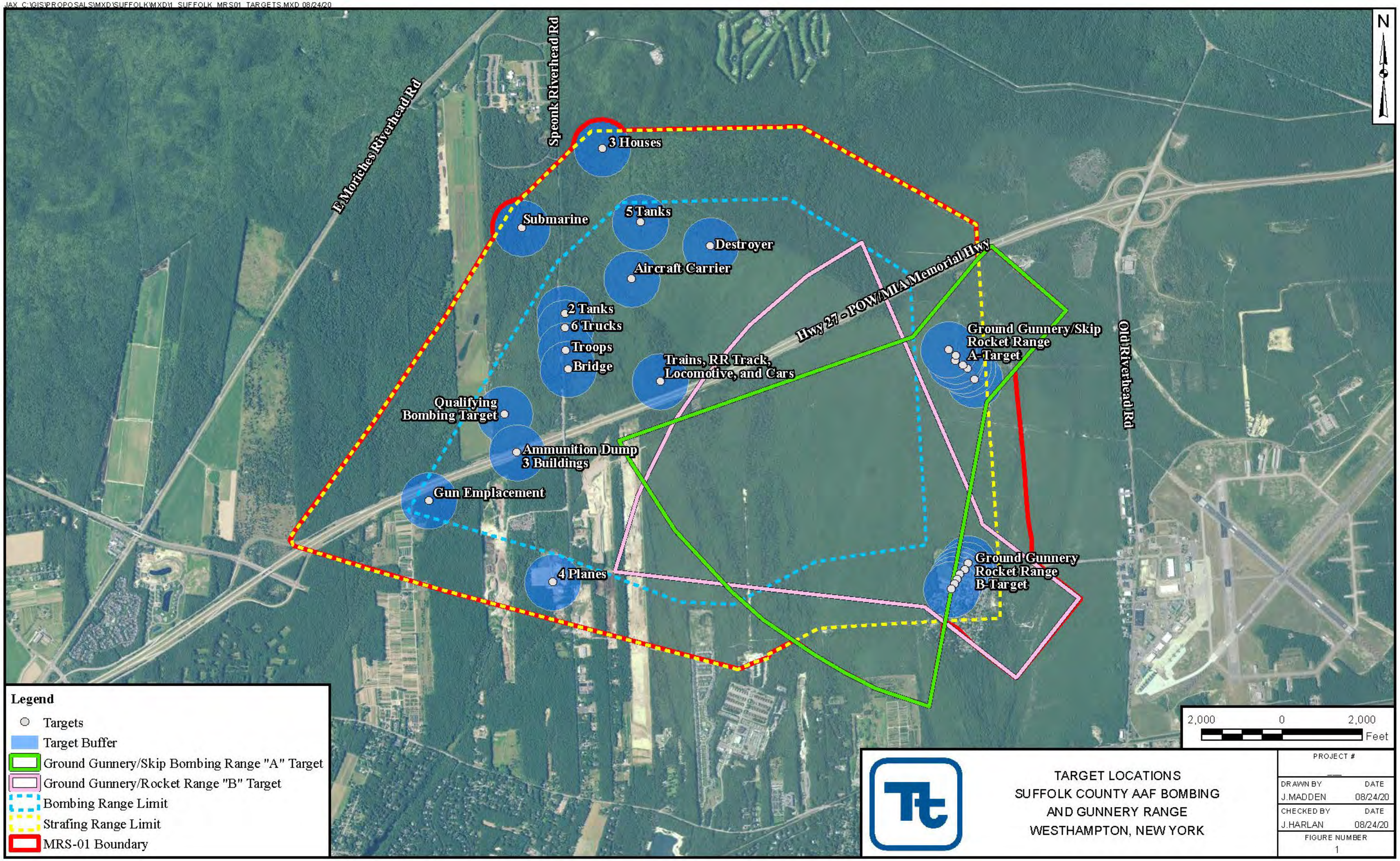
Suffolk County AAF BGR MRS-01



Preliminary Conceptual Site Model (CSM)

- **Current Land Use:** Mostly undeveloped with light industrial, commercial, and residential land. Large portion of the site is part of the Central Pine Barrens Groundwater Conservation District.
- **Future Land Use:** Not expected to substantially change
- **Known or Suspected Contamination Sources:** Potential MC – aluminum, antimony, barium, copper, iron, lead, nickel, and explosives
- **Potential or Suspected Location and Distribution:** Where survey results and investigation identify areas where MEC existed or currently exists and/or a potential MEC release could have occurred
- **Source or Exposure Medium:** Soil and groundwater
- **Current and Future Receptors:** Residents, recreational users, trespassers, commercial/industrial workers, municipal workers, construction workers, and biota

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Preliminary Conceptual Site Model (con't)

- **Potentially Complete Exposure Pathways:**
  - In surface and subsurface soils, the presence of explosives or select metals above background and screening levels could result in potentially complete exposure pathways and potential risks for humans and biota
  - In groundwater, if the exposure pathway is complete, the presence of MC including explosives and select metals above background and screening levels could result in potential risks for humans
    - MEC Exposure Pathways
      - Current/Future Human Receptors: Direct contact at the surface and subsurface with MEC
    - MC Exposure Pathways
      - Current/Future Human Receptors: Incidental ingestion, inhalation of particulates, and dermal absorption of surface and subsurface soil. Ingestion and dermal absorption of groundwater
      - Ecological Receptors: Incidental ingestion, dermal absorption, and indirect exposure by ingestion of biota that has been exposed to MC

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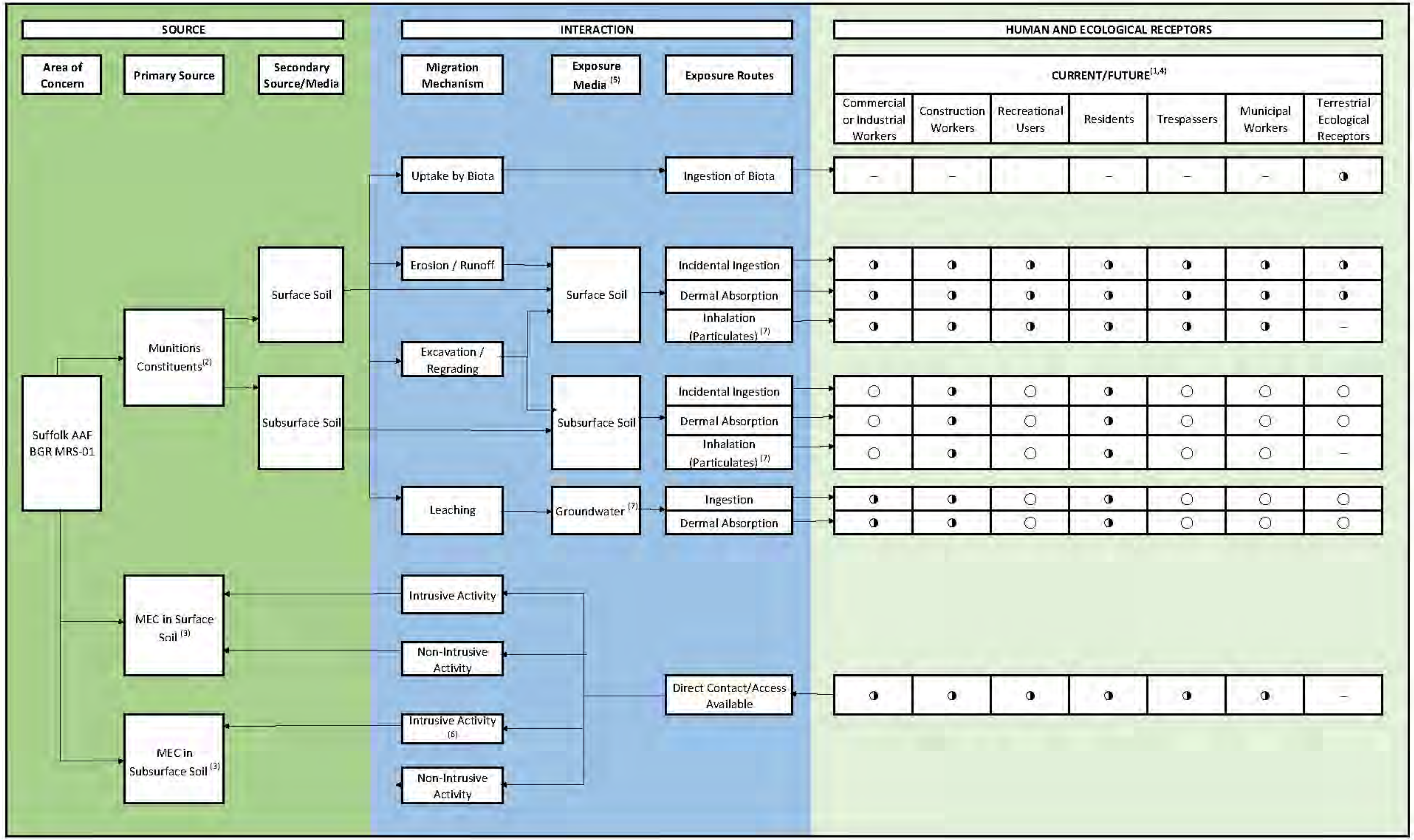
Preliminary Conceptual Exposure Site Model



Notes:
(1) Preliminary CESM based on previous investigation results.
(2) The SI indicated that select metals are present in either surface soil at groundwater at the site.
(3) Results of the previous field activities indicate that MD were identified on the surface soil and metallic anomalies were present in the subsurface soil.
(4) Not all receptors may be applicable throughout all areas within the MRS (e.g., residential, commercial, and Central Pine Barrens Area)
(5) Current site information does not suggest surface water (SW)/sediment within the MRS; therefore, this is considered an incomplete pathway. Should SW/sediment be found during the field investigation, the PDT will discuss sampling of these media.
(6) This pathway is incomplete if the intrusive activity does not reach the depth of MEC present
(7) None of the analytes of interest are volatile

● Complete Exposure Pathway
◑ Potentially Complete Exposure Pathway
○ Incomplete Exposure Pathway
– Receptor or Exposure Pathway Not Present – Historical information indicates this receptor is not present within the MRS or the exposure from this pathway is inapplicable or insignificant for this receptor.

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DQO Step #1 – State the Problem

- Problem
  - Human receptors may come into contact with MEC hazards; therefore, there is the potential for an explosive safety risk. Also, the extent of MC within the MRS is undefined, and may be associated with human health or ecological risks.
- Define the Problem
  - Previous investigations have found MEC and munitions debris (MD), however the extent of MEC is unknown
  - During the 2009 Site Inspection, limited soil and groundwater samples were collected
    - A potential ecological risk from select metals in surface soil was identified
    - No unacceptable risk was identified for subsurface soil or groundwater
  - Further Investigation is needed to:
    1. Confirm locations of targets
    2. Delineate High Density (HD) and Low Density (LD) areas for characterization
    3. Conduct detailed characterization to determine if anomaly sources are munitions-related or not, and to establish boundaries for high use areas (HUAs), low use areas (LUA)s, and no evidence of use (NEU) areas

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DQO Step #1 – State the Problem (con't)

4. Characterize the type, nature, and distribution (horizontal and vertical) of munitions within each HUA and LUA
5. Determine if findings are consistent or inconsistent with the preliminary Conceptual Site Model (CSM), revisit DQOs, and, if necessary, collect additional MEC data to ensure all RI data needs are met
6. Collect MC data within each HUA (including areas with significant quantities of small arms) in sufficient quantity to determine the horizontal and vertical extent and to evaluate risk
7. Evaluate human health and ecological risk for MEC and/or MC
8. Support determinations of areas with no evidence of use (NEUs)
9. Collect data to support a Feasibility Study (FS), if necessary

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DQO Step #2 – Identify the Project Goals

- **Principal Study Questions:**
  - What are the nature and extent (i.e., horizontal and vertical distribution) of explosive hazards from MEC throughout MRS-01?
  - What are the nature and extent (i.e., horizontal and vertical distribution) of and potential exposures to MC at MRS-01?
  - What current and potential future threats may be posed to human health and the environment by MEC and/or MC remaining at the site?
- **Outcomes:**
  - Determine which of the following apply to the entire MRS or specific area within the MRS:
    1. The area is a HUA.
    2. The area is a LUA.
    3. The area shows NEU.
  - Determine risk:
    1. There is no unacceptable risk.
    2. There is an unacceptable risk; therefore, remedial alternatives will be evaluated to mitigate unacceptable risk in the FS.

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DQO Step #3 – Identify Information Inputs

- Information needed to establish presence/absence of MEC and MC and characterize the potential hazards and risks
  - **MEC**
    - Expected background anomaly density
    - Average target area density above background
    - The horizontal and vertical boundaries of high-use and low-use areas
    - The anticipated depth of reliable detection for munitions known to be present
    - Mapped anomaly locations and anomaly sources
    - Types of munitions on the site
  - **MC**
    - Analytical data for MC associated with MEC, MD, and/or small arms ammunition
    - Type of media impacted, if any, beyond soil
    - Other sources of contamination in the area
    - Public and private drinking water sources

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DQO Step #3 – Identify Information Inputs (con't)

- Information needed to establish exposure potential
  - Current and reasonably anticipated future land use
  - Current and reasonably anticipated future receptors
  - Potential exposure scenarios based upon current/future land use activities and receptors

- Information needed to support the FS
  - Data to establish the effectiveness of various alternatives
  - Anticipated detection technology performance
  - Data to support costing of various alternatives

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DQO Step #4 – Define the Boundaries of the Project

- Horizontal Boundaries
  - 4,297-acre MRS
- Vertical Boundaries
  - The vertical boundary for each munition is the munition-specific maximum depth of detection based on the detection threshold.
    - For example, the smallest TOI is the 4 lb M54 Incendiary Round with a EM61-MK2 detection depth of 18.59 inches (~1.5 feet)
    - Maximum detection depth is for the 500 lb HE bomb at 155.98 inches (~13 feet)
- Access
  - Right of Entry (ROE) required for each parcel
  - Moderate to heavy vegetation that will require vegetation clearance along transects, grids and access points
  - NY Natural Heritage Consultation and coordination with Pine Barrens Commission in progress
- Temporal Boundaries
  - No work from June 1 – July 31st due to Northern Long Eared Bat restrictions
  - Summer tourist season

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DQO Step #4 – Define the Boundaries of the Project (con't)

- Target Population: Known or Suspected MEC
  - Small arms (.50 cal)
  - AN-M20 or MN-M18 100lb bomb, explosive burster tube
  - AN-M30 100lb bomb HE
  - AN-M64 & AN-M64A1 500lb bomb HE (MGFD)
  - AN-M50 4lb incendiary bomb
  - AN-M54 4lb incendiary bomb [smallest target of interest (TOI)]
  - AN-M69 6lb incendiary bomb
  - WP bombs
  - M38A2 100lb practice bomb
  - M47A4 100lb smoke bomb
  - M8 4.5" barrage rocket HE
  - 2.25" practice rocket & nose cones
  - M1 3lb black powder spotting charges
  - M77 10lb smoke or incendiary bomb
  - 10lb bombs

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DQO Step #5: Develop the Project Data Collection and Analysis Approach

MEC: The data collection and analysis approach for the RI generally involves three work phases to meet the goals of the project:

- Phase 1: Preliminary MRS Characterization
- Phase 2: HD/LD Characterization
- Phase 3: Intrusive Investigation

MC: Sampling locations will be based on the results of the geophysical survey results and intrusive investigation findings

- Conducted after Intrusive Investigation in Phase 3

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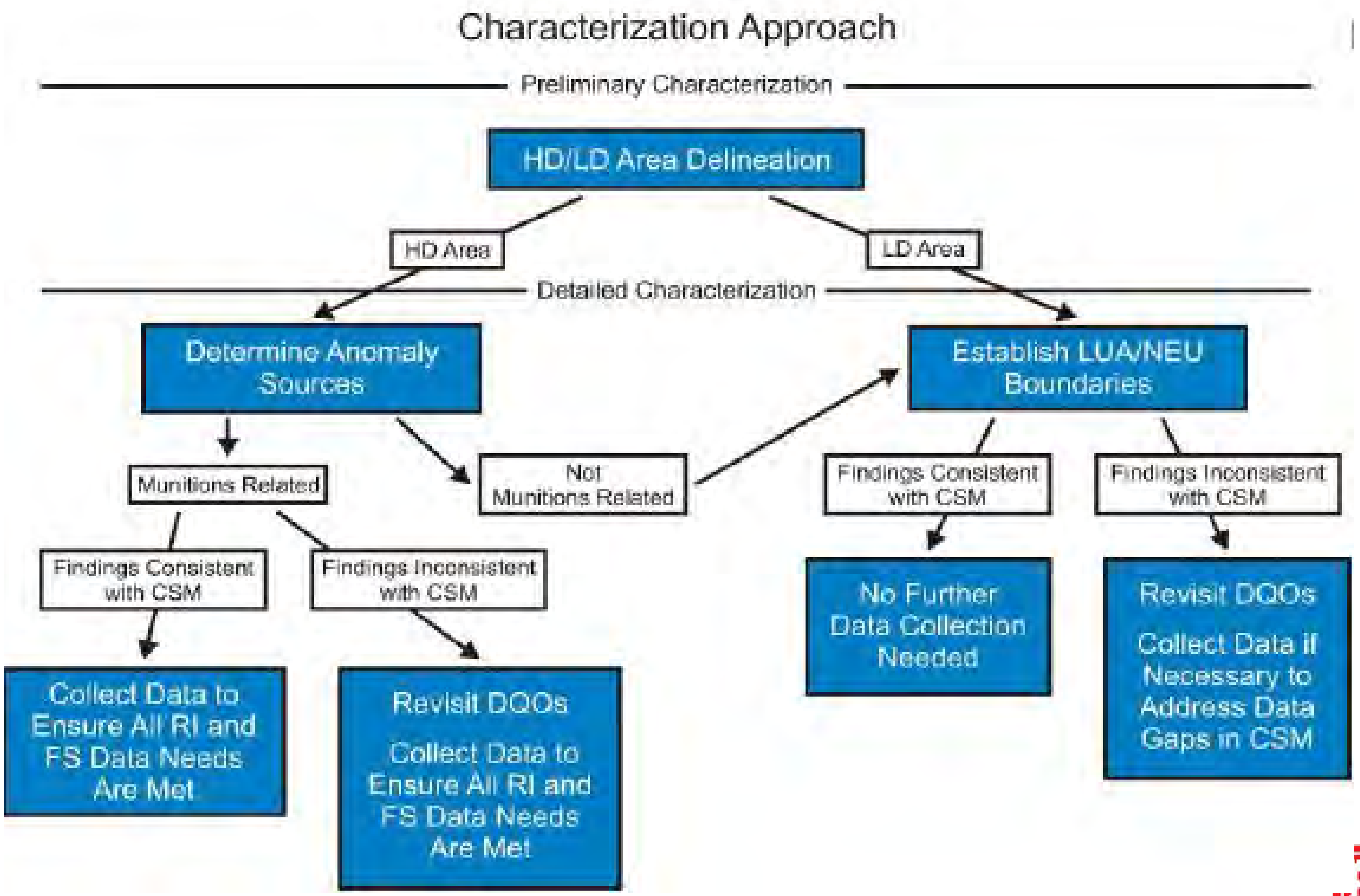
MR-QAPP Phased RI Approach



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DQO Step #6: Specify Project-specific Measurement Performance Criteria (MPCs) and Performance/Acceptance Criteria

- MPCs are documented on UFP-QAPP Worksheet #12
- MEC Data Quality Indicators include completeness, sensitivity, precision, bias, accuracy, comparability, and representativeness
- MC Data Quality Indicators include precision (field and laboratory), accuracy (laboratory), representativeness (field and laboratory), completeness (field and laboratory), comparability (field and laboratory), and sensitivity (laboratory)
- Develop MPC for each process

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Example: MPC Table – Advanced Geophysical Classification (AGC) Investigation (MEC)
(MR-QAPP Worksheet #12a)

Measurement	Data Quality Indicator	Specification	Activity Used to Assess Performance
Anomaly Resolution (AGC)	Accuracy/ Completeness	100% of reacquired flag locations are intrusively investigated; inversion results correctly predict one or more physical properties (e.g. size, symmetry, or wall thickness) of the recovered items .	Qualitative examination and documentation of recovered items
Anomaly Resolution (Intrusive)	Completeness	All metallic items within 16-inch radius around reacquired dig location (i.e. source fit X,Y location) are recovered, categorized and positions are documented relative to flag location	Verification by UXOQCS and QC Geophysicist (or designees)
Anomaly Classification (AGC)	Completeness/Comparability	Library must include signatures for all items considered by the project team to be TOI, as listed in the CSM.	Verification of site-specific library
Anomaly Classification (AGC)	Completeness	All detected geophysical anomalies classified as one of the following: 1. TOI 2. Non-TOI 3. Can't Analyze	Data verification
Anomaly Classification (AGC)	Accuracy	100% of predicted non-TOI intrusively investigated are confirmed to be non-TOI	Visual inspection of recovered items from classification validation
No Evidence of Use (NEU) Area Designation	Representativeness/ Completeness	Well-developed CSM, confirmed by RI results, showing no evidence of munitions use	Data usability assessment

Note: Similar tables will be included in the MR-QAPP for all RI fieldwork processes including site preparation, sampling design, data acquisition, and intrusive investigation

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Example: MPC Table – Incremental Sampling and Analysis for Explosives (MC)

Matrix Soil (MR-QAPP Worksheet # 12b)

Matrix	Solids (Bulk Building Materials and Soil)
Analytical Group	Explosives

Sampling Procedure[1]	Analytical Method/ Standard Operating Procedure (SOP)[2]	Data Quality Indicators (DQIs)	Measurement Performance Criteria	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)
SOP A7-6 (Appendix 7) SOP A7-9 (Appendix 7)	MSE018/ MSE018IS/ HPL8330	Precision (field methodologies - small-scale/sample-specific); Representativeness	s;50% Relative Percent Difference (RPD)	Field Duplicate [Discrete Grab only]	S&A
		Precision; Representativeness	s;20% Relative Standard Deviation (RSD) when results are above limit of quantitation (LOQ)	Field Triplicate [ISM only]	S&A
		Accuracy/Bias	Compound Specific (as provided in DoD QSM v5.0); If not provided in QSM v5.0, use laboratory in-house control limits provided in Appendix 4 [which may not be greater than ±3 times the Standard Deviation (SD) of the mean recovery]	Laboratory Control Sample (LCS)	A
		Accuracy/Bias	Compound Specific (as provided in DoD QSM v5.0 [3]); If not provided in QSM v5.0, use laboratory in-house control limits provided in Appendix 4 [which may not be greater than ±3 times the Standard Deviation (SD) of the mean recovery]	Surrogate Compounds	A

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Example: MPC Table – Incremental Sampling and Analysis for Explosives (MC) (continued)

Matrix	Solids (Bulk Building Materials and Soil)
Analytical Group	Explosives

Sampling Procedure[1]	Analytical Method/ Standard Operating Procedure (SOP)[2]	Data Quality Indicators (DQIs)	Measurement Performance Criteria	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)
		Accuracy/Bias	No analyte detected > ½ LOQ or > 1/10 the amount measured in any sample or 1/10 the regulatory limit, whichever is greater	Method Blank	A
		Accuracy/Bias	No analyte > ½ LOQ	Soil Grinding Blank [ISM only]	A
		Bias/Precision	± 20% of the expected (true) value	Calibration Verification	A
		Accuracy/Precision/ Bias	s; 40% RPO (for results between primary and secondary columns)	Second Column Confirmation	A
		Sensitivity	LOQ < ½ PAL (if possible); see Worksheet #15	Data evaluation by Project Chemist or designee as part of Data Verification Procedures (see Worksheet #35)	A
		Representativeness	Implementation of approved plans and procedures	Data evaluation by Project Chemist or designee as part of Data Verification Procedures (see Worksheet #35)	S
		Comparability	Use of standard procedures/ methods as outlined in approved plans and/or approved modifications	Data evaluation by Project Chemist or designee as part of Data Verification Procedures (see Worksheet #35)	A

Note: A similar table will be included in the MR-QAPP for all incremental sampling and analysis for metals

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DQO Step #7 – Develop the Sampling Design and Project Work Flow

- Definable Features of Work (DFWs) are documented on UFP-QAPP Worksheet #17
- Visual Sample Plan (VSP) for transect design for DGM transect investigations
- Workflow including activities (MEC and MC characterizations) and decision points
- Contingencies if field conditions are different than expected and require re-evaluation of sampling design (additional planning sessions, if needed)
- Points in process at which USACE and stakeholders will interface for decision making (e.g., concurrence on target dig sheets)

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Technical Approach Summary – Site Preparation

Site Preparation

- Site setup – onsite storage containers, portable toilets, etc. Location for containers/storage area TBD
- Establish site controls using a NY registered professional land surveyor
- Establish analog instrument test strip
- Vegetation reduction along transects using mechanical equipment
  - Will not remove trees 4 inches or greater in diameter
  - Stumps and roots will be left in place to protect the soil and foster regeneration
  - Brush material will be chipped and left in place
  - Appropriate precautions will be taken to ensure site activities do not cause a wildfire

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Technical Approach Summary – Phase 1

Preliminary MRS Characterization (Phase 1)

- Install Instrument Verification Strip (IVS) & Submit IVS Technical Memorandum
- Visual Sample Plan (VSP) inputs based on AN-M54 4lb incendiary bomb as smallest TOI

VSP Input	MRS-01
Target Area Size and Pattern	AN-M54 4-lb Incendiary Bomb, air-dropped (1.69-inch diameter per PWS draft WS #11)
Target Diameter	1,028 feet (from VSP)
Background Anomaly Density	20/acre
Average Target Area Density (above background)	55/acre
Average Target Area Density (above background) input determined at:	Outer edge of target
Target Distribution	Bivariate Normal Density
Probability of Traversing and Detecting Target Area	100%
Transect Width	3.3 feet (single EM61-MK2 sensor)
Transect Pattern	Parallel
Orientation	North-South

- EM61-MK2 transect survey at 500 ft spacing throughout the MRS, covering 374,355 linear feet or 28.2 acres
- To traverse between transects, may conduct additional vegetation clearance at ends of transects ~6 acres
- Final coverage amounts dependent on ROEs
- Excluded quarry and highway from investigation area
- Transects in residential area will be spaced slightly farther apart
- Submit Preliminary MRS Characterization Memorandum detailing results of the transect survey and proposed locations for Phase 2 mini-grid investigations

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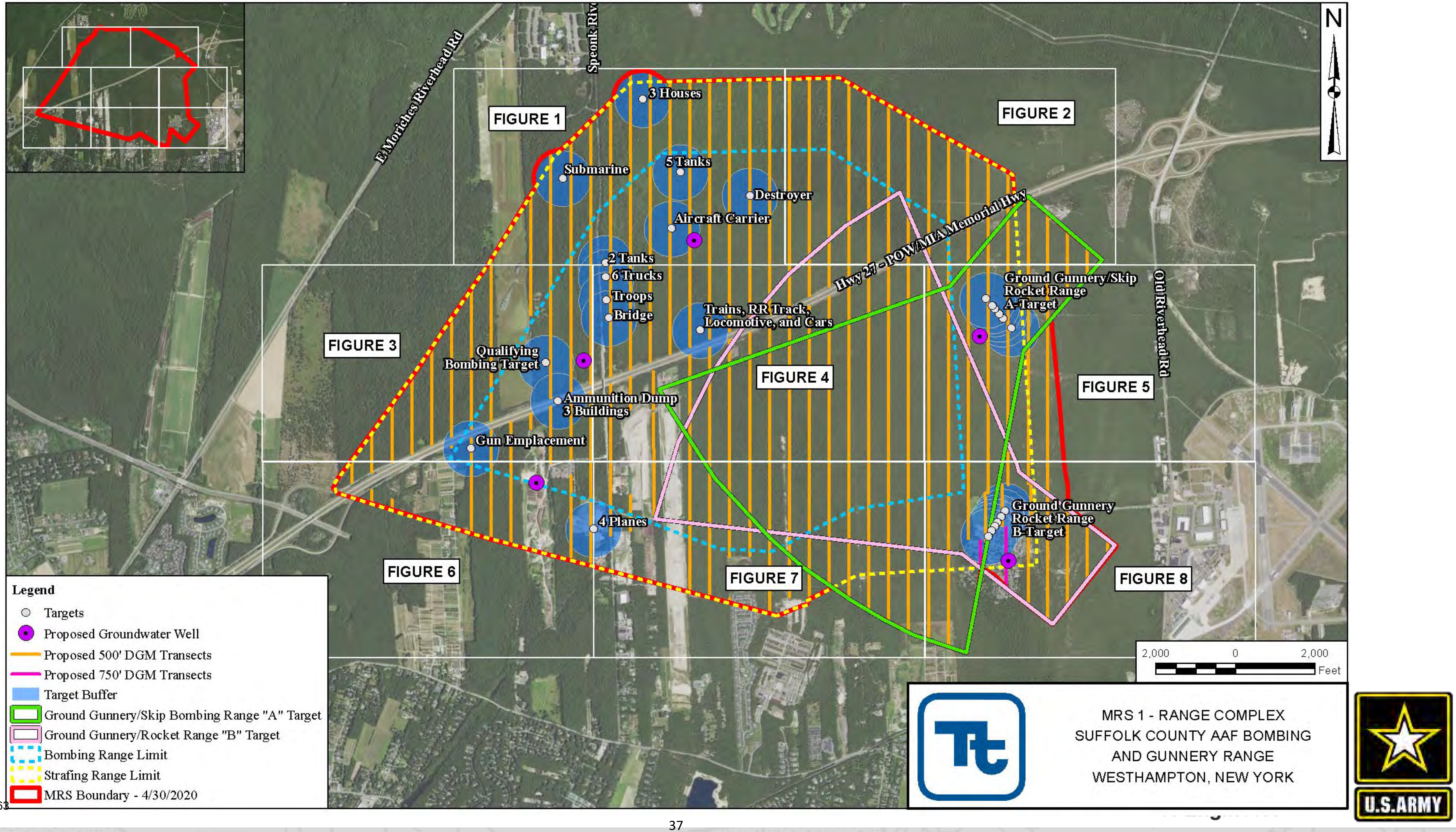
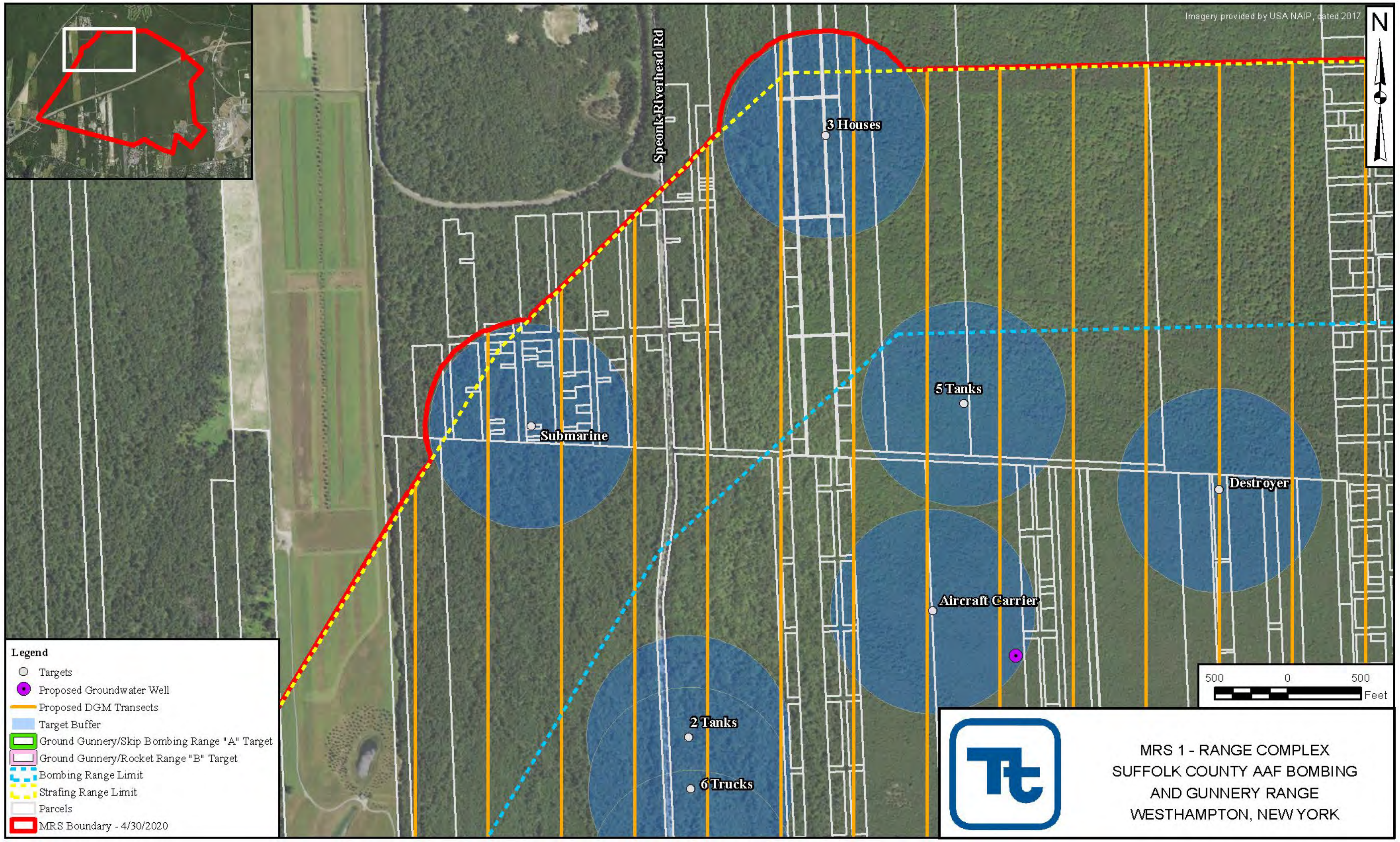
Overall Proposed Transect Approach



B-63

Proposed Transect Layout – Subsection 1



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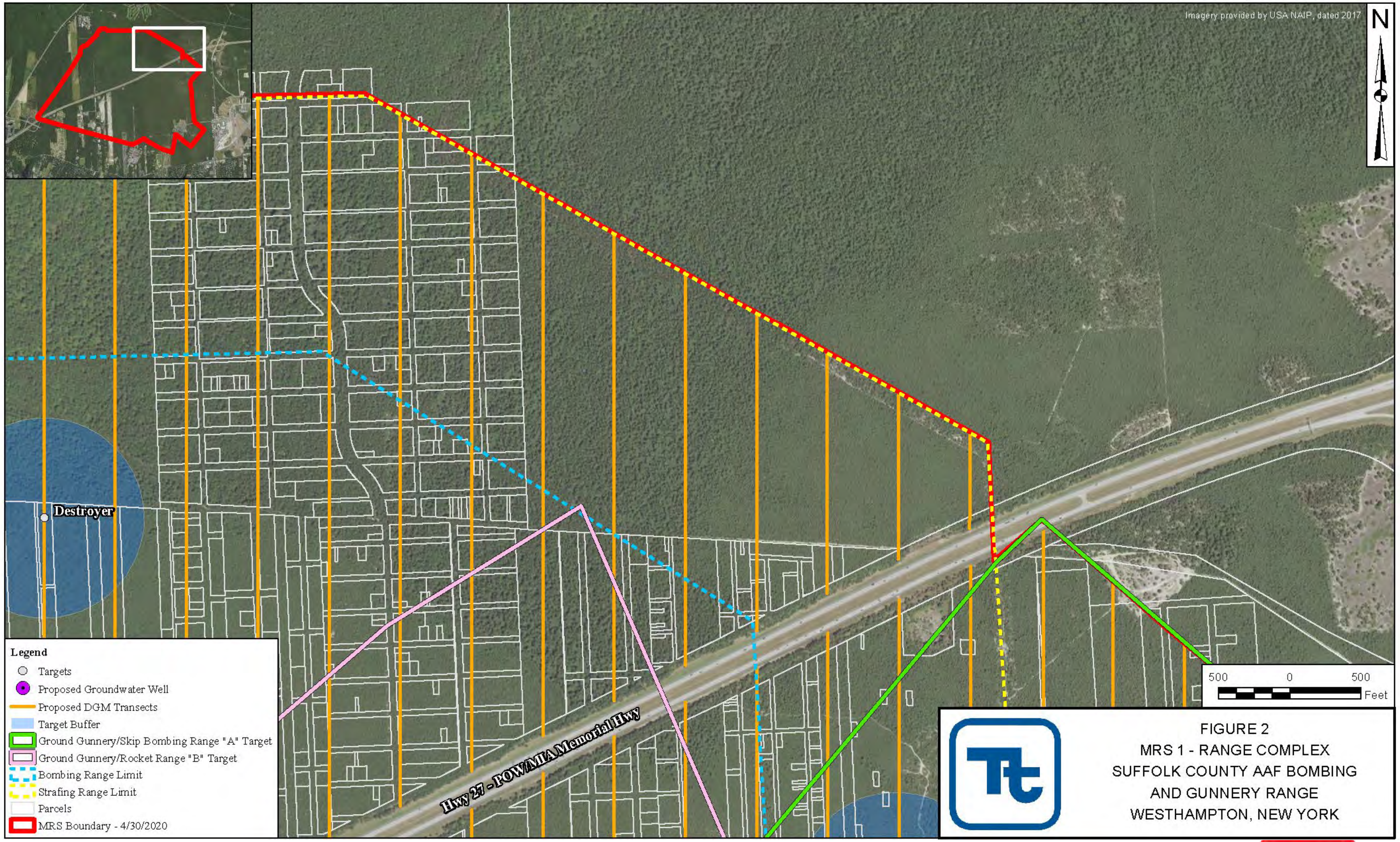
Proposed Transect Layout – Subsection 2



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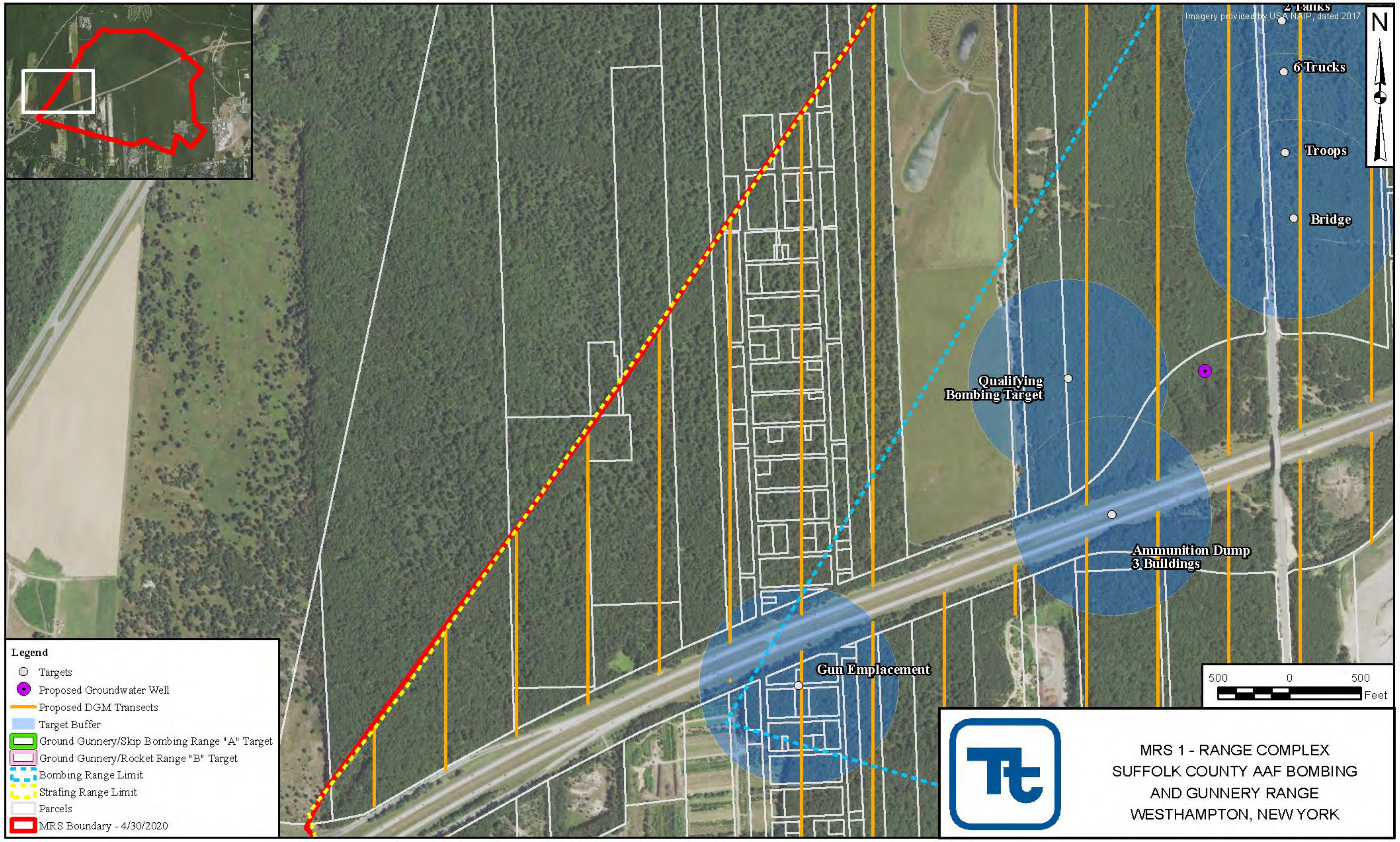
Proposed Transect Layout – Subsection 3



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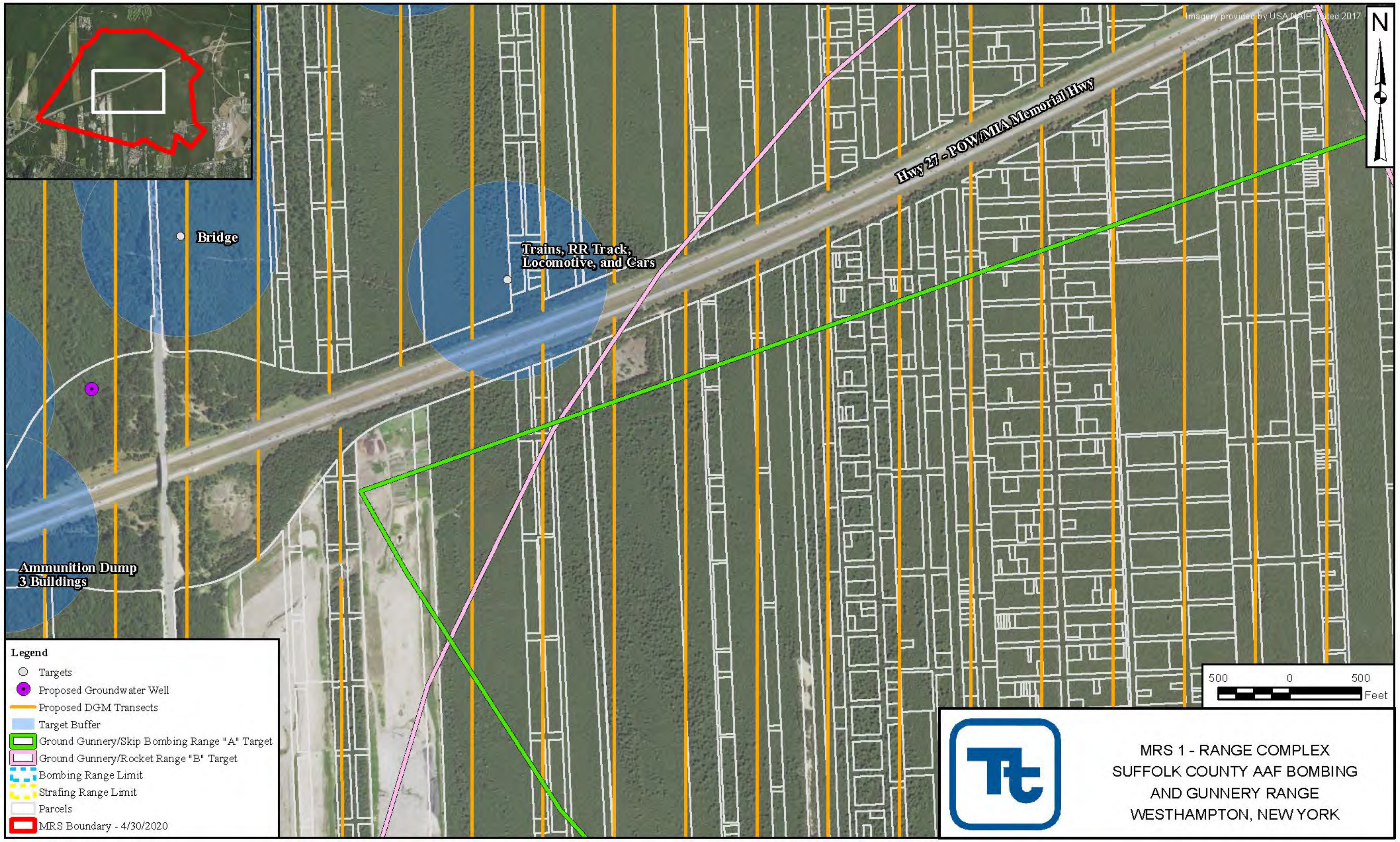
Proposed Transect Layout – Subsection 4



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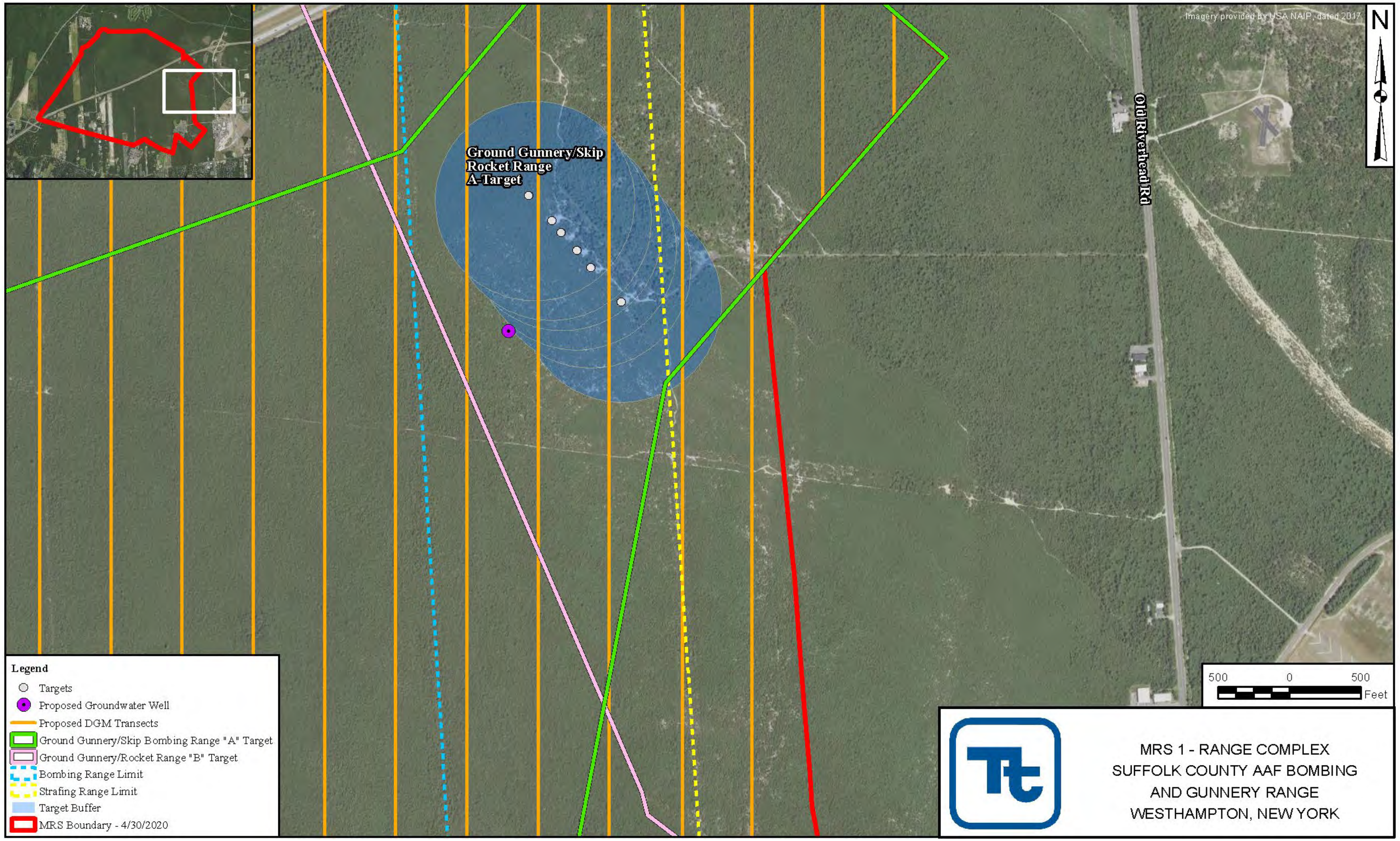
Proposed Transect Layout – Subsection 5



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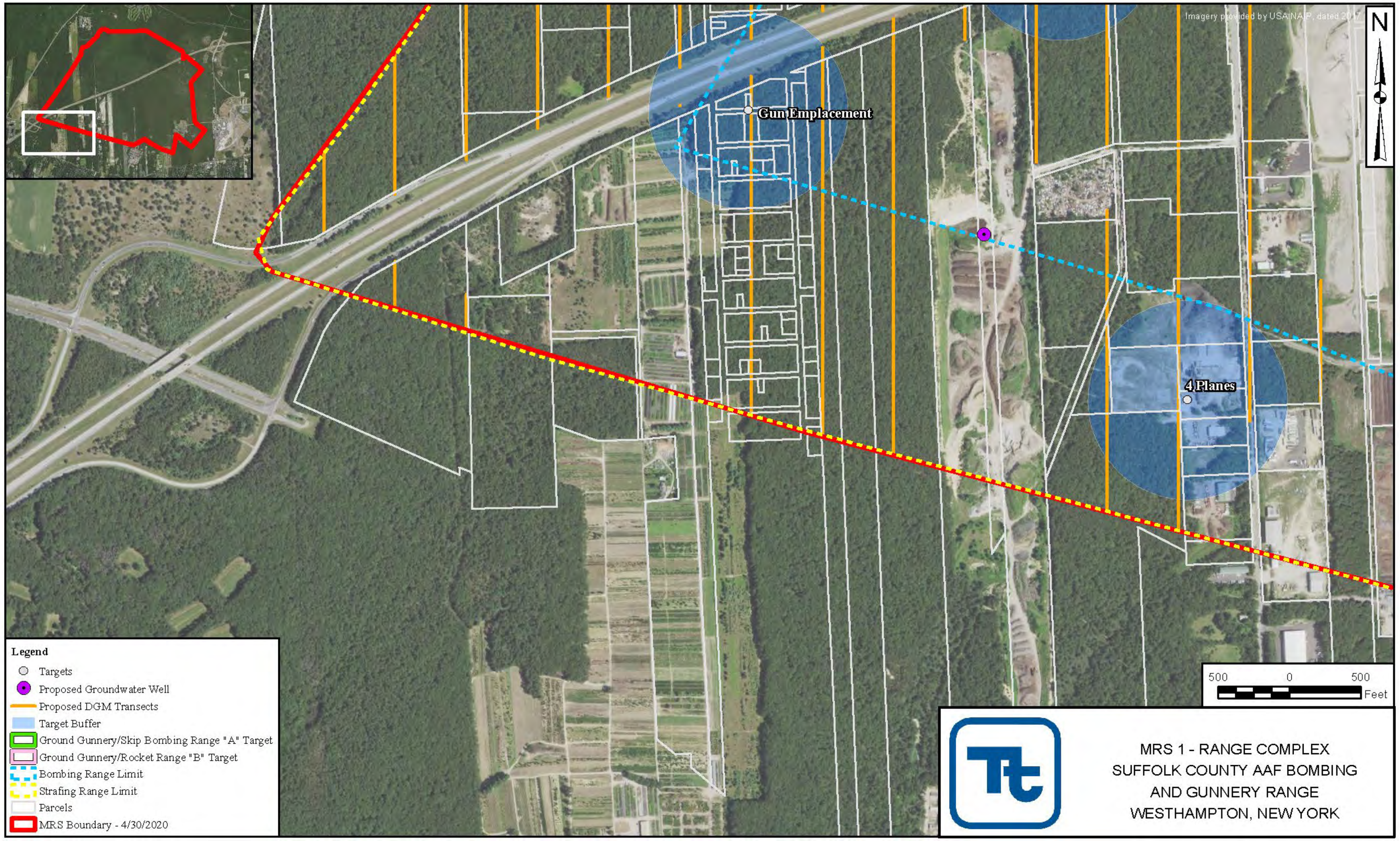
Proposed Transect Layout – Subsection 6



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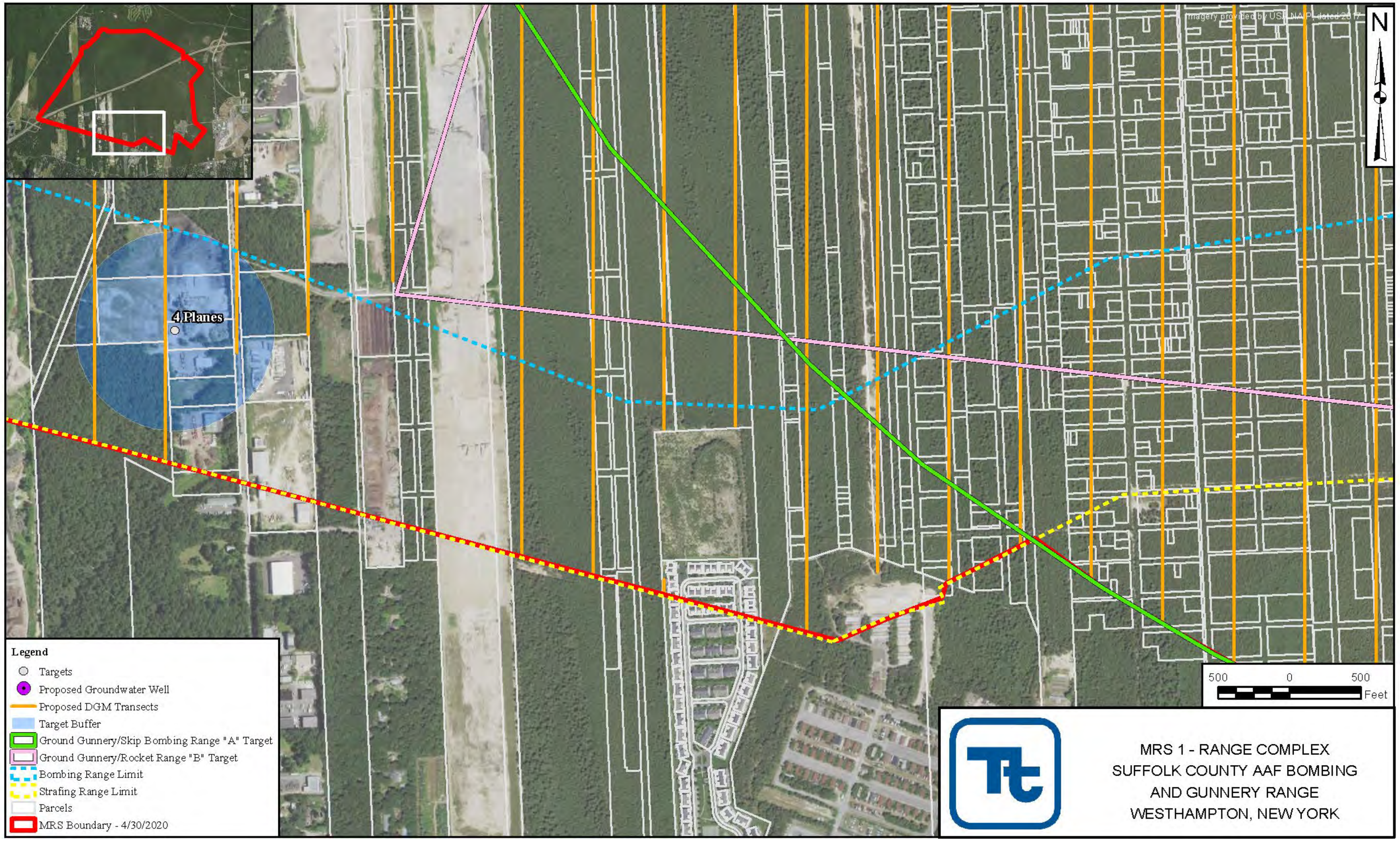
Proposed Transect Layout – Subsection 7



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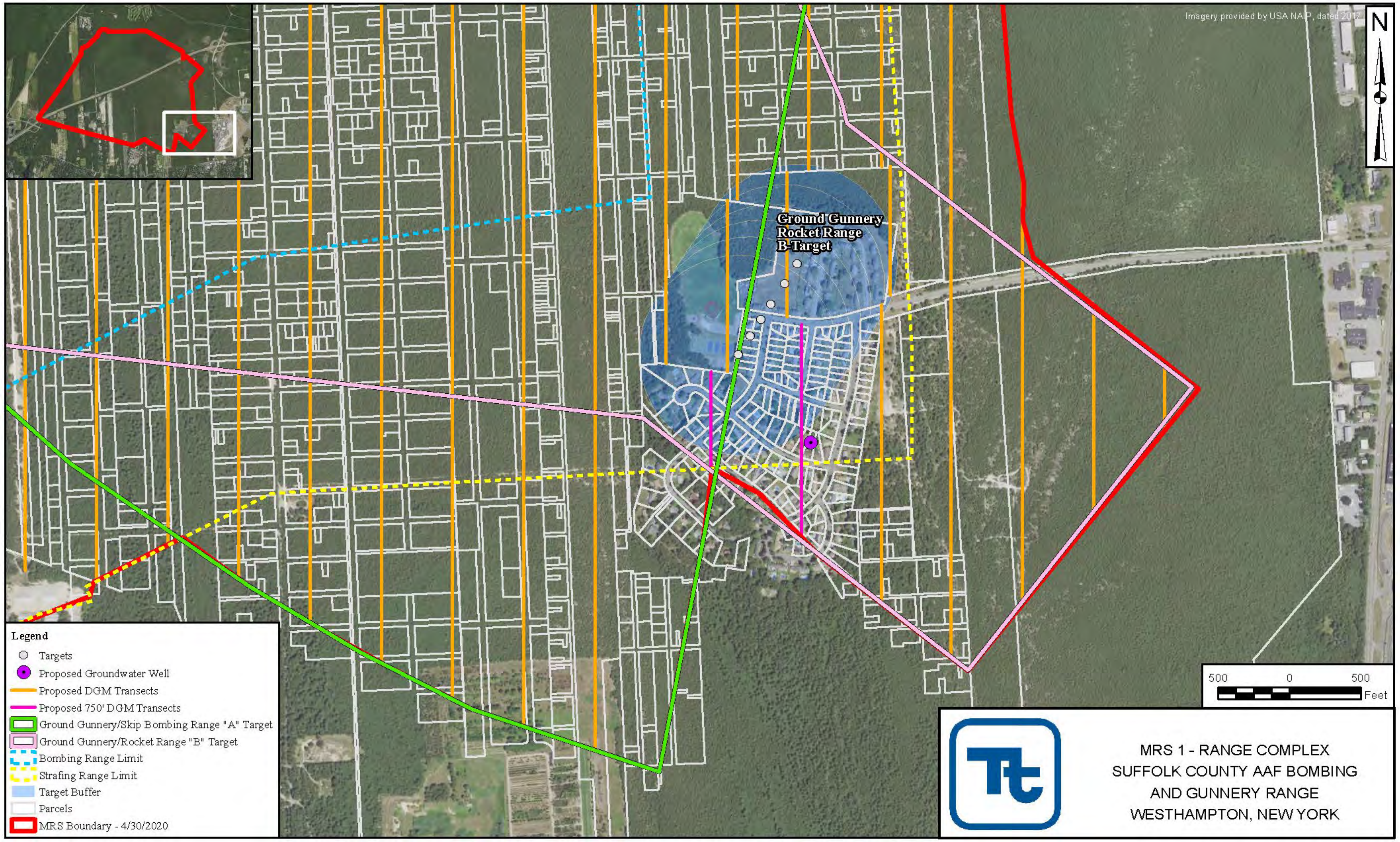
Proposed Transect Layout – Subsection 8



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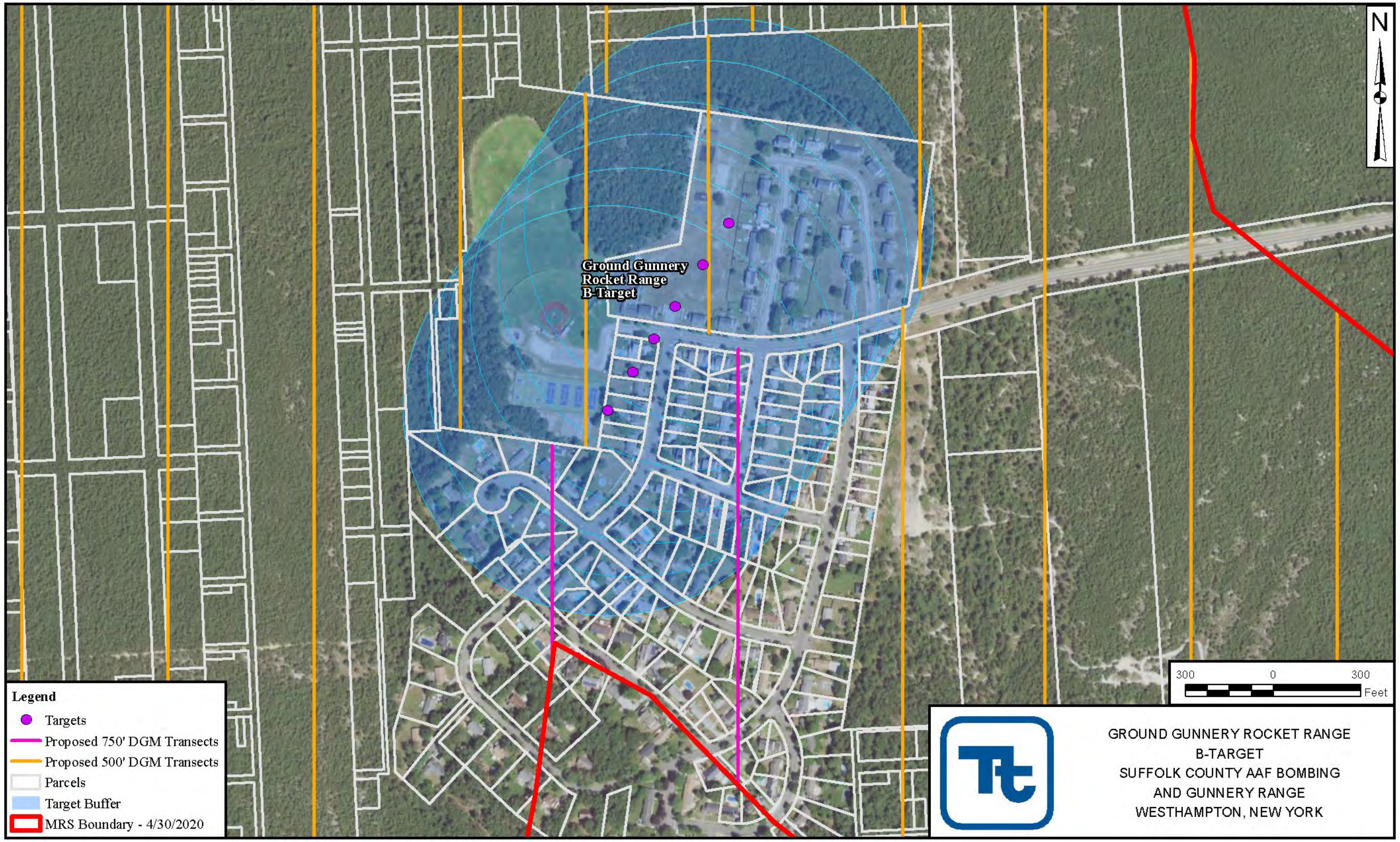
Proposed Transect Layout – Subsection 8 – Residential Close Up



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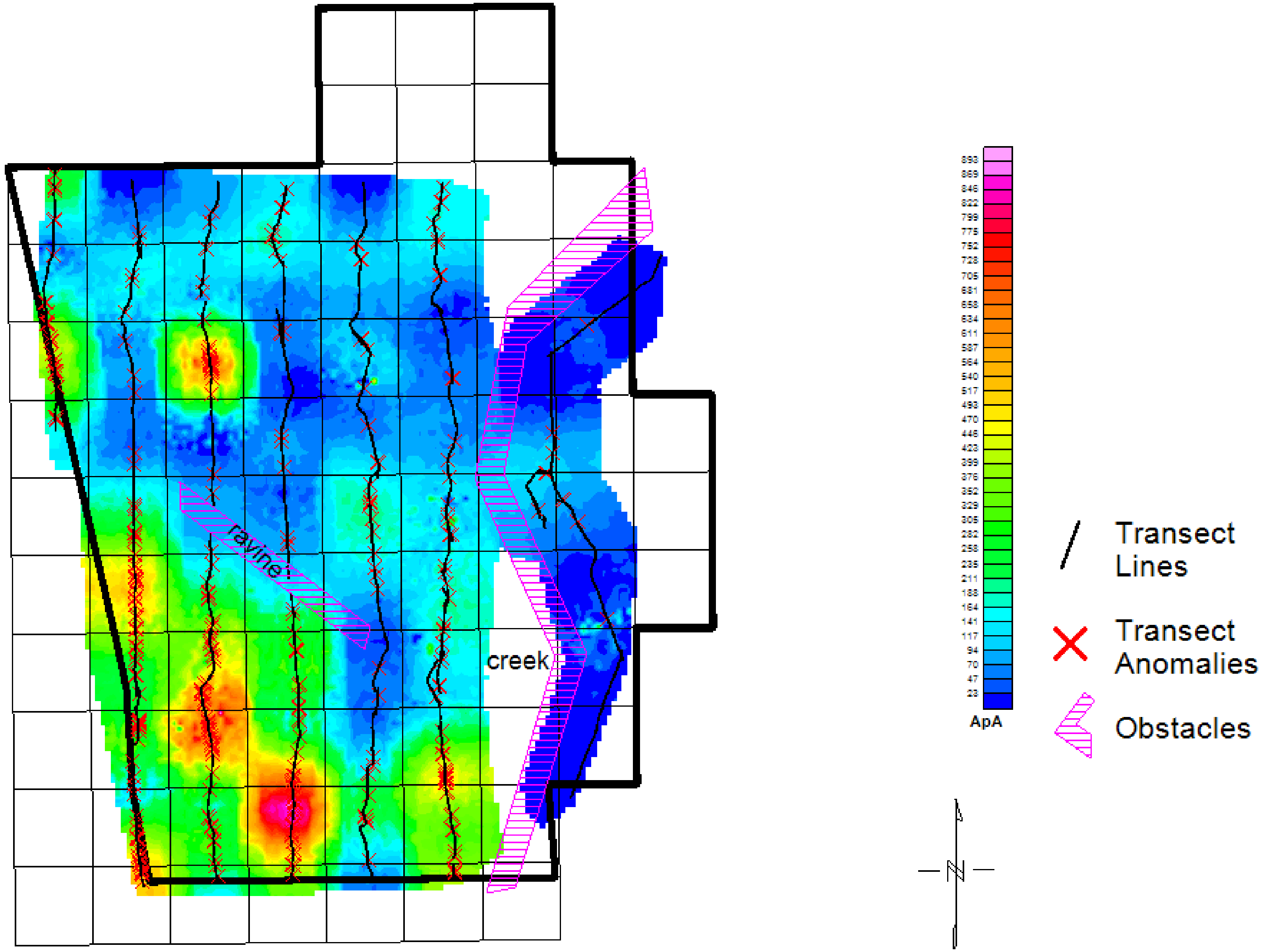
Example Phase 1 Processed Data



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Technical Approach Summary – Phase 2

High Density/Low Density (HD/LD) Area Characterization (Phase 2)

- Establish ~50 mini-grids of 50 x 100 feet (approximately 5.7 acres) through HD areas, as detailed in the Preliminary MRS Characterization Memorandum
- Perform vegetation reduction and surface clearance of mini-grids
- Conduct Quality Control seeding; Government Quality Assurance (QA) seeding will occur at the same time
- Conduct dynamic advanced geophysical classification (AGC) survey covering 100% of mini-grids with Metal Mapper 2x2 (MM2x2)
- Conduct cued AGC survey with MM2x2 on 50% of mini-grids (approximately 2.9 acres) to evaluate clutter rejection rates and in mini-grids within residential/commercial properties to decrease impact to property owners during intrusive operations
- Submit data packages and Dig List

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Technical Approach Summary – Phase 3

Intrusive Investigation (Phase 3)

- Reacquire MM2x2 target locations
- Intrusively investigate 100% of targets in mini-grids as defined during the dynamic survey using qualified UXO personnel
  - Coordinate dig list with PDT as we want to limit impacts to the community where possible (residential areas, near major highways, etc.)
  - Conservation/species considerations TBD
  - When excavating potential munitions, an exclusion zone of up to 638 ft will be established around the dig area
- Conduct evacuations, if needed/optioned
- Complete anomaly resolution for each target
- Material Potentially Presenting an Explosive Hazard (MPPEH)/MEC management and disposition
  - Use on-call explosives
  - No magazine onsite
  - Guard overnight, if needed
- Property restoration (if optioned)

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MC Sampling Design

- Collection of surface soil samples using incremental sampling (IS) based on geophysical and intrusive investigation results
  - Phased approach – additional samples may be collected based on results of primary samples (i.e., if results show exceedances in surface soil, subsurface samples may be collected to define extent), or if MEC/significant quantities of small arms in a limited area found in subsurface
  - A Technical Memorandum will be submitted for approval detailing the <u>recommended</u> sampling locations.
  - An additional Technical Memorandum will be submitted for approval detailing the <u>additional</u> sampling locations.
- Collection of background soil samples – location TBD
- Analysis of select metals (aluminum, antimony, barium, copper, iron, lead, and nickel) in soil by 6010 and explosives 8330 plus NG and PETN
- High Use Areas (HUAs) assumed to be areas with sufficient MEC density or significant quantities of small arms in a limited area will be sampled
  - Surface soil samples collected from 0-0.5 feet below vegetative cover
  - Each Sampling Unit (SU) comprised of 30 discreet soil increments
  - In all cases, at least 1 SU within the Decision Unit (DU) will be collected in triplicate.

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MC Sampling Design - Exposure Units

- In the residential areas of the MRS, possible receptors include residents, trespassers, construction workers, and potentially ecological receptors.
  - The exposure area for residential areas will likely be equal to the parcel size
- In the non-residential areas of the MRS that are industrial areas, the possible receptors include commercial/industrial worker, construction workers, trespassers, and potentially ecological receptors
  - The exposure area for industrial areas will likely be equal to the parcel size
- In the non-residential areas of the MRS that are conservation areas within the Central Pine Barrens, possible receptors include recreational users (e.g., bird watchers, campers, hikers, hunters, horseback riders, and mountain bikers), construction workers, municipal workers, and ecological receptors
  - The exposure area for these recreational users may vary from the size of a small campsite (camper) to a range of several acres (hunter/hiker). The exposure unit for a hiker or a hunter will likely not exceed between 2 and 5 acres.
  - The potential representative ecological receptors in the Central Pine Barrens will be terrestrial wildlife. The home ranges (exposure areas) of these different receptors could vary substantially from less than 0.25 acres to greater than 274 acres. As such, the ecological risk assessment may need to consider both point estimates and aerial estimates of exposure (i.e., 95% UCL of the mean), depending on the home ranges of the various representative receptors.

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MC Sampling Design – Decision Units

- **Residential Areas:**
  - If HUA spans across multiple parcels, subdivide HUA by the individual residential parcel boundaries.
  - For residential parcels less than or equal to 0.25 acres in size, the parcel boundary will be the DU, where one SU will cover the entire DU
  - For residential parcels between 0.25 and 1 acres in size, the parcel boundary will be the DU, which will then be subdivided into 0.25-acre SUs that would completely cover the DU.
  - If an individual residential parcel is larger than 1 acre in size, the parcel boundary will again be the DU, where we may consider a stratified sampling approach tied to the anomaly density distribution within the DU. This approach would involve the placement of a specified number of 0.25-acre SUs in representative locations of differing geophysical response related to MEC/MPPEH/significant quantities of small arms ammunition (SAA). The DU would not be sampled with 100% coverage.
- **Central Pine Barrens Areas:**
  - If the HUA is less than 2 acres, than the HUA will be the DU, and it will be subdivided into approximately 0.25-acre SUs for complete (100%) coverage.
  - If the HUA is larger than 2 acres, the HUA will be divided into 2-acre DUs.
  - Within each DU, a stratified sampling approach tied to the anomaly density distribution within the DU will be considered. This approach would involve the placement of a specified number of 0.25-acre SUs in representative locations of differing geophysical response related to MEC/MPPEH/significant quantities of SAA within the DU. The DU would not be sampled with 100% coverage.

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MC Sampling Design – Decision Units (con't)

- **Industrial Areas:**
  - If a HUA is located across multiple industrial parcels, the HUA will be first subdivided by the individual parcel boundaries.
  - The DU will correspond to the parcel boundary for parcels up to 2 acres in size.
  - If a HUA or industrial parcel size is less than 2 acres in size, it will be subdivided into approximately 0.25-acre SUs for complete (100%) coverage.
  - If a HUA is larger than 2 acres, a stratified sampling approach tied to the anomaly density distribution within the DU will be considered. This approach would involve the placement of a specified number of 0.25-acre SUs in representative locations of differing geophysical response related to MEC/MPPEH/significant quantities of SAA within the DU. The DU would not be sampled with 100% coverage.

- **Background sampling:**
  - Background sampling will be conducted after all MRS sampling is completed and each SU will be 0.25 acres.
  - Eight (8) background samples will be collected, and at least 1 background sample will be collected in triplicate.
  - If MRS subsurface soil samples are collected, then we will also collect background subsurface soil samples for comparison.
  - Samples collected in each DU will be compared to the background dataset using statistical hypothesis testing, and will be detailed in the Risk Assessment Work Plan.

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MC Sampling Design (con't)

- If no evidence of munitions is found during geophysical surveys in an area, no MC sampling will be conducted
  - Exception to this is for the known target areas, which may be sampled if not determined to be an HUA unless there are field observations that negate collection of soil samples (such as redevelopment, roads, etc.)
- LUAs assumed to be distinct, individual MEC items that visibly show likely potential release of MC
  - Each LUA is a separate DU; DU = SU
  - SU 10 ft x 10 ft, centered on item located
  - Determine presence/absence; if screening levels exceeded, conduct additional sampling in 0.25-acre DU
- Post-detonation sampling DU based on approximate 10 ft diameter circular area or 10 ft x 10 ft area centered on detonation location
  - Used to confirm no impacts to the area due to RI investigation; not part of risk assessment program
  - Determine presence/absence; if screening levels exceeded, conduct additional sampling in 0.25-acre DU

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MC Sampling Design (con't)

- Installation of temporary groundwater monitoring wells based on geophysical results, soil sampling results, and knowledge of groundwater in area
  - Vegetation clearance may be needed to access groundwater sampling location with drill rig
  - Background wells will be installed
  - 2-inch pre-packed screened monitoring wells via direct push technology
  - Allow well to settle for 24 to 48 hours, then develop wells
  - Obtain groundwater level measurements prior to sample collection
  - Purge monitoring wells using low-flow methodologies with stabilization of water quality parameters prior to collection of groundwater samples
  - Analysis of select metals (aluminum, antimony, barium, copper, iron, lead, and nickel) in groundwater by 6010/6020 (depending on reporting levels) and explosives 8330 plus NG and PETN
- Potential Screening Criteria:
  - USEPA Regional Screening Levels (USEPA, 2020)
  - USEPA Ecological Soil Screening Levels (USEPA, 2018)
  - Site-specific background
- Laboratory analysis (Microbac) and data validation (HSW)

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Definable Features of Work (DFW) for RI Fieldwork

- DFW #1 – Pre-mobilization Activities
  - Complete SPP process
  - Prepare MR-QAPP, Community Relations Plan, Accident Prevention Plan/Site Safety & Health Plan
- DFW #2 – Site Preparation
- DFW #3 – Field Quality Control (QC) Activities
- DFW #4 – Preliminary MRS Characterization
  - Collect DGM data (EM61) along transects
  - Process DGM data to identify high density (HD) and low density (LD) areas
- DFW #5 – HD/LD Characterization
  - Grid preparation – vegetation clearance and surface clearance
  - Conduct AGC (MM2x2) in follow-up grids
- DFW #6 – Cued AGC Investigation
  - Collect static AGC (MM 2x2) in grids placed within HD areas to characterize HUAs
  - Static AGC DUA/Target Dig List

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DFW for RI Fieldwork (con't)

- DFW #7 – Intrusive Investigation/Anomaly Resolution
  - Targets of interest (TOIs) and random selection of non-TOIs to sample population and verify classification
- DFW #8 – MC Sampling (based on results of geophysical and intrusive investigation)
- DFW #9 – Material Potentially Presenting an Explosive Hazard Inspection, Verification, and Certification
- DFW #10 – Demolition
- DFW #11 – Material Documented as Safe Disposal and Demobilization

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Potential Constraints/Coordination Issues

- ROEs
  - Significant amount of ROEs and coordination required to conduct geophysical surveys
  - Locations for background sampling outside of MRS, but within FUDS boundary
- Vegetation reduction coordination requirements/limitations
- No field work from June 1 – July 31 due to Northern Long Eared Bat; no field work planned during summer tourist season
- Hunting seasons
- Wildfire danger and mitigation activities
- NY Natural Heritage consultation in progress
- Work in residential areas/near highways
- Coordination with airport during intrusive operations
- High public visibility, even in non-residential areas

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Schedule

- ✓ November 16, 2020 – SPP Meeting 1
- December 2020 – Draft MR-QAPP, USACE review
- March 2021 – Draft Final MR-QAPP Review, Stakeholder review
- May 2021 – SPP Meeting 2
- May 2021 – Final MR-QAPP
- September 2021 – January 2022 – RI fieldwork
- March 2022 – August 2022 –RI Report
- September 2022 – February 2023 - FS Report (Could combine RI and FS if all stakeholders agree)
- March 2023 – August 2023 – Proposed Plan
- August 2023 – May 2024 –Decision Document

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SAFETY REMINDER

Follow the 3Rs of Explosives Safety:

Recognize:

When you may have encountered a munition and that munitions are dangerous.

Retreat:

Do not approach, touch, move or disturb it, but carefully leave the area.

Report:

Call 911 and advise the police of what you saw and where you saw it.

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Questions/Open Discussion

APPENDIX C
Blind Seed Firewall Plan

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BLIND SEED FIREWALL PLAN

FOR

SUFFOLK COUNTY ARMY AIR FIELD

BOMBING AND GUNNERY RANGE

MUNITIONS RESPONSE SITE 01

FORMERLY USED DEFENSE SITE

MILITARY MUNITION RESPONSE PROGRAM

REMEDIAL INVESTIGATION THROUGH DECISION DOCUMENT

SUFFOLK COUNTY, NEW YORK

Contract No.: W912DR-16-D-0021, Delivery Order W912DR20F0374

Prepared for:

US Army Corps of Engineers

BUILDING STRONG

September 2021

PROJECT IDENTIFYING INFORMATION

1. Project Identifying Information
2. Formerly Used Defense Site Suffolk County Army Air Field Bombing and Gunnery Range Military Munitions Response Program Remedial Investigation through Decision Document, Munitions Response Site-01 Suffolk County, New York
    a. Contract Number: W912DR-16-D-0021
    b. Delivery Order Number: W912DR20F0374
3. Geophysical Contractor
    a. QC Geophysicist

       ____

       Jeff Gamey, PGp, Tetra Tech, Inc.

    b. Contractor Quality Manager

       ____

       Eugene M. Mikell III, CQA, Tetra Tech, Inc.

CONTENTS

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ABBREVIATIONS AND ACRONYMS

AGC	advanced geophysical classification
GSV	geophysical system verification
MMRP	Military Munitions Response Program
MRS	Munitions Response Site
QA	Quality Assurance
QAPP	Quality Assurance Project Plan
QC	quality control
RCA/CA	root cause analysis/corrective action
RI	remedial investigation
SOP	standard operating procedure
UFP	Uniform Federal Policy
USACE	United States Army Corps of Engineers
UXOQCS	Unexploded Ordnance Quality Control Specialist

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1.0 INTRODUCTION

Work on this delivery order is being performed by Tetra Tech, Inc. (Tetra Tech) in support of the Military Munitions Response Program (MMRP) Remedial Investigation (RI) Munitions Response Site 01 (MRS-01), Suffolk County Army Air Field Bombing and Gunnery Range, located in Suffolk County, New York. This work is being performed in accordance with the Uniform Federal Policy Quality Assurance Project Plan (UFP-QAPP) dated December 2020, Tetra Tech's Quality Management System and applicable accredited Advanced Geophysical Classification (AGC) Standard Operating Procedures (SOPs).

As part of the Geophysical System Verification (GSV) process, Tetra Tech is responsible for the identification of suitable locations for blind QC seeds within the MRS, physical emplacement of the seeds, documentation of their emplacement, and their successful detection, classification (as applicable) and eventual recovery. In order to confirm the results of the blind seeding effort are unbiased, this Blind Seed Firewall Plan will be implemented to ensure seed details are not accessible to the clearance or survey teams, data processors, their team partners, or any subcontractors involved with these production tasks.

2.0 ORGANIZATIONAL STRUCTURE

QAPP Worksheets #3 and #5 present the Tetra Teach team organizational structure for the RI. It is the responsibility of the Tetra Tech QC Geophysicist and Unexploded Ordnance Quality Control Specialist (UXOQCS) to implement this firewall plan.

3.0 COMMUNICATIONS FIREWALL

Worksheet #6 in the UFP-QAPP presents the communication pathways for the RI. As part of this firewall plan, the QC team will have no direct written or verbal communication with other project team members regarding blind seed locations or seed emplacement details. Direct communication with field teams will be limited to what is necessary to coordinate on-site logistics, address health and safety matters and to execute field operations in accordance with the requirements in the QAPP. Specific details may be released by the QC Geophysicist to the Tetra Tech AGC Project Geophysicist, as necessary, to support development of a root cause analysis/corrective action (RCA/CA) in response to a nonconformance.

4.0 DATA FIREWALL

The QC Geophysicist and UXOQCS will oversee emplacement and documentation of the seeds in accordance with AGC SOP 3. They, or their designees, may perform the field work, provided the individuals performing the work are not involved with production aspects of the project. The QC Geophysicist will be responsible for preparing, updating daily, and sending the U.S. Army Corps of Engineers (USACE) Quality Assurance (QA) Geophysicist a spreadsheet of blind seed attributes as a password-protected file. The QC Geophysicist will password-protect the data files containing seed locations and photos of the emplaced seeds and back them up to a secure Tetra Tech network server or Share Point site. The Tetra Tech Corporate QC Manager will be provided with all relevant passwords as a backup measure in the event that personnel with that knowledge become unable to support the project.

APPENDIX D
Risk Assessment Work Plan

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APPENDIX D

RISK ASSESSMENT WORK PLAN

FOR

SUFFOLK COUNTY ARMY AIRFIELD BOMBING AND GUNNERY RANGE FORMERLY USED DEFENSE SITE MILITARY MUNITION RESPONSE PROGRAM REMEDIAL INVESTIGATION, FEASIBILITY STUDY, PROPOSED PLAN, AND DECISION DOCUMENT MUNITIONS RESPONSE SITE 01 SUFFOLK COUNTY, NEW YORK

September 2021

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TABLE OF CONTENTS

FIGURES

ABBREVIATIONS AND ACRONYMS

AAF	Army Air Field
ALM	Adult Lead Model
ASR	Achieves Search Report
ATSDR	Agency for Toxic Substances and Disease Registry
AUF	Area Use Factor
BAF	bioaccumulation factors
BERA	baseline ecological risk assessment
BGR	Bombing and Gunnery Range
BGS	below ground surface
BHHRA	Baseline Human Health Risk Assessment
BISS	Background Incremental Sample Simulator
BTAG	Biological Technical Advisory Group
BTVs	Background Threshold Values
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
COC	chemical of concern
COPC	chemicals of potential concern
COPEC	chemical of potential ecological concern
CSF	cancer slope factor
CSM	Conceptual Site Model
CWM	chemical warfare material
DoD	U.S. Department of Defense
DOE	Department of Energy
DU	decision unit
ELCR	Excess Lifetime Cancer Risk
EPC	exposure point concentrations
ERA	Environmental Protection Agency
ERAGS	Ecological Risk Assessment Guidance for Superfund
FS	Feasibility Study
FUDS	Formerly Used Defense Site
GI	gastrointestinal
HE	high explosive
HEAST	Health Effects Assessment Summary Tables
HERD	Human and Ecological Risk Division
HHRA	Human Health Risk Assessment
HI	Hazard Index
HQ	Hazard Quotient
IEUBK	Uptake Biokinetic Model for Lead in Children
IRIS	Integrated Risk Information System
ISM	Incremental Sampling Methodology
ITRC	Interstate Technology & Regulatory Council
IUR	Integrated Exposure Uptake Biokinetic Model for Lead in Children
LOAEL	lowest observed adverse effect level
MC	munitions constituents
MD	munitions debris
MEC	munitions and explosives of concern

MR-QAPP	Munitions Response Quality Assurance Project Plan
MRS	munitions response site
MRSPP	Munitions Response Site Prioritization Protocol
NOAELs	no observed adverse effect levels
NYSDEC	New York State Department of Environmental Conservation
PEF	participation emission factor
PPRTV	Provisional Peer Reviewed Toxicity Values
QA/QC	quality assurance/quality control
RAGS	Risk Assessment Guidance for Superfund
RAO	remedial action objectives
RAP	Remedial Action Objectives
RAWP	Risk Assessment Work Plan
RfC	reference concentration
RfD	reference dose
RI	Remedial Investigation
RME	reasonable maximum exposure
RMM	Risk Management Methodology
RRR	Records Research Report
RSL	Regional Screening Level
SLERA	significant potential hazards
SMDP	Scientific Management Decision Point
SU	sampling unit
TRVs	toxicity reference values
UCL	upper confidence level
USACE	U.S. Army Corps of Engineers
USEPA	U.S. Environmental Protection Agency
UTL	upper prediction limits
UU/UE	unlimited use and unrestricted exposure

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1.0 INTRODUCTION AND SITE DESCRIPTION

This Risk Assessment Work Plan (RAWP) presents a description of the methodology to be followed in the Baseline Human Health Risk Assessment (BHHRA) and Screening Level Ecological Risk Assessment (SLERA) for MRS-01 at the Suffolk County Army AirField (AAF) Bombing and Gunnery Range (BGR) in Suffolk County, NY (the Site).

The Suffolk County AAF BGR MRS consists of 4,297 acres, located approximately two miles north of Westhampton Beach. The Site was used from May 1943 through January 1944 as a gunnery training range for fighter pilots and instructors flying training missions out of the Suffolk County AFB and Mitchel Field Army Air Base, Garden City, New York. The fighter groups that trained at the Suffolk County AAF BGR received gunnery, bombing, small arms, and rocketry training before going overseas in World War II. Historical documents state that the bulk of the training exercises were carried out using P-47 Thunderbolt aircraft employing .50 caliber machine guns, practice bombs, and practice rockets. However, during brief live fire exercises between May 1943 and January 1944, 100-lb and 500-lb high explosive (HE) bombs, incendiary bombs and 4.5-inch HE rockets were deployed against the targets. A surface clearance was reportedly conducted in 1946. No military structures remain except for two target silhouettes (a destroyer and aircraft carrier).

The MRS consisted of four separate ranges: a bombing range, a strafing range, and two 1500 by 3000 feet scoring ranges. Construction of targets and facilities in the range areas consisted of 23 strafing targets, 25 bombing targets, 12 target pits, 2 range houses, and 2 range towers. Bombing and strafing targets included elaborately constructed wooden trains, tanks, trucks, ammo storage buildings, planes, submarines, and houses. Ship silhouette targets—with features outlined on the earth in white stone—were also constructed. An additional skeet range was also constructed on bombing and gunnery range lands bordering the Suffolk County AAF BGR, but due to its proximity to the airfield, the skeet range is not included in the assessment of this MRS.

A majority of the MRS is owned by Suffolk County and the Town of Southampton with New York State and private owners also owning parcels of land. Current land use of the MRS includes undeveloped property, light commercial/industrial use, and residential use. Future land use is not expected to substantially change. The residential properties are located primarily to the east and south. Private companies own parcels to the west which are used for light industrial activities as well as sand/gravel quarrying. The northern portion of the MRS is located within the Long Island Central Pine Barrens Groundwater Conservation area. The conservation area was established in 1993 by the Long Island Pine Barrens Protection Act to preserve and protect the land overlaying the Magothy aquifer. Walking trails are present throughout the central portion of the MRS.

2.0 PREVIOUS INVESTIGATIONS AND DATA SUMMARY

Previous investigations at the MRS include a 1991 Inventory Project Report (INPR), 1998 Archives Search Report (ASR) and a 2009 Site Investigation (SI).

During the SI, analog and visual observations of approximately 5.8 acres of the MRS were performed. No MEC was discovered, but munitions debris (MD) including .50 caliber shell casings and bullets, debris from one M38A2 100-lb practice bomb, and 2.25-inch practice rocket bodies and nose cones were found. Several subsurface anomalies were discovered. However, intrusive investigation of these subsurface anomalies was not in the scope of the SI. The SI concluded that there is a reasonable probability that MEC or MD may be present within the MRS. Worksheet 10 in the MR-QAPP provides a summary of previously found munitions; Table 11-1 in the MR-QAPP provides details on potential munitions at this MRS.

Soil and groundwater samples were collected during the SI to evaluate munitions constituents (MC) onsite. In surface soils, the presence of antimony, barium, copper, iron, lead, and nickel above their respective background values resulted in the determination of a complete pathway for humans and biota. Antimony and iron were identified as chemicals of potential concern (COPCs) in surface soil; however, based on a Weight of Evidence (WOE) evaluation, surface soil was not determined to represent an unacceptable risk to human receptors. In subsurface soil, antimony, copper, and lead were detected at concentrations exceeding both background and their respective ecological screening levels and were identified as chemicals of potential ecological concern (COPECs). A WOE evaluation for these three COPCs indicated that exposure to surface soil may represent a potential risk to biota that warranted further evaluation to confirm the findings of the 2009 SI.

Of the analytes detected in groundwater during the SI, aluminum, iron, and lead exceeded their associated screening criteria. Aluminum did not exceed background levels and therefore was indicated to not pose additional risks based on former U.S. Department of Defense (DoD) activities. Based on a WOE evaluation, the SI stated exposures to iron and lead are not expected to produce unacceptable risks to human receptors.

3.0 RISK MANAGEMENT METHODOLOGY (RMM)

On January 3, 2017, the USACE published a new munitions assessment tool, the Risk Management Methodology (RMM) (USACE, 2017). This tool is being applied in trial mode at Formerly Used Defense Sites (FUDS) and other Military Munitions Response Program (MMRP) sites. The RMM was designed to provide information to support risk management decisions about explosive hazards, develop associated remedial action objectives (RAOs), and provide a basis for assessing achievement of the RAOs relative to acceptable clean-up outcomes. This methodology defines "unacceptable" explosive risk as existing when the conditions at a site indicate the presence of accessible MEC in the context of a specific land use such that the likelihood of encounter, sensitivity of the munitions items to detonation, and severity of a potential incident are collectively unacceptable.

The RMM assesses potential explosive hazards qualitatively in terms of four sequential matrices of combinational risk factors:

Matrix 1 – Likelihood of Encountering the Munitions: Amount of MEC vs. Access Conditions (Frequency of Use) – Assessed based on risk factors for "Amount of MEC" and "Access Conditions (frequency of use)".

Matrix 2 – Severity of Explosive Incident: Severity vs. Likelihood of Encounter – Assessed based on the outcome of Matrix 1 and a risk factor for "Severity Associated with Specific Munitions Items".

Matrix 3 – Likelihood of Detonation: Munitions Sensitivity vs. Likelihood of Energy to Be Imparted on an Item – Assessed based on risk factors for "Likelihood to Impart Energy on an Item" and "Sensitivity: Susceptibility to Detonation".

Matrix 4 – Acceptable and Unacceptable Site Conditions (using results from Matrices 2 and 3)

The four matrices are first applied to evaluate the "baseline" or current site conditions. This baseline evaluation allows an identification of which aspects or characteristics of the site are most influential in driving the explosive hazard to an "unacceptable" outcome: where the MEC is located; the size and types of MEC that are present; how the site is currently used; how often the site is currently used; or the intrusive activities currently conducted at the site. At a later point, scoring adjustments to the baseline risk factor assignments in the matrices that would change a Matrix 4 outcome from “unacceptable” to “acceptable” could be identified as part of developing an effective response action. These potential Matrix 1 through 3 scoring adjustments can then be translated into specific munitions response alternatives that would, if implemented, justify that risk factor assignment change. These could include: removing MEC from the surface and/or subsurface; containing or isolating the MEC items at the site; limiting site access or restricting some future activities to reduce exposure; or educating site users to minimize contact and exposure to explosive items that may remain. These alternatives could then be assessed and compared in a feasibility study evaluation.

The Suffolk County AAF BGR MRS-01 will be scored using the RMM application. However, if a HUA is found to be present within the MRS that has difference source characteristics (i.e., type of munitions or amount of munitions) or a potentially different land use than the rest of the MRS, these factors will score differently using the RMM. Therefore, a separate RMM for the HUA and the remainder of the MRS will be scored.

4.0 BASELINE HUMAN HEALTH RISK ASSESSMENT (BHHRA)

A BHHRA will be prepared to address any MC found to be present at the MRS in accordance with the Risk Assessment Guidance for Superfund (RAGS) series published by USEPA (as interpreted by Region 1), CERCLA and USACE risk assessment guidance contained in EM 200-1-4 (Volume I) so that the BHHRA will meet the intent of CERCLA. Published guidance from the New York State Department of Environmental Conservation (NYSDEC) will also be considered. If MEC is present at the MRS, the potential risk to the public will be assessed in the RI document using the RMM application. The BHHRA also will assess the risk to the human receptors associated with the complete or potentially complete current or reasonably anticipated future MC exposure pathways.

To evaluate MC at the MRS, the BHHRA will consider the range of concentrations of detected analytes measured in surface soil (where soil 0 – 0.5 feet bgs is considered to be surface soil) and subsurface soil. The BHHRA also will consider the extent and distribution of these constituents relative to the potential points of exposure of the current and future MRS users. The BHHRA will summarize and present this information. If potential risks to human receptors are determined to be present at the MRS based on the BHHRA, corresponding preliminary risk-based soil remedial goals may be developed for the identified chemicals of concern (COCs) that were shown to contribute the most to the projected baseline risks. These preliminary remediation goals would be used in the FS to evaluate human health protectiveness. These preliminary remedial goals would identify the levels of constituents in the impacted media that would reduce the projected risks to levels deemed to be acceptable by the risk managers and stakeholders.

The BHHRA will be performed by following these four steps:

1. Data Evaluation
2. Exposure Assessment
3. Toxicity Assessment
4. Risk Characterization

These four steps are described in detail below.

4.1 Data Evaluation

4.1.1 Selection of Chemicals of Potential Concern

Chemicals of potential concern (COPCs) will be separately identified for each decision unit (DU) or exposure area at the MRS. Exposure areas for the risk assessment may be identified based on a DU or a combination of DUs within an area of concern (where size and exposure unit will be considered when combining DUs). Once a list of COPCs is identified for each DU, a more detailed assessment of potential risk associated with the selected COPCs will be performed. COPCs will be identified by statistical comparison of the maximum detected concentrations of each constituent in the surface soil and subsurface soil to background concentrations (see Section 4.1.2 below for more detail on the background assessment to be performed), for the applicable analytes (i.e., for metals). All other non-metal COPCs will be identified by comparing the 95% upper confidence level (UCL) of the mean of each detected constituent to the appropriate PAL. The justification for retaining a constituent as a COPC or screening it out will be clearly documented in the risk assessment report. A summary of the pertinent fate and transport characteristics of each COPC will also be provided.

4.1.2 Background Assessment

The RI work plan includes the collection of surface and potentially subsurface soil incremental sampling methodology (ISM) background samples from eight background sampling units (SUs) with at least one SU sampled in triplicate. Note that subsurface background samples will only be collected if onsite subsurface sampling occurs. ISM samples collected onsite will be compared to the planned ISM background samples. For the ISM background comparison, statistical hypothesis testing is the preferred method (USEPA, 2002). The most appropriate hypothesis testing technique is expected to be a two-sample test of the means, such as the Welch's t-test or the Student's t-test. If the data do not appear to be normally distributed, non-parametric tests (such as Mann-Whitney) will be performed. The selection of the technique to be applied will ultimately be based on the characteristics of the data collected. If the collected data is such that statistical testing methods would not be sufficiently powerful to support the required site management decision-making, graphical evaluation techniques for comparing the subarea data to background will be employed, as recommended by Interstate Technology & Regulatory Council (ITRC, 2020) and DoD guidance.

The hypothesis testing will be set up to match the current CSM. Site history suggest metals related to historical site use may be present in certain areas of the MRS. As such, the most appropriate hypothesis to be tested is that the concentrations of candidate COPCs are statistically significantly greater than background (i.e., a one-tailed hypothesis using Test Form 1). The use of Test Form 1 is consistent with Section 5.4 of USEPA's Guidance for Comparing Background and Chemical Concentrations in Soil for CERCLA Sites, which suggests that in the characterization stage, Background Test Form 1 is useful for determining if the difference between the MRS mean and background mean is significantly greater than zero (USEPA, 2002). If the comparisons (including statistical testing, graphical evaluation, and consideration of other lines of evidence) indicate candidate COPC concentrations are comparable to background, they will not be carried forward in the Risk Assessment. If the comparisons indicate the concentrations of one or more of the selected COPCs in an exposure area or DU are greater than background, further risk evaluation may be warranted.

4.2 Exposure Assessment

Current land use of the MRS includes undeveloped property, light commercial/industrial use, and residential use. Future land use is not expected to substantially change. Current and future human receptors at the MRS would include residents, commercial/industrial workers, construction workers, recreational users, trespassers, and municipal workers. To assess current and potential future uses, the BHHRA will assume the possibility of unrestricted future MRS use, including residential use (child and adult). Assessment of these receptors will identify whether any future use should be prohibited or if MRS conditions are acceptable for unrestricted future uses.

4.2.1 Calculating Exposure Point Concentrations

Exposure Point Concentrations (EPCs) are the concentrations of the COPCs in the environmental media at the point of human exposure, such as groundwater in a drinking water well and soil in a residential yard. Reasonable Maximum Exposure (RME) EPCs to be calculated for use in a BHHRA will be the 95 % UCL of the mean concentration of the constituent in the soil at the exposure area or point of interest. The EPC will be calculated for each COPC using the most current version of the ProUCL software (currently Version 5.1). ProUCL's functionality for handling non-detects (i.e., not applying the ½ detection limit substitution for non-detect results) will be used in the calculation of the EPCs (USEPA, 2015). If there is not a sufficient number of samples for an exposure area to use ProUCL (which may occur with incremental sampling), then guidance provided in the ITRC Technical and Regulatory Guidance Incremental Sampling Methodology (ITRC, 2012) will be used to compute appropriate estimates for the EPC. Fortunately, ProUCL has been modified to facilitate the computation of UCLs from ISM based samples. The minimum sample size requirement in ProUCL has been lowered to three so that one can compute the 95 % UCL for ISM datasets of three or more samples.

Surface soil EPCs will be calculated using the ISM sample results collected from 0 to 6 inches bgs. If multiple DUs are combined to form a larger exposure area, then the 95 % UCL of the mean of the DUs will be calculated consistent with the ITRC guidance using the Weighted DU Calculator. Subsurface soil EPCs for the applicable receptors will be calculated using the ISM sample results collected from below 0.5 feet bgs, if applicable. If there is not a sufficient number of samples for an exposure area to calculate a 95 % UCL, then the maximum detected concentration will be used as the EPC.

The use of ProUCL is recommended by USEPA for the evaluation of the UCLs. The ProUCL software uses an internal decision scheme to select the "optimal" UCL calculation method in consideration of: the number of detected and non-detected sampling results; the shape of the probability distribution of the chemical concentration data set as determined by distributional fit tests (e.g., normal, lognormal, gamma, or nonparametric); the estimated standard deviation of the log-transformed data set; and the estimated gamma distribution shape parameter (that is related to the skewness of the data set). Based on these parameters, ProUCL recommends the best UCL estimation method from 15 computational algorithms (including five parametric methods and 10 nonparametric methods) and calculates the parameter.

Simple modeling using a suitable Particulate Emission Factor (PEF) will be used to estimate the EPCs for airborne dust from soil. If domestic use of groundwater impacted by volatiles is found to be a potentially complete exposure pathway, the RSL calculator will be used to model volatilization of contaminants from water while showering.

4.2.2 Exposure Parameters and Chemical-Intake Estimation

Default exposure parameters published by the USEPA (2008, 2011a) and OSWER Directive 9200.1-120 (USEPA, 2014), or DoD will be used, when appropriate, in the evaluation of the exposure pathways indicated to be complete or potentially complete in the updated CSM. Preference will be given to the use of exposure parameters from USEPA sources. However, consideration will be given to other MRS-specific observations of activity patterns and professional judgment will be used to specify the other exposure parameters needed to complete the exposure assessment.

Estimates of intake or dose will be calculated using current USEPA risk assessment guidance. Intake parameters for each combination of media and receptor will be presented in tables. Non-carcinogenic hazards will be assessed by estimating a total annual exposure, then converting the dose to an average daily projected intake. Carcinogenic risks will be estimated as an incremental lifetime exposure and then converting the dose to an average daily projected intake.

4.2.3 Exposure Pathways and Potential Receptors

The future land use of the MRS is anticipated to remain as a combination of residential, commercial/industrial and conservation area. As the MRS is to be assessed for the need for remedial actions under an unrestricted use and unrestricted exposure (UU/UE) scenario, current and hypothetical future human receptors at the MRS would include residents, commercial/industrial workers, construction workers, recreational users, trespassers, and municipal workers. Exposure pathways to soil for these receptors given the current CSM would be through direct exposures including dermal absorption, incidental ingestion, inhalation of particulates. For those receptors that may be exposed to groundwater, the exposure pathways would be ingestion and dermal absorption. Since the investigation of the MRS does not include volatile organic compounds (VOCs) as potential contaminants of concern, inhalation of volatiles will not be considered.

Figure 1 reflects the assessment of the "completeness" of each exposure pathway considering the current MRS conditions. A "complete" exposure pathway exists only when the following four elements are present:

1. A source and mechanism of chemical constituent release to the environment
2. An environmental transport pathway or secondary media for the released chemical constituent or mechanism of transfer of the chemical from one environmental medium to another
3. An exposure point (or area) for potential contact by human or ecological receptors with the environmental medium of interest
4. A route of exposure (i.e., ingestion, dermal absorption, inhalation, or uptake) for that receptor to contact the chemical constituent of interest

Prior to the performance of the RI, exposure pathways were evaluated as being either "potentially complete" or "incomplete". The potentially complete exposure pathways are shown with a black circle half-filled in in the column beneath the receptor. Exposure pathways that are known to be incomplete (i.e., known to not have all four of the required elements) are shown with an open black circle. A more detailed, refined human health CSM will be developed based on updated information and observations collected during the RI field activities. The following reflects the preliminary assumptions that will be verified or revised for the updated CSM. At this time, the potentially complete pathways are considered to be:

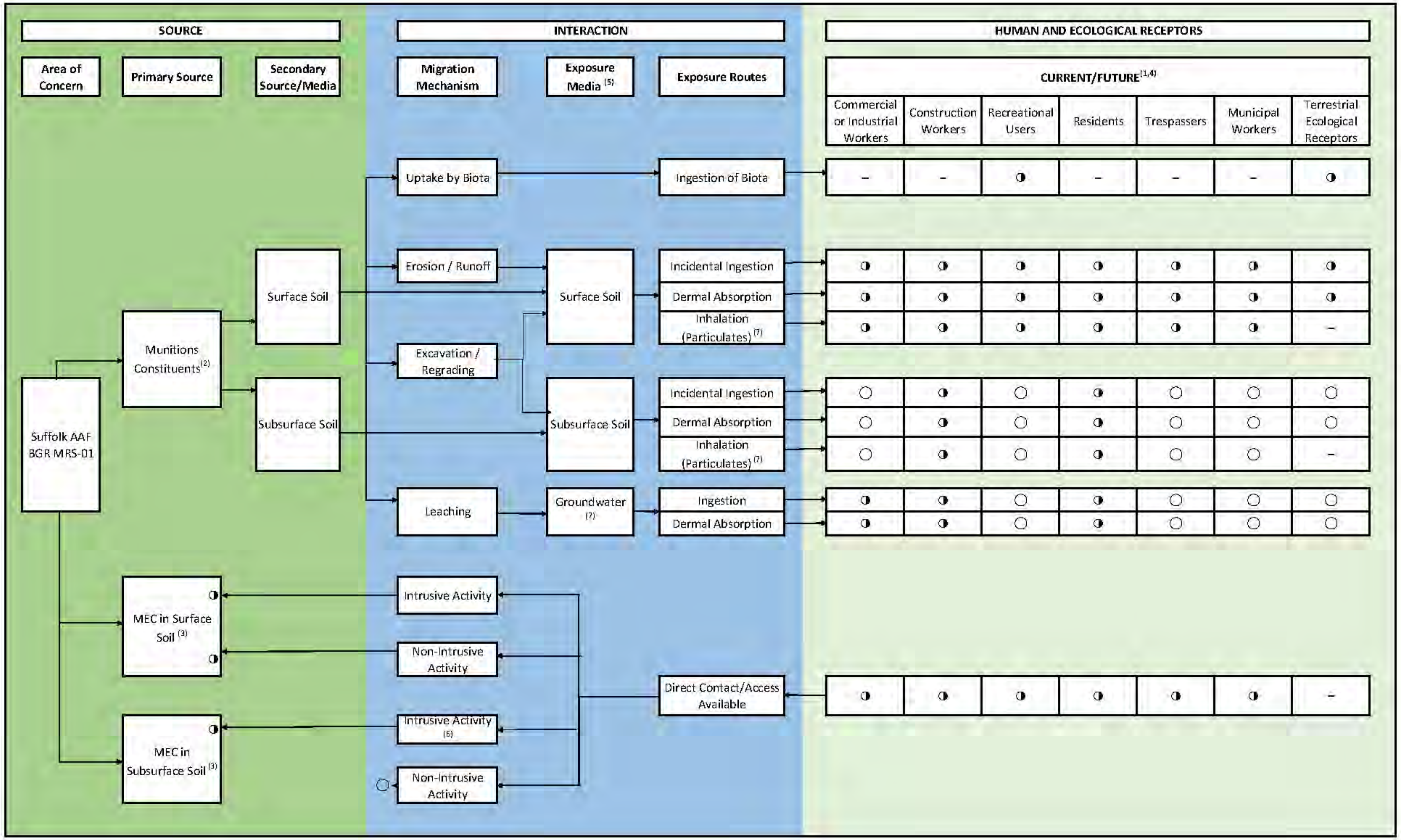
- Potential MEC exposure pathways will be evaluated using the RMM application considering the findings of the RI.
- Each of the identified human receptors could be exposed to the ambient air that could contain MC impacted surface soil particulates from unvegetated or disturbed areas that could be entrained by the wind or resuspended by future construction activities or vehicle traffic, or from limited emitted volatiles.
- Each of the identified human receptors could be exposed to MC impacted surface soil via incidental ingestion and/or dermal absorption.
- Construction workers and residents could be exposed to MC impacted subsurface soil via incidental ingestion or dermal absorption to the subsurface soil during excavation or following MRS regrading.
- Construction workers, residents and commercial/industrial workers could be exposed to MC impacted groundwater via ingestion (direct and incidental) and dermal absorption.

4.3 Toxicity Assessment

Consistent with USEPA (1989, 2004), the most current published toxicity values from the preferred approved sources will be used to evaluate the significant of the potential exposures of people to the COPCs in the soil, groundwater or air at the Site. Toxicological information and toxicity values will be drawn from the following hierarchy of sources and using the preferential order of selection specified by USEPA (USEPA, 2003):

1. USEPA's Integrated Risk Information System (IRIS), which is an on-line database containing current toxicity values for many chemicals that have gone through a peer review and USEPA consensus review process [http://www.epa.gov/ncea/iris];
2. USEPA's Provisional Peer Reviewed Toxicity Values (PPRTVs) developed by the Office of Research and Development/National Center for Environmental Assessment/ Superfund Health Risk Technical Support Center on a chemical-specific basis when requested by USEPA's Superfund Program; and
3. Other Toxicity Values - Additional USEPA and non-USEPA sources of toxicity information, including (but not limited to) the California Environmental Protection Agency (CalEPA) Office of Environmental Health Hazard Assessment (OEHHA) toxicity values, the Agency for Toxic Substances and Disease Registry (ATSDR) Minimal Risk Levels, and toxicity criteria published in the USEPA Health Effects Assessment Summary Tables (HEAST). Priority will be given to those sources of information that are the most current, the basis for which is transparent and publicly available, and which have been peer reviewed.
4. The reference dose (RfD) is the toxicity value used to evaluate non-cancer health effects for ingestion and dermal exposures. The reference concentration (RfC) is used to evaluate non-cancer health effects for inhalation exposures. The RfD and RfC represent a daily exposure level for a human population that is unlikely to pose an appreciable risk during a portion or all of a human lifetime. Non-cancer RfDs and RfCs are based on a review of animal and/or human toxicity studies, including laboratory or epidemiological studies. Carcinogenic effects are quantified using the cancer slope factor (CSF) for ingestion and dermal exposures, and inhalation unit risks (IUR) for inhalation exposure. CSFs and IURs are developed as a plausible upper bound estimate of the probability of developing cancer on the basis of a per unit intake of the chemical over a lifetime. CSFs are appropriate for estimating the lifetime probability (assumed 70-year lifespan) of human receptors developing cancer as a result of exposure to known or potential carcinogens.

Figure 1. Preliminary Exposure Conceptual Site Model



● Complete Exposure Pathway
◑ Potentially Complete Exposure Pathway
○ Incomplete Exposure Pathway
– Receptor or Exposure Pathway Not Present – Historical information indicates this receptor is not present within the MRS or the exposure from this pathway is inapplicable or insignificant for this receptor.

NOTES

(1) Conceptual Site Model (CSM) based on previous investigation results.

(2) The SI indicated that explosives and select metals are present in surface or subsurface at the site.

(3) Results of the previous field activities indicate that MD were identified on the surface soil and metallic anomalies were present in the subsurface soil; the RI is needed to determine if MEC and MD are present in this MRS.

(4) Not all receptors may be applicable throughout all areas within the MRS (e.g., residential, commercial, and Central Pine Barrens Area)

(5) Current site information does not suggest surface water (SW)/sediment (SD) within MRS, therefore this is considered an incomplete pathway. Should SW/SD be observed during the field investigation, the PDT will discuss sampling of these media.

(6) This pathway is incomplete if the intrusive activity does not reach the depth of MEC present

(7) None of the analytes of interest are volatile.

RfDs and CSFs are typically expressed as “administered” (i.e., not “absorbed”) doses based on estimating toxicity via the oral route of exposure. As such, these values are considered to be potentially inappropriate for estimating risks associated with dermal exposures. Therefore, oral dose response parameters based on administered doses will be adjusted to absorbed doses as per standard protocols before they are compared to estimated dermal exposure intakes. The adjustment from administered to absorbed dose will be made using chemical-specific gastrointestinal (GI) absorption efficiencies published in numerous sources of guidance (e.g., USEPA, 2004 (which will be the primary reference), IRIS, and ATSDR toxicological profiles).

USEPA’s Supplemental Guidance of Assessing Susceptibility from Early-Life Exposure to Carcinogens (USEPA, 2005) recommends adjustments to the toxicity of carcinogenic chemicals that act via the mutagenic mode of action when evaluating early-life exposures. The guidance recommends using age-dependent adjustment factors (ADAFs) combined with age-specific exposure estimates when assessing cancer risks to receptors exposed at an early age. In the absence of chemical-specific data, the supplemental guidance recommends the following default adjustments, which reflect the fact that cancer risks are generally higher from early-life exposures than from similar exposures later in life:

- For exposures before 2 years of age (i.e., spanning a 2-year interval from the day of birth until a child’s second birthday), a 10-fold adjustment.
- For exposures between 2 and 16 years of age (i.e., spanning a 14-year time interval from a child’s second birthday until their sixteenth birthday), a three-fold adjustment.
- For exposures after turning 16 years of age, no adjustment.

The adjustments will be applied using the same method that was used by USEPA in the development of the screening level RSLs. Children will be evaluated as two age groups, ages 0 to 2 years and ages 2 to 6 years, and older children / adults will be evaluated as two age groups, ages 6 to 16, and ages greater than 16 years old.

If lead is selected as a COPC, the Integrated Exposure Uptake Biokinetic Model for Lead in Children (IEUBK) and the Adult Lead Model (ALM) will be used to estimate the blood lead concentration as appropriate for the identified receptors.

4.4 Risk Characterization

Non-cancer hazards will be assessed using the concept of Hazard Quotients (HQs) and Hazard Indices (HIs). The HQ for a COPC is defined for ingestion and dermal exposures as the ratio of the estimated intake (expressed in units of milligrams per kilogram per day [mg/kg/day]) to the RfD, while for inhalation exposures, the HQ is the ratio of the exposure concentration (expressed in units of milligrams per cubic meter [mg/m^3]) to the RfC. HIs will be generated by summing individual HQs for all of the COPCs for that exposure medium (e.g., soil). If the value of the total HI exceeds unity (1.0), the potential for non-carcinogenic health hazards associated with exposure to a particular chemical mixture cannot be ruled out (USEPA, 1989). In that case, a review of the target organ(s) affected by each COPC will be performed. This further assessment reveals the most sensitive toxic endpoints that were used to develop the associated RfDs for each COPC. Target organ specific HIs will be evaluated for a receptor by summing the HQs for all COPCs with the same target organs or systems. USEPA's goal of protection for non-cancer hazards is an HI less than or equal to one for a target organ or system.

Excess Lifetime Cancer Risk (ELCR) estimates will be generated for each complete or potentially complete exposure pathway in the updated CSM using the estimated intakes and published cancer toxicity factors. An ELCR is defined as a unitless expression of an individual's increased likelihood of developing cancer over a lifetime as a result of a specific period and amount of exposure to carcinogenic chemicals. An ELCR of $1x10^{-6}$ indicates that the exposed receptor has a one in one million chance of developing cancer under the defined exposure scenario.

Risks will be estimated for each of the identified receptors of interest. The ELCRs and HIs will be summed across the full set of complete exposure pathways and across the full set of identified soil COPCs. The results will be tabulated and evaluated to determine if there is an excess risk in accordance with CERCLA guidelines. As part of this determination, HIs will be evaluated relative to a target threshold HI of 1 and the excess cancer risk estimates for the receptors will be evaluated relative to the National Oil and Hazardous Substances Pollution Continency Plan risk management range ($1x10^{-4}$ to $1x10^{-6}$ excess cancer probability). This risk management range defines a range of excess cancer risk estimates considered to be acceptable under CERCLA. If the total HI for a receptor exceeds one (1), the target organ or system-specific HI also will be considered.

4.5 Uncertainty Analysis

The uncertainty analysis discusses the general and Site-specific uncertainties associated with the estimated risks, exposure models, and assumptions utilized in the human health risk assessment. The goal of the uncertainty analysis is to identify important uncertainties and limitations that are associated with the risk assessment and its results.

Uncertainty in the selection of COPCs is related to the current status of the toxicity databases; the grouping of samples; the numbers, types, and distributions of samples; and the procedures used to include or exclude constituents as COPCs. Uncertainty associated with the exposure assessment includes the values used as input variables for a given intake route or scenario, the assumptions made to determine EPCs, and the predictions regarding future land use and population characteristics. Uncertainty in the toxicity assessment includes the quality of the existing toxicity data needed to support dose-response relationships and the weight of evidence used to determine the carcinogenicity of COPCs. Uncertainty in risk characterization includes that associated with exposure to multiple chemicals and the cumulative uncertainty from combining conservative assumptions made in earlier steps of the risk assessment process.

Typically, risk assessments carry two types of uncertainty: measurement and informational uncertainty. Measurement uncertainty refers to the usual variance that accompanies scientific measurements. For example, this type of uncertainty is associated with the analytical data that will be collected. The risk assessment reflects the accumulated variances of the individual values used. Informational uncertainty stems from inadequate availability of information needed to complete the toxicity and exposure assessments. Often, this gap is significant, such as the absence of information on the effects of human exposure to low doses of a chemical, on the biological mechanism of action of a chemical, or the behavior of a chemical in soil.

Once the risk assessment is complete, the results will be reviewed and evaluated to identify the type and magnitude of uncertainty involved. Both the results of the risk assessment and the uncertainties associated with those results must be considered when making risk management decisions that rely on those results. Uncertainty interpretation is especially relevant when the risks exceed the point of departure for defining “acceptable” risk.

5.0 ECOLOGICAL RISK ASSESSMENT

This section describes the approach and methodology for the ecological risk assessment (ERA) to be conducted for this MRS. The ERA will determine whether any constituent of interest released contributes an excess risk from exposure to potential ecological receptors present in the habitats associated with the Site. The ERA will consist of a SLERA and, if warranted, a focused baseline ecological risk assessment (BERA). A focused BERA will be conducted only if potential exposures to contaminants of concern are identified as posing significant potential risks in the SLERA. The ERA will be conducted in accordance with the USACE (2010), and Ecological Risk Assessment Guidance for Superfund (ERAGS) (USEPA, 1997, 1998).

5.1 Screening Level Ecological Risk Assessment

The Phase I SLERA for the Site will identify and evaluate potentially complete exposure pathways and exposure routes between Site-related constituents and potential ecological receptors present and determine whether or not these constituents pose significant risks to the ecological receptors identified. For the SLERA the primary constituents will be select metals, explosives and propellants.

The three key components of the SLERA will be:

- Preliminary Problem Formulation;
- Exposure and Effects Analysis; and
- Risk Characterization.

Each component will be conducted in accordance with technical risk assessment approaches in the CERCLA process and other guidance as developed by the USACE (2010), and USEPA (1997, 1998).

5.1.1 Preliminary Problem Formulation

The preliminary Problem Formulation in the SLERA will provide the scoping assessment for the ERA process and describe the Site history, the ecological setting and habitats and receptors of concern, identify potentially complete exposure pathways/routes, identify chemicals of potential ecological concern (COPECs), and determine if the ERA process should continue to the BERA stage for the Site.

Preliminary Assessment and Measurement Endpoints

Assessment endpoints are explicit expressions of the environmental value that are to be protected. Assessment endpoints are operationally defined by an ecological entity and its response (USEPA, 1998). Measurement endpoints are defined and measurable changes in an attribute of an assessment endpoint or its surrogate in response to a stressor to which it is exposed (USEPA, 1998).

Preliminary assessment endpoints for ecological receptors (i.e., plants and animals) will consist of: (1) protection of terrestrial plant and invertebrate communities from adverse impacts due to exposures to Site-related constituents; and (2) protection of avian and mammalian wildlife populations from adverse impacts due to exposure to Site-related constituents. Ecologically relevant endpoint for lower trophic level receptors will include screening values for survival, growth or development. Toxicological endpoints for higher trophic level receptors could include reduction in survival, growth or reproductive success and mortality. These endpoints will be assessed using appropriate measures of effect as identified in the Exposure and Effects Assessment supported with guidance from the identified guidance documents referenced above.

Identification of Site-Related Chemical Constituents

Given the historic use of the MRS and the findings of the 2009 SI, the potential for MC contamination in soil exists at this site. As described in Worksheet #17 of the MR-QAPP, sampling is planned to characterize and screen the MRS-related constituents of concern for identification of COPECs present in surface soils. According to data from the USGS, depth to groundwater ranges from less than 11 feet to 100 feet bgs, where the average depth across the project area is 40 feet to 60 feet bgs. Based on hydrological data gathered during the 2009 SI field event, the depth to groundwater varied from 15 feet bgs to at least 45 feet bgs. A majority of the MRS lies within the Long Island Central Pine Barrens Groundwater Conservation area.

Groundwater discharge to any unnamed tributaries in the sub-basins present nearby may be present during high periods when groundwater levels are high. According to the Fish and Wildlife Service's National Wetlands Mapper and NYSDEC GIS Resource Mapper, the only wetlands at the MRS are lower perennial riverine in nature and are associated with tributary channels of the associated sub-basins of East River, Speonk River, an unnamed tributary, and a tributary to Beaverdam Creek all of which drain to the south to tidal waters of Moriches Bay, Long Island, and along and adjacent to the southern perimeter of the MRS. These are characterized as having a low gradient, with no tidal influence, and a substrate consisting of sand and mud. The locations of these riverine wetlands are consistent with the previous surface water and topography discussions. According to local stakeholders and available mapping information from the National Hydrologic Database, the stream channels are typically intermittent in the MRS area and do not generally support sustained standing water throughout the year.

However, the only media being addressed during this RI are surface soils (0-6 inches bgs) and subsurface soil, as warranted, through ISM. For ecological receptors, only surface soils are identified as having a complete exposure pathway for ecological receptors. Although groundwater is also being addressed in this RI, ecological receptors are unlikely to come into direct contact with groundwater and no surface water and sediment sampling is proposed during this RI at this time.

MRS-related chemical constituents will be identified from the soils data collected at the MRS as part of the RI. Site data will consist of the characterization results meeting appropriate quality assurance/quality control (QA/QC) criteria. The validated RI data will be drawn on for inclusion in the SLERA. All detected chemical constituents in an environmental media of concern (i.e., surface soils) will be evaluated in the SLERA. The results of the statistical background comparison will be incorporated into the SLERA.

Ecological Habitats and Receptors of Concern

Areas supporting natural vegetation across the MRS has been described as moderate to heavily vegetated with prevalent tree species being shrubby scrub oak (*Quercus ilicifolia*), pitch pine (*Pinus rigida*), white pine (*Pinus strobus*), and to a lesser extent red maple (*Acer rubrum*). Other small tree, plant, and shrub species found near the project site include black huckleberry (*Gaylussacia baccata*), blueberry (*Vaccinium pallidum* and *V. angustifolium*), sheep laurel (*Kalmia latifolia*), wintergreen (*Gaultheria procumbens*) and poison ivy (*Toxicodendron radicans*). According to the 2009 SI and in consultation of the NYSDEC Environmental Resource Mapper, it is indicated that there are state listed rare, threatened, or endangered plant and animal species identified within the boundaries and in the vicinity of the project area. The exact location and identification of these species was not given in the resource mapper or available historical documentation.

An update for occurrence of any state or federally listed endangered or threatened species or their habitats will be queried through the NYSDEC Natural Heritage Program and U.S. Fish and Wildlife iPaC database. Based on communications with Suffolk County and Pine Barrens Commission personnel in April 2020, protected plant species such as the dwarf pine are widespread and occur within the site. Information on occurrence of state or federally listed species or critical habitats will be incorporated into the CSM as necessary and used to characterize the exposure pathways and ecological receptors present at the Site.

Ecological Exposure Pathways and Routes

A CSM is a description of a site and its environment that can be used to identify and summarize potential contamination and the possible human and environmental receptors potentially present, and also to focus the investigation and guide the selection of appropriate and effective characterization methods. The preliminary CSM for the Site is presented in Figure 1. Associated potential ecological exposure pathways are described below.

The CSM includes ecological receptors, an environmental medium (i.e., surface soils), medium-specific transport and migration pathways and associated exposure routes for ecological receptors to come into contact with detected constituents of concern. All migration and exposure pathways associated with environmental medium of concern will initially be evaluated for completeness based on Site characteristics and the habitats present. A complete exposure pathway includes all of the following elements:

1. A detected chemical constituent source and mechanism of release to the environment
2. An environmental transport pathway or secondary media for the released chemical constituent or mechanisms of transfer of the chemical from one environmental medium to another
3. An exposure point for potential contact by ecological receptors with the environmental medium of interest
4. A complete route of exposure (i.e., ingestion, dermal absorption, inhalation, or uptake) for that receptor to contact the chemical constituent of interest

The potential exposure pathways reflected in the preliminary CSM are discussed in general in Worksheet #10 of the QAPP. A more detailed, refined ecological CSM will be developed based on updated information and observations collected during the RI field activities and resource agency queries. The following sections reflect preliminary assumptions that will be verified or revised for the updated CSMs.

Incomplete Exposure Pathways

Direct contact of groundwater with ecological receptors is considered an incomplete pathway. Therefore, groundwater at the Site will not be included in the evaluation of exposure and risk to ecological receptors. Preliminary review of the U.S. Fish and Wildlife Wetland Mapper and NYSDEC Environmental Resource Mapper the only wetlands at the MRS are lower perennial riverine in nature and are limited to areas near or outside the MRS boundary. Drainage channels within the MRS boundary are depicted as being intermittent. Based on the descriptions in Worksheet #10 Preliminary Conceptual Site Model, no permanent waterbodies have been identified on the Site. As such, no surface water or sediments are proposed for sampling during this RI.

Exposure to environmental constituents of concern is assumed to be limited to near surface interval for ecological receptors. Therefore, data collection activities at the MRS will be confined to the near surface interval (0-6 inches) or in subsurface soil, as needed.

Potentially Complete Exposure Pathways

Only those exposure pathways and routes that are present and complete or potentially complete (i.e., where all four exposure pathway elements are known to be present) for ecological receptors will be evaluated. The following exposure pathways were judged to be potentially complete for the Sites:

- Ecological receptors could be exposed to the accessible surface soils either via incidental and dietary ingestion (i.e., the birds, and mammals) or via direct contact/absorption/ uptake (i.e., the plants and soil benthic invertebrates). As such, these potential exposures to Site-related constituents in impacted surface soils are considered complete pathways to be considered in the SLERA.
- Higher and intermediate trophic level ecological receptors are expected to come into contact with Site-related constituents that can be bioaccumulated through uptake in terrestrial plants and fauna (i.e., soil invertebrates and small mammals/birds) through the dietary ingestion exposure route.

Potentially Complete Not Quantitatively Assessed Exposure Pathways

The following exposure pathways are considered potentially complete though will not be quantitatively assessed for ecological receptors at the Site:

- Dermal contact and inhalation of particulates for ecological receptors are considered potentially complete exposure pathways. Dermal absorption may be a relatively minor exposure pathway for birds and mammals in certain circumstances because results of exposure studies indicate that exposures to various chemicals such as metals due to dermal absorption are insignificant compared to ingestion (Peterle, 1991). Incidental soil ingestion also incorporates exposures from grooming of particulates on skin, feathers, and fur.
- Inhalation of airborne particulates is believed to be a relatively insignificant portion of the total risk in most circumstances (Carlsen, 1996). Given the minor contribution of this exposure route relative to other routes, it will not be quantified for ecological receptors.

5.1.2 Analysis Phase

The Analysis phase bridges the Problem Formulation (including the CSM) with the Risk Characterization by providing the information necessary to determine or predict ecological exposures relative to potential risks from the presence of chemical constituents through the primary exposure routes evaluated. The Analysis phase further refines the CSM developed during Preliminary Problem Formulation step to provide site specific focus and structure for the analysis phase (USEPA, 1998). The Analysis phase consists of two individual components: Exposure Assessment and Effects Assessment. These components provide the basis for estimating and describing environmental hazards in the risk characterization.

Exposure Assessment

The exposure assessment for the SLERA will consist of calculating EPCs for each chemical constituent. An EPC is the representative concentration of a chemical constituent in a contaminated environmental medium (e.g., surface soil) at the point of contact with a receptor. EPCs for each detected chemical constituent will be calculated for the surface interval of soils (0-6 inches bgs) as part of the ISM sampling program.

The maximum detected concentrations of a chemical constituent in an exposure area will be initially compared in the SLERA to the most stringent applicable screening ecological benchmarks. Only if a chemical constituent is identified in this manner would other EPCs be calculated. If there is a potential for ecological exposures to terrestrial plants/soil invertebrates (i.e., spatially fixed or limited home range receptors), a sample-by-sample comparison to the appropriate screening values will be conducted.

If there is a complete exposure pathway identified for avian or mammalian wildlife, the exposure area average (over an exposure area based on habitat) and reasonable maximum exposure concentrations will both be used in the screening to span the likely exposure concentrations for constituents of concern. The RME concentrations will be assumed to be the 95 % UCL (calculated using ProUCL) on the mean or maximum concentration will be used in the exposure assessment. Where the 95 % UCL exceeds the maximum detected concentration, the maximum concentration will be used as the RME term in the assessment.

Effects Assessment

Measures of effects will be based on ecological soil screening levels that will be selected for each receptor group (i.e., plants, soil invertebrates, birds, and mammals). Screening levels are typically based on toxicity studies that indicate the potential for adverse impacts on individuals or populations due to decreased reproductive success, decreased survival, or other appropriate endpoints. Ecological screening levels will be selected from the following sources in the preferential order shown:

Surface Soils:

1. Eco-SSLs for plants, soil invertebrates, mammals and birds developed by the USEPA (https://www.epa.gov/risk/ecological-soil-screening-level-eco-ssl-guidance-and-documents);
2. Soil-based toxicity benchmarks for plants and soil invertebrates developed by the DOE (Sample et al. 1996, 1998a, 1998b);
3. USEPA Region 4 Ecological Screening Values for energetic compounds (if detected) other sources including Checkai et al. (2012), Kuperman et al. (2006) and Talamage et al. (1999) or references from the US Army Center for Health Promotion and Preventative Medicine (CHPPM).

Metals screening values will be preferentially based on the USEPA Eco-SSLs when available.

5.1.3 Risk Characterization

The Risk Characterization portion of the SLERA will evaluate the potential for adverse impacts to receptors considered to have potentially complete exposure pathways. This process will consist of comparisons of chemical constituent concentrations in soil to the protective ecological screening levels selected for each receptor group. The screening comparisons will be calculated as HQs, the ratios of the EPC to the identified screening level:

$$HQ = EPC / \text{Ecological Screening Level}$$

An HQ less than or equal to 1 is considered to represent a negligible potential for adverse ecological effects. An HQ greater than 1 is considered indicative of a potential for adverse ecological impacts. The Risk Characterization will describe the results of the screening comparisons and their associated uncertainties. Those chemical constituents with HQs greater than 1 for a given receptor group will be identified as COPECs. Consistent with the ERA process, a Scientific Management Decision Point (SMDP) will be used to evaluate the findings of the SLERA process and determine if the Site will need to proceed to a Baseline Ecological Risk Assessment

(BERA). A BERA workplan will be prepared based upon the findings of the SLERA and refinement of the Problem Formulation.

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APPENDIX E
Tetra Tech Field SOPs

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APPENDIX F
Laboratory SOPs and Accreditation

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APPENDIX G
APP/SSHP
(Provided only with the Final MR-QAPP)

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APPENDIX H

Deviations from MR-QAPP Recommended Minimum Requirements

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Reference	Deviation	Justification
Worksheet #11, Table 11-2.	Deleted column for predicted geophysical detection depth for munitions listed in Table 11-2.	Because this is an RI/FS, the vertical extent of MEC is not known and will be evaluated as part of the data gathering phases for the RI objectives. No information is known with regards to site-specific background geophysical response at MRS-01. Available tools for modeling geophysical response for the EM61-MK2 and MM2x2 must assume an RMS noise level, which may be inaccurate compared to actual noise levels, potentially resulting in meaningless depth predictions. Additionally, available modeling tools for modeling detection depth for the EM61-MK2 and MM2x2 sensors do not have options for many of the munition items themselves or the specific mark/mod for the items listed in Table 11-1. As a result, modeling must be completed with an available assumed comparable item, which, combined with the aforementioned RMS noise assumptions, leads to potentially increased meaningless depth predictions. Physics-based models can be better used to predict depth of detection using data collected at the IVS, data collected along the transects (for the EM61-MK2) as well as via synthetic seeding of TOIs during background location validation at the IVS blank space or in the mini-grids for the MM2x2.
Worksheet #12A	No specification provided for the following MPCs in the MR QAPP Toolkit 1, Update 1, Table 12-1: 7, 12, 14	MPCs 7 and 11 from the MR QAPP guidance document are not in Tetra Tech's Worksheet #12A because analog instruments are not intended for use in this RI/FS other than to support MEC avoidance, subsurface anomaly avoidance and to aid in surface clearance ahead of digital surveys. MPC14 is not included because Tetra Tech's approach does not include 100% excavation of representative grids but

		rather 100% intrusive investigation of 100% of the mini-grids.
Worksheet #12A, Table 12-1, MPC #2. Measurement: Planned Survey Coverage (Preliminary MRS Characterization)	Removal of statement regarding infill transects being conducted to meet requirements of MPC11.	The technical approach for Phase 1 of this RI/FS includes a transect spacing of 500 feet, which is >50% less than what VSP indicates is necessary to meet the traversal and detection goals for a target area. It should not be a foregone conclusion that infill transects at a spacing of <500 feet are necessary to meet the density estimate goal in MPC11 in Worksheet #12A. While the intent of the density estimate goal (+50% / -30%) is understood, the potential localized variability in anomaly density within an HD area at a scale of 0.11 acres (i.e., size of the mini-grids) should be discussed with the PDT after completion of the Phase 2 dynamic MM2x2 survey. Noting already the transect survey will be completed with EM61-MK2 and the mini-grid surveys with the MM2x2, there already exists the potential for a difference in anomaly density by nature of the difference in resolution capabilities between the two sensors. Differences in observed densities that do not meet this goal should be discussed by the PDT because it is possible that while MPC11 is the goal, if the densities in the mini-grids are outside goal range, the data may still be usable for purposes of meeting the RI objectives and development of an FS.
Worksheet #12A, Table 12-1, MPC #11. Measurement: Anomaly Resolution (Dynamic MM2x surveys with no AGC)	No specification included for preliminary MRS characterization	Tetra Tech's approach for this RI/FS does not include performing cued surveys or classification of sources identified on transects during the preliminary MRS characterization.

Worksheet #22, General	Repeating MQOs are not included multiple times in Worksheet #22 in order to condense the worksheet tables and facilitate easier reference in RCA/CA documents in the event of a nonconformance. Instead Tetra Tech has sequentially numbered the MQOs across all Worksheet #22 tables and has included as part of the first column in each table mention of when the MQO applies to all RI phases of work.	The MR QAPP Toolkit 1, Update 1 repeats MQOs during multiple phases of work, but simply renumbers them based on the specific task presented in Tables 22-1 through 22-5 of the guidance document. While this format is understood, it unnecessarily increases the size of the worksheet tables. The deviation still facilitates proper, clear reference to MQOs in the event of a nonconformance or when discussing MQOs as part of a DUA or technical memorandum.
Worksheet #22, MQO #2, Vegetation clearance Verification (mechanized): Verify correct assembly (1 of 2), Failure Response (Note: this MQO is an example; same deviation applies to other MQOs with similar added language)	When an MQO addresses acceptance criteria for an equipment check, instrument assembly or function test conducted in the field, for which the field team can assess the result, the failure response is written such that they may make the necessary adjustments to correct the problem and re-verify without an automatic response of generating an RCA/CA.	This deviation allows for the possibility of human error, but which can be caught when following SOPs and this MR QAPP in terms of performing quality control checks at the specified frequency. The deviation in the failure response does not avoid performing an RCA/CA if a failure carries into production aspects of the task and has the potential to impact downstream data quality and/or usability of collected data.
Worksheet #22, MQO #31, Coverage – Mini-grid (MM2x2)	Acceptance criteria in cross-track gaps accounts for sensor footprint overlap based on 80cm (2.6 feet) MM2x2 sensor array width and does not tie performance solely to purposefully conservative survey line spacing of 50cm (1.6 feet).	This deviation allows for minor cross-track deviations in line spacing which do not have adverse impacts to usability of the dynamic MM2x2 data. In the expected wooded conditions in the mini-grids at MRS-01, there exists the potential for the MM2x2 sensor to experience these minor deviations from the intended 50cm (1.6ft) line spacing. By providing a tolerance which appropriately accounts for the sensor footprint and the sensor's multi Tx and Rx array, the

		field team would not have to spend significant time in the field chasing small sliver gaps which would not necessarily enhance the usability of the data on a practical level. Furthermore, the criteria as written in the MR QAPP guidance document includes a specification for 98% coverage at ≤1m (3.3ft), which is meaningless for the MM2x2.
Worksheet #22, MQO #44, Confirm derived features match ground truth (MM2x2, 1 of 2)	Deviation allows for recovered clutter sources (for mini-grids in which cued surveys were performed) to be recovered from within ±40cm (1.3 feet) from the flag location instead of ±25cm (0.82 feet) to account for potential for multiple non-TOI sources present within the footprint of the MM2x2 sensor array.	Because the decision statistic for flag locations classified as non-TOI sources, by definition, results in a ranking below the dig/no dig threshold, the properties of the clutter items, combined with potential presence of multiple clutter items, may result in less accurate fit locations. Similarly, clutter sources collocated with a TOI should not prevent both successful classification of a MEC item as a TOI and accurate estimation of fit location, but during prosecution of the flags in the intrusive phase of work, the clutter sources should be able to be recovered from within the specified search radius around the flag and not the more stringent radius applicable to the TOI source itself without the need for an RCA/CA.

APPENDIX I
EDR Report Summary

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APPENDIX I

EDR REPORT SUMMARY

FOR

SUFFOLK COUNTY ARMY AIRFIELD BOMBING AND GUNNERY RANGE FORMERLY USED DEFENSE SITE MUNITIONS RESPONSE SITE 01 SUFFOLK COUNTY, NEW YORK

December 2020

Regulatory Agency Record Reviews

A review of federal and state records was accomplished through an examination of available database records. The database search results, as provided by Environmental Data Resources, Inc. (EDR), were reviewed for information regarding documented and/or suspected releases of regulated hazardous substances and/or petroleum products on or near the Suffolk County Army Airfield Bombing and Gunnery Range (referred hereafter as the "Site"). During the review, the "Target Property" was defined as the approximate area of the Site, while the "Search Buffer" extends outward one mile from the Target Property.

A summary of facilities identified through review of the federal and state regulatory agency databases that may be of importance to the investigation at the Site is provided in the following table.

Well Search Report

There are nine wells within the Site boundaries (Well IDs 12, 13, 14, 15, 17, 18, 21, 23, and 24) that range in depth between 36 and 1,123 feet below ground surface (ft bgs) with a majority commonly being 86 ft bgs deep (see Figure for well locations). Groundwater levels were measured in seven of these nine wells, and depth to water ranged from 41 to 60 ft bgs (or 17 to 30 feet above mean sea level [ft amsl]).

There are 43 wells within a one-mile search radius from the Site, with well depths ranging from 27 to 839 ft bgs. Groundwater levels ranged between 32 and 142 ft bgs (8 and 28 ft amsl).

None of the public water supply systems have had major violations or enforcements.

Table 1-1 Records Review

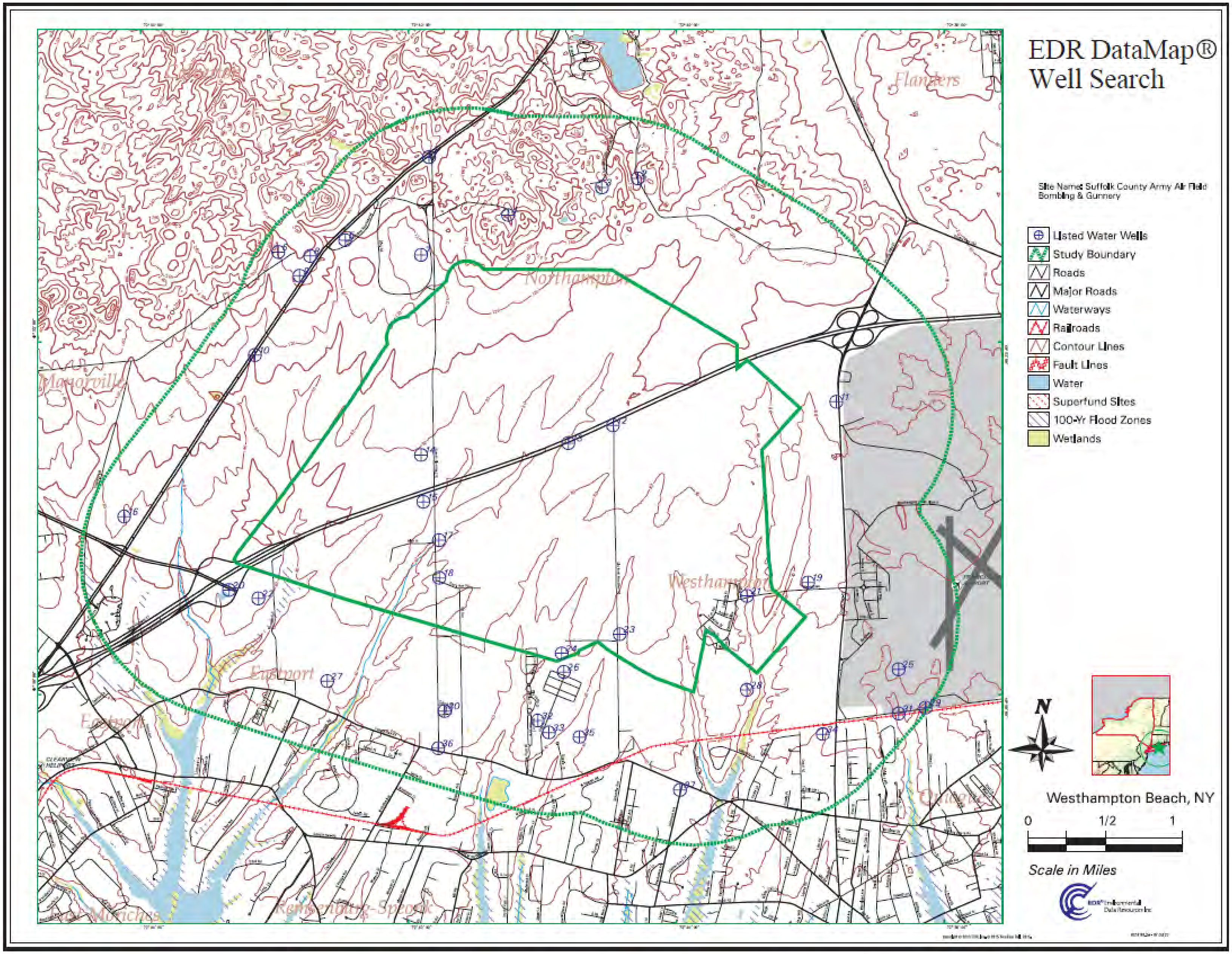
Environmental Record Database; Date Last Updated	Database Search Distance	No. of Facilities within Target Property	No. of Facilities within Search Buffer	Name, Address, and Relative Location of Facility to Target Property (Focus Map ID from EDR Area/Corridor Report)	Identified Environmental Concerns
Federal CERCLIS list - Superfund Enterprise Management System (SEMS); 07/29/2020	½ mile	0	1	Speonk Solvent Plume, North Phillips Avenue, 365 feet SSW (Focus Map 10)	This site was a "Removal Only Site" according to the regulatory database report. Based on information in the U.S. Environmental Protection Agency Administrative Record (https://semspub.epa.gov/work/02/110167.pdf), it appears that local residences were connected to a new water supply.
Federal CERCLIS NFRAP site list - Superfund Enterprise Management System Archive (SEMS-ARCHIVE) 07/29/2020	½ mile	0	1	Westhampton LF (Active), Old Country Road, 0.413 miles SSW (Focus Map 15)	This facility does not qualify under the Federal Superfund Program and is currently listed in the State and Tribal equivalent CERCLIS database (see further details below).
State and Tribal equivalent CERCLIS (SHWS: Inactive Hazardous Waste Disposal Sites in New York State); 05/12/2020	1 mile	3	6	B.B & S. Treated Lumber Corporation, 1348 Speonk Riverhead Road, Target Property (Focus Map 10)	This listing is for a 5-acre former lumber treatment and storage yard that operated from early 1980s to 1996. Primary contaminants of concern were chromated copper arsenate (released to environment through surface spills and sump leakage) and zinc oxide in soil and groundwater. Remedial actions have successfully achieved soil cleanup objectives for commercial use. Residual contamination in the soil and groundwater is being managed under a "Site Management Plan".
				Speonk Sand and Gravel, Box 810, Target Property (Focus Map 10)	As of 2005, this site was an active borrow pit and asphalt recycling operation. Construction and demolition waste were also reported to be present at the facility. A Phase II investigation did not document the disposal of hazardous waste related to the site. Class GA Groundwater Standards have been contravened by iron and manganese.

Environmental Record Database; Date Last Updated	Database Search Distance	No. of Facilities within Target Property	No. of Facilities within Search Buffer	Name, Address, and Relative Location of Facility to Target Property (Focus Map ID from EDR Area/Corridor Report)	Identified Environmental Concerns
				Eastport Landfill, Northway Lane Off Route 27, Target Property (Focus Map 9)	The property is currently vacant and was previously used as a dump and transfer station during the 1960s and 1970s. An inspection performed in 1986 found construction and demolition materials and household and farm trash which had recently been dumped onsite. Suffolk County Department of Health Services did not suspect that there were any significant quantities of industrial or agricultural chemical waste at this site. A Federal Investigative Team inspected the site and vicinity in 1983 and concluded that no potential hazards existed and that there was no need for further action. The listing stated: “There are no environmental problems associated with the disposal of hazardous waste at this site.”
				Manorville Landfill (Brookhaven Town) Paper Mill Road, 0.282 miles SSW, (Focus Map 15)	This site received municipal sludge and liquid septic wastes from domestic holding tanks and liquid industrial wastes. The wastes were deposited in a series of unlined settling basins, containing high amounts of organic and inorganic suspended solids and high concentrations of total nitrogen. Liquid waste disposal occurred between 1964 and 1982. Water contamination by iron, magnesium, manganese, ammonia, and dichlorobenzene has been documented in downgradient monitoring wells. A State funded Preliminary Site Assessment (PSA) was completed in 1995. According to the regulatory database listing: “There is no documentation of hazardous waste disposal.”

Environmental Record Database; Date Last Updated	Database Search Distance	No. of Facilities within Target Property	No. of Facilities within Search Buffer	Name, Address, and Relative Location of Facility to Target Property (Focus Map ID from EDR Area/Corridor Report)	Identified Environmental Concerns
				Westhampton Landfill, Old Country Road, 0.411 miles SSW, (Focus Map 15)	At this site, a plume of 1,1,2-trichloroethylene, tetrachloroethylene, 1,2-dichloropropane, and cis-1,2-dichloroethylene that extends in a northeasterly direction from its discharge boundary along a small stream just west of Jagger Lane for approximately one-half mile. The origin point was not precisely defined. The consultant interpreted this to mean that the plume extended south of Old Country Road from a point north of the landfill.
				BOMARC Missile Base, Old Country Road, within 0.5 miles (orphan listing)	Former Boeing Michigan Aeronautical Research Center (BOMARC) Missile Base located on the north side of Old Country Road, just west of Old Westhampton Road. Per- and polyfluoroalkyl substances (PFAS), including perfluorooctanesulfonic acid (PFOS) and/or perfluorooctanoic acid (PFOA), have been detected in on-site monitoring wells, in a public supply well immediately south of the former BOMARC facility, and several private wells in the area south (downgradient) of BOMARC. Testing identified PCBs at levels of concern in two floor drains. In addition, tritium was detected on-site near the location where the former BOMARC missiles were housed.
				Francis S. Gabreski Airport, Old Riverhead Road, within a 1-mile radius (orphan listing)	PFOA and PFOS were detected in groundwater and surface water at the facility. The unknown source of this contamination is believed to be on Airport grounds.

Environmental Record Database; Date Last Updated	Database Search Distance	No. of Facilities within Target Property	No. of Facilities within Search Buffer	Name, Address, and Relative Location of Facility to Target Property (Focus Map ID from EDR Area/Corridor Report)	Identified Environmental Concerns
State and tribal landfill and/or solid waste disposal site lists (SWF/LF); 07/01/2020	½ mile	4	7	Long Island Compost Farm #30, Speonk-Riverhead Road (Between Sunrise Hwy And Evergreen), Target Property (Focus Map 10)	This site is an active composting/waste disposal facility that receives yard materials. No violations have been reported.
				Hampton Sand Mining Corp, 1 High Street, Target Property (Focus Map 10)	This listing is an active waste disposal facility that receives wood, concrete, clean soil, and asphalt. No violations were reported.
				Westhampton Property Associates Inc, 1220 Speonk-Riverhead Road, Target Property (Focus Map 10)	This listing is an active waste disposal facility that receives clean soil, rock, concrete, brick and asphalt. No violations were reported.
				John T Montecalvo Inc, Spenok Riverhead Road, Target Property (Focus Map 10)	This listing is an active waste disposal facility that receives asphalt. The facility has numerous administrative violations of unknown statuses.
				Speonk Earth Recycling LLC, 60 5th Avenue, 113 feet SSW, (Focus Map 10)	This listing is an active waste disposal facility that receives brick, concrete, rock, uncontaminated soil, gravel and sand. In the past, it also received asphalt and wood. No violations were reported.
Formerly Used Defense Sites (FUDS), 05/13/2020	1 mile	1	1	Suffolk Co Missile AX, Target Property (Focus Map 6)	Former Suffolk County Missile Annex was used from March 1959 through June 1960 and was declared excess in 1964.
				Suffolk Co Rec, 0.268 miles E, (Focus Map 12)	The site provided a recreation area for the Suffolk Air Force Base (located east of the Base)
Mines Master Index File (US Mines)	¼ mile	2	2	Westhampton Property Associates Inc, Speonk Riverhead Road, Target Property (Focus Map 7)	This facility is an active construction sand and gravel company within the Site boundaries. The facility has numerous violations that have been addressed/closed.

Environmental Record Database; Date Last Updated	Database Search Distance	No. of Facilities within Target Property	No. of Facilities within Search Buffer	Name, Address, and Relative Location of Facility to Target Property (Focus Map ID from EDR Area/Corridor Report)	Identified Environmental Concerns
				Hunting Ready Mix, Target Property (Focus Map 10)	Minimal information was provided in the regulatory database report for this site; however, it appears that there have been no violations for this facility.
Unexploded Ordnance Site (UXO), 12/31/2018	1 mile	1	0	Bombing & Gunnery Range Complex, Target Property (Focus Map 6)	This is the Site under investigation.
Hazardous Substance Waste Disposal Site Inventory (HSWDS); 01/01/2003	½ mile	2	2	Speonk Sand and Gravel, Speonk Riverhead Road, Target Property (Focus Map 10)	Construction and demolition debris waste were accepted at this facility circa 1979-1984. A Phase II investigation was completed, and no threat to public health or the environment was noted according to the regulatory database report. See also the SHWS listing above.
				Eastport Landfill, Exit 62 Sunrise Highway, Target Property (Focus Map 9)	This facility operated as a municipal landfill between 1971 and 1979. A Phase 1 was completed. The type of material disposed at the facility is listed as “unknown”, as is the threat to public health or the environment, according to the regulatory database report. According to the listing in the SHSW database for the “Eastport Landfill” (above), “There are no environmental problems associated with the disposal of hazardous waste at this site.”


EDR DataMap®
Well Search
Site Name: Suffolk County Army Air Field Bombing & Gunnery
Listed Water Wells
Study Boundary
Roads
Major Roads
Waterways
Railroads
Contour Lines
Fault Lines
Water
Superfund Sites
100-Yr Flood Zones
Wetlands
Flanders
Northampton
Manorville
Westhampton
Eastport
Remsenburg-Speonk
N
Westhampton Beach, NY
0
1/2
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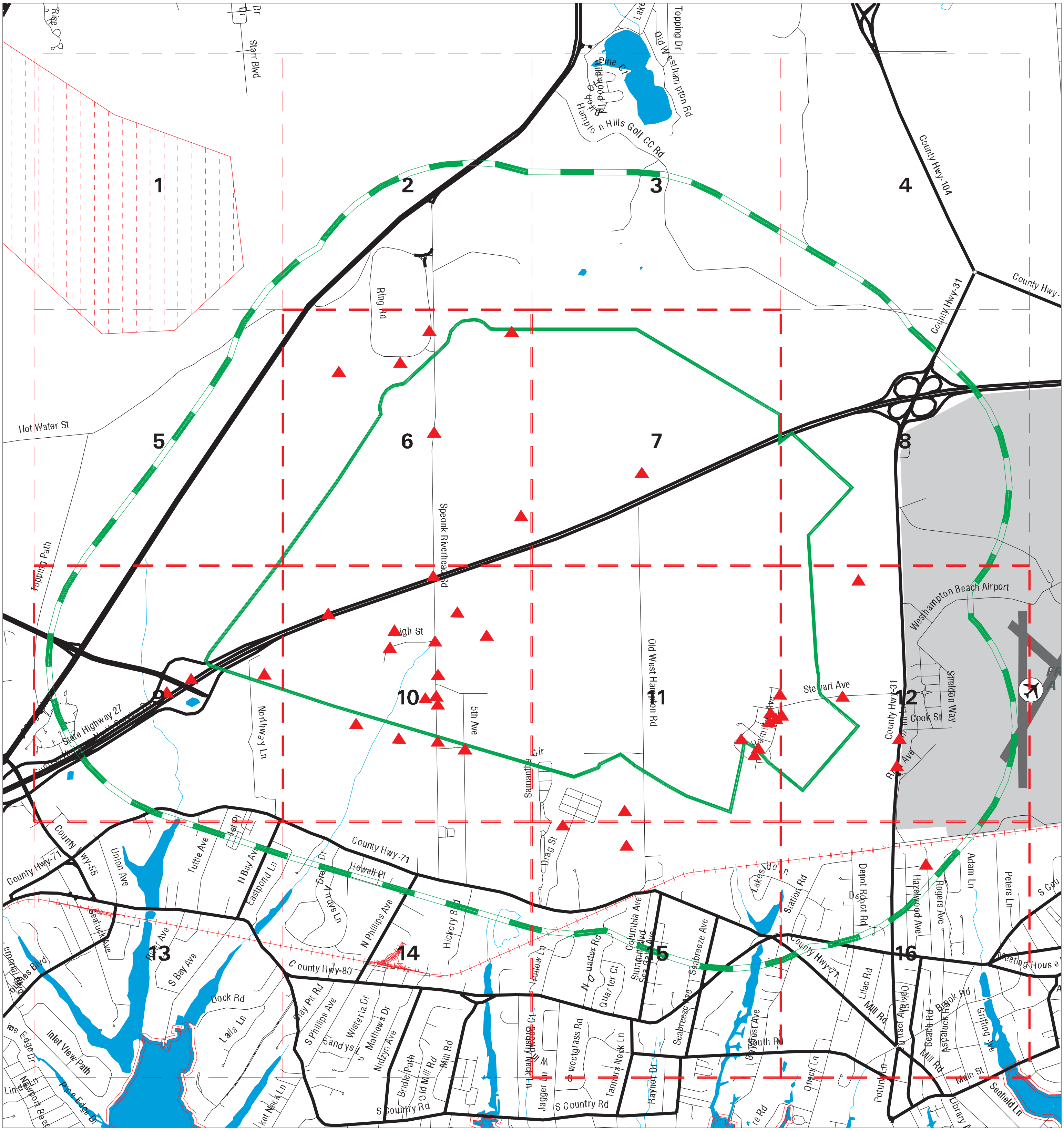
Scale in Miles

Key Map - 6216181.2s



▲ Sites	Focus Map - Sites
Target Property	National Priority List Sites
Search Buffer	Dept. Defense Sites
Focus Map - No Sites	Indian Reservations BIA

0 1/2 1 Miles

SITE NAME: Suffolk County Army Air Field Bombing & Gunnery	CLIENT: Tetra Tech
ADDRESS: Range Complex Suffolk County AAS Bombing & Gunnery	CONTACT: Mariana Bonich Wissink
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APPENDIX J
Performance Work Statement

Suffolk County Army Air Field Bombing & Gunnery Range

MMRP- RI through DD

Performance Work Statement (PWS)

Original: February 2020
Revision 1: ***18 May 2020***

1.0 Introduction and Background

This requirement is for environmental services for Military Munitions Response Program (MMRP) at the Suffolk County Army Air Field (AAF) Bombing & Gunnery Range Formerly Used Defense Site (FUDS) located in Suffolk County, NY. This is a performance-based, firm fixed price task order. The overall objective is:

- Achieve Decision Document for the following Munition Response Site (MRS):
    - MRS-01 Suffolk County AAF Bombing & Gunnery Range FUDS

Property History: The former Suffolk County AAF Bombing and Gunnery Range is approximately two miles north of Westhampton Beach, New York and occupies approximately 9,224 acres. The site is situated in a relatively flat area and is south of, and partially within, the Central Pine Barrens in Suffolk County. The Atlantic Ocean lies approximately three miles to the south of the former Suffolk County AAF. The Suffolk Co AAF Bombing and Gunnery Range FUDS was activated in 1943 for bombing, strafing, and rocket fire training exercises. Military use of the Suffolk Co AAF site ceased in 1946. Currently, New York State and Suffolk County own the majority of the property. The northern portion of the FUDS is located within the Long Island Central Pine Barrens Groundwater Conservation area and is under the stewardship of the Central Pine Barrens Joint Planning and Policy Commission. With the exception of two target silhouettes constructed of painted boulders, a destroyer, and an aircraft carrier, no military structures remain at the former Suffolk County AAF Bombing and Gunnery Range.

The MRS contains approximately 3,121 acres of land (see Attachment B and Worksheet #10 for discussion of revised Investigation Area). Historical documents and the results of the 2009 SI field visit indicate the potential presence of ~~Munitions & Explosives of Concern~~ (MEC) in the form of practice bombs with spotting charges, incendiary bombs, ~~high explosive~~ HE rockets, and small arms munitions at the MRS. SI samples collected from surface soil, subsurface soil, and groundwater did not contain explosives above reporting limits. ~~Munition constituents~~MC metals were detected in soil and groundwater samples above human health screening values~~but based on a weight of evidence evaluation do not represent an unacceptable risk to human receptors at the MRS.~~ The Final SI Report indicates additional investigation focusing on MEC is warranted. The Final SI also recommended further investigation for MC (surface soil only) based on three metals (MC) in surface soil which is noted to "may pose a potential risk to ecological receptors". ~~However, the MRS is not considered an "ecological important place" (IEP), and no ecological receptors are present. Therefore, MC will not be the focus of the RI, unless any MEC discoveries lead to MC sampling.~~

Suffolk Co AAF B&G Range FUDS responses are being performed under the Comprehensive Environmental Restoration, Compensation and Liability Act (CERCLA). Suffolk Co AAF B&G Range FUDS is not on the National Priority List (NPL). The New York State Department of Environmental Conservation (NYSDEC) is the lead regulatory agency.

The information in Section 1 is provided for background information only.

2.0 Requirements

The Department of Defense (DoD) established the MMRP and IRP under the Defense Environmental Restoration Program (DERP). Work required under this Performance Work Statement (PWS) falls under the Military Munitions Response Program (MMRP) and Formerly Used Defense Site Program (FUDS). All activities involving work in areas potentially containing MEC hazards will be conducted in full compliance with DoD, Department of the Army and United States Army Corps of Engineers (USACE) safety regulations.

The Contractor shall be responsible for fully executing the Firm Fixed Price Remediation (FFPR) approach under a Performance-Based Acquisition (PBA) by: conducting required environmental investigative and restoration services for which the United States Department of the Army (the “Army”) is statutorily responsible; addressing any and all unforeseen environmental, explosive safety, scheduling, and regulatory issues; and, assuming contractual liability and responsibility for the achievement of the performance objectives for the site at Suffolk Co AAF FUDS identified in this Performance Work Statement (PWS), including any sites with off-installation contamination.

The contractor must possess all the required expertise, knowledge, equipment and tools required to meet or exceed the government’s objectives identified in this PWS in accordance with established industry standards. The Contractor must have the capability and experience to perform, or provide investigative and restoration services required for hazardous substance and waste sites and munitions and explosives of concern (MEC). Work will include one or more of the following: Remedial Investigation (RI), Feasibility Study (FS), Proposed Plan (PP), Decision Document (DD) based on historical use of the site.

It is the Contractor's responsibility to comply with all applicable federal, state and local laws and regulations and to fulfill the performance objectives of this PWS in a manner that is consistent with any applicable orders or permits, all existing cleanup agreements or guidance for the FUDS property, and relevant DoD and Army policy, for the duration of the contract.

The Contractor must perform all the necessary environmental remediation work as required to meet the performance objectives of this PWS. All environmental services will comply with CERCLA, as amended by the Superfund Amendments and Reauthorization Act (SARA); the NCP requirements; and with regulatory coordination, as appropriate, of the NYSDEC. The DoD recently revised its Ammunition and Explosives Safety Standards (DoD 6055.09-STD) (Feb 08 as amended to DoD Manual 6055.09-M) and this document must be adhered to in the investigation and remediation of sites with MEC. Specific requirements concerning explosives safety are further clarified in EP-385-1-95b, ER 385-1-95, EM 385-1-97, and EP 385-1-95a.

Certain pollutants or contaminants (P/C) may be an issue at sites covered by this PWS and will require testing. Cleanup of P/C may be warranted if the P/C present an imminent and substantial endangerment to the public health or welfare that result in an unacceptable risk. P/C, as defined in CERCLA, typically does not have a federally promulgated maximum contaminant limit (MCL). For any such P/C, or any other chemical, that does not have a federally promulgated MCL, but does have a finalized reference dose (RfD) or slope factor listed in USEPA's Integrated Risk Information System (IRIS) database, that RfD or slope factor should be incorporated in the National Contingency Plan (NCP) risk assessment process. However, funding will not be provided for responses that are not in full compliance with CERCLA, the DERP, and DoD and Army policy. Additionally, state standards will only be analyzed through the CERCLA applicable or relevant and appropriate requirement (ARAR) process.

3.0 Types of Services Required

This PWS includes broad-spectrum environmental services for MMRP program categories. These services may include, but are not limited to, Remedial Investigation (RI), Feasibility Study, Proposed Plans (PPs), and Decision Documents (DD), regulatory coordination, and incidental construction associated with environmental investigation activities.

As described in ER 200-3-1, the MMRP category includes identification and investigation of Munitions and Explosives of Concern (MEC) or Munitions Constituents (MC)

4.0 Task Order Type

This is a firm fixed-price task order without environmental insurance. The period of performance on this Task Order is not to exceed 60 months from award, inclusive of all options.

5.0 Performance Objectives and Standards

The overall objective of this task order is to perform and achieve US Army Corps of Engineers (USACE) acceptance of an RI/FS and Decision Document(s) in compliance with Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), as amended, and Department of Defense, Army, and USACE Regulations and Guidance to include Interim Guidance at the Suffolk Co. AAF FUDS.

The objective of the Remedial Investigation at the Suffolk Co. AAF FUDS is to characterize the nature and extent of MEC and MC attributable to past DoD activities, and to determine if unacceptable risks to human health and the environment exist due to the presence of hazardous substances or explosive hazards. Advanced Geophysical Classification (AGC) methods should be utilized to the maximum extent practical for purposes of site characterization. AGC will be considered during the remedial alternatives analysis, if an unacceptable risk is determined from characterization; therefore, the site-specific capabilities of AGC will be evaluated during the field investigation of the MRS.

The Contractor shall be required to furnish all plans, labor, materials, and equipment necessary to meet the performance objectives and standards identified in Table 1 below.

Table 1: Performance Objectives Summary

Performance Objectives	Performance Standard
CLIN 0001: Approved Project Management Plan (PMP) • Draft PMP within 30 calendar days of contract award • Final PMP within 15 calendar days of receipt of COR comments on the draft.	- Army approval through Contractor's Representative (COR)
CLIN 0002: Achieve Decision Document (DD) at MRS-01 –Range Complex, within 60 months of award.	- Compliance with the Government provided, DDESB approved Explosives Siting Plan (ESP). - Army approval through the COR and Regulator concurrence (e.g., receipt of documentation confirming approval of Reports)
~~OPTION CLIN:~~ ~~- Complete Investigation of Additional Areas outside of MRS boundary~~ ~~Fixed unit price, per acre.~~	~~- Compliance with the Government provided, DDESB approved Explosives Siting Plan (ESP).~~ - ~~- Army approval through the COR and Regulator concurrence (e.g., receipt of documentation confirming approval of Reports)~~

OPTION CLIN 0003a: Evacuation: Achieve evacuation of residential and commercial properties, and roads during MEC intrusive investigation. Actual evacuation costs will be subject to Army approval prior to execution. Contractor shall conduct evacuations not to exceed $50,000.	Government approval of evacuation cost estimate. Government acceptance through the COR.
OPTION CLIN 0003b: Evacuation: Achieve evacuation of residential and commercial properties, and roads during MEC intrusive investigation. Actual evacuation costs will be subject to Army approval prior to execution. Contractor shall conduct evacuations not to exceed $50,000.	Government approval of evacuation cost estimate. Government acceptance through the COR.
OPTION CLIN 0003c: Evacuation: Achieve evacuation of residential and commercial properties, and roads during MEC intrusive investigation. Actual evacuation costs will be subject to Army approval prior to execution. Contractor shall conduct evacuations not to exceed $50,000.	Government approval of evacuation cost estimate. Government acceptance through the COR.
OPTION CLIN 0003d: Evacuation: Achieve evacuation of residential and commercial properties, and roads during MEC intrusive investigation. Actual evacuation costs will be subject to Army approval prior to execution. Contractor shall conduct evacuations not to exceed $50,000.	Government approval of evacuation cost estimate. Government acceptance through the COR.
OPTION CLIN 0004a: Property Restoration: Achieve approved property restoration at private properties. Actual restoration costs will be subject to Army Approval prior to execution. Contractor shall conduct property restoration not to exceed $50,000.	Government approval of property restoration cost estimate. Government acceptance through the COR.
OPTION CLIN 0004b: Property Restoration: Achieve approved property restoration at private properties. Actual restoration costs will be subject to Army Approval prior to execution. Contractor shall conduct property restoration not to exceed $50,000.	Government approval of property restoration cost estimate. Government acceptance through the COR.
OPTION CLIN 0004c: Property Restoration: Achieve approved property restoration at private properties. Actual restoration costs will be subject to Army Approval prior to execution. Contractor shall conduct property restoration not to exceed $50,000.	Government approval of property restoration cost estimate. Government acceptance through the COR.
OPTION CLIN 0004d: Property Restoration: Achieve approved property restoration at private properties. Actual restoration costs will be subject to Army Approval prior to execution. Contractor shall conduct property restoration not to exceed $50,000.	Government approval of property restoration cost estimate. Government acceptance through the COR.

~~** See Attachment B for further explanation of OPTION CLINs.~~

There may be multiple milestones and/or deliverables for each performance objective (see Section 6.2 of this PWS). Payments will be based on successful completion of the milestones. Final decisions regarding the adequacy of milestone and deliverable completion resides with the U.S. Army Corps of Engineers' COR (see **Section 8.3** of this PWS), with appropriate acceptance and approval of necessary site remediation documentation by regulators, consistent with applicable regulatory drivers listed in Section 2.0 of this PWS. Milestone structure and payments will be proposed by the Contractor in the Project Management Plan.

6.0 Project Management

The PBA approach requires careful coordination of project activities to ensure that all stakeholders are kept informed of the project status, existing or potential problems, and any changes required to prudently manage the project and meet the needs of the FUDS property's project stakeholders and decision-makers. The contractors shall be responsible for the following project management activities.

6.1 Project Management Plan and Schedule

The Contractor shall develop and maintain a detailed Project Management Plan (PMP) in accordance with Engineer Regulation (ER) 5-1-11 and Engineer Manual (EM) 200-1-15. The PMP will specify the schedule, technical approach, and resources required for the planning, execution, and completion of the performance objectives. The first draft of the PMP will be due within thirty (30) calendar days of contract award. The draft PMP and subsequent revisions will be subject to Army review and approval through the Contracting Officer's Representative (COR). The final PMP will be due within fifteen (15) calendar days of comments received from the COR. A payment milestone will be established for Army approval of the final PMP through the COR.

As part of the PMP, the Contractor will develop and maintain an activity-based schedule that fully supports the technical approach and outlines the due dates for all milestones and payable deliverables. A payment plan will be included with the schedule that allows for payments to the Contractor based on successful completion of interim milestones proposed by the Contractor. It is the Army's intent to make all payments after verification of progress in accordance with this schedule. The Contractor will coordinate activities with the COR to ensure that the proposed project schedule does not conflict with other contractor activities on site, or interrupt FUDS property mission activities.

As part of the PMP, the Contractor will identify and implement a means for providing project status reports to the COR. The PMP will address the frequency and content of status reports.

6.2 Milestone Presentations

Milestone presentations shall be made to the COR at the completion of each indicated milestone to provide analysis and lessons learned, and to present approaches for completion of future milestones. At the COR's request, the Contractor may also make milestone presentations to the other project stakeholders, consistent with the applicable regulatory drivers listed in **Section 1.0** of this PWS, to show achievement of the performance objectives.

The Contractor may propose a revision of the milestones below to reflect their PMP and provide for interim milestones. Interim milestones will only be accepted if they represent significant progress toward milestone completion, and completion of these interim steps can be measured and demonstrated. Payments will be tied to the successful completion major milestones listed below or an interim milestone plan approved by the Army, through the COR. To that end, all proposed interim milestones should be associated with easily demonstrated metrics tied to performance measurements (e.g., resolution of comments on a draft, acceptance of a final report, or acceptance of a data submittal or meeting minutes). All milestones must have a defined means for demonstrating completion in order to facilitate certification and approval (see **Section 8.3**, *Certification and Approval of Project Milestones and Deliverables*).

MILESTONES for MRS-01 Suffolk County AAF Bombing & Gunnery Range FUDS

CLIN	Milestone	Milestone Description
0001 -PMP and Meetings	0001a	Project Management Plan
	0001b	Community Relations Plan
	0001c	Meetings
0002 - MMRP MRS-01 Range Complex	0002a	~~Remedial Investigation Work Plans~~ UFP-QAPP
	0002b	Remedial Investigation Field Work
	0002c	Remedial Investigation Report
	0002d	Feasibility Study
	0002e	Proposed Plan
	0002f	Decision Document
OPTION CLIN ~~0003 – Additional study areas outside MRS (Fixed unit price per acre – not~~0003a: Evacuation (Not to exceed (NTE) ~~100 acres~~$50,000)	OPTION 0003a	~~Remedial~~MEC Intrusive Investigation ~~Field Work (Fixed Unit Price per acre, not to exceed 100 acres)~~Evacuation Technical Memorandum
OPTION CLIN 0003b: Evacuation (Not to exceed (NTE) $50,000)	OPTION 0003b	MEC Intrusive Investigation Evacuation Technical Memorandum
OPTION CLIN 0003c: Evacuation (Not to exceed (NTE) $50,000)	OPTION 0003c	MEC Intrusive Investigation Evacuation Technical Memorandum
OPTION CLIN 0003d: Evacuation (Not to exceed (NTE) $50,000)	OPTION 0003a	MEC Intrusive Investigation Evacuation Technical Memorandum
OPTION CLIN 0004a: Property Restoration (Not to exceed (NTE) $50,000)	OPTION 0004a	Property Restoration Technical Memorandum

OPTION CLIN 0004b: Property Restoration (Not to exceed (NTE) $50,000)	OPTION 0004b	Property Restoration Technical Memorandum
OPTION CLIN 0004c: Property Restoration (Not to exceed (NTE) $50,000)	OPTION 0004c	Property Restoration Technical Memorandum
OPTION CLIN 0004d: Property Restoration (Not to exceed (NTE) $50,000)	OPTION 0004d	Property Restoration Technical Memorandum

6.3 Environmental Requirements

The Contractor will identify: applicable Federal, State and local rules, laws, and regulations; applicable Property-specific orders, agreements, or rules; as well as Army and DOD requirements, such as those established by the DoD Explosive Safety Board; and perform its work in accordance with said authorities. The Contractor will ensure that all activities performed by its personnel, subcontractors and suppliers are executed in accordance with said authorities. Any incident of noncompliance noted by the Contractor will immediately be brought to the attention of the COR and USACE Point of Contact (POC) telephonically and then by written notice. Nothing in this contract will relieve the Contractor of its responsibility to comply with applicable laws and regulations. The Contractor will obtain all approvals and permits (i.e., excavation, wetlands, NPDES, etc), necessary to accomplish the work. When the work to be performed requires facility clearances, the Contractor will obtain them with the assistance of the USACE POC prior to any work and coordinate all work with that POC prior to initiation.

Contractors are required to perform their own utility checks. The Contractor will comply with all FUDS property or site-specific time and procedural requirements (federal, state, and local) described in the approvals obtained. The Army technical experts will also independently review Contractor work to ensure compliance with all applicable requirements.

The Contractor shall review and fully understand "Executive Order 13423 -- Strengthening Federal Environmental, Energy, and Transportation Management," in particular those requirements pertaining to environmental management system (EMS).

The Contractor shall consider and implement green response/remediation strategies and applications to maximize sustainability, reduce energy and water usage, promote carbon neutrality, promote industrial materials reuse and recycling, and protect and preserve land resources, consistent with DOD's Policy on Consideration of Green and Sustainable Remediation Practices in the Defense Environmental Restoration Program. The contractor shall present green remediation options and approaches in its work plans, maintain records of "green-related" activities, and report this information to the COR in its project status reports.

6.4 MEC Related Guidance

MEC includes, but may not be limited to: UXO, as defined in 10 U.S.C. 101(e)(5); DMM, as defined in 10 U.S.C. 2710(e)(2); or MC, as defined in 10 U.S.C. 2710(e)(3), present in high enough concentrations to pose an explosive hazard.

MEC distinguishes specific categories of military munitions that may pose unique explosives safety risks. Because MEC that is being actively managed may be determined to be hazardous wastes, 29 Code of Federal Regulations (CFR), Hazardous Waste Operations and Emergency Response, Section 1910.120 may apply.

The Contractor will comply with all site-specific time and procedural requirements (federal, state, and local) described in the approvals obtained.

UXO qualified personnel will be responsible for determining the explosive safety status of any material recovered that may pose an explosive hazard (i.e., material potentially presenting an explosive hazard (MPPEH).

Should MEC be encountered during this response, UXO-qualified personnel will evaluate the explosive hazard and remove it, including by open detonation in place. This response will be conducted per the CERCLA and the NCP, applicable state and federal regulations, and applicable DOD, U.S. Army, and USACE) standards.

6.5 Health and Safety Requirements

Upon receipt of notice to proceed the Contractor shall conduct a site specific hazard evaluation as defined in paragraph 06.A.02 of EM 385-1-1. The hazard evaluation shall not be limited to potential exposure to hazardous and/or toxic agents but will include all potential hazards which workers may encounter on the site. This evaluation shall be documented in a written report and provided for review and acceptance by the Government Designated Authority (GDA) prior to submission of the Accident Prevention Plan (APP). Prior to beginning any fieldwork, the Contractor shall implement a written Safety and Health Program compliant with federal, state, and local laws and regulations and approved by the COR. The Contractor shall develop and ensure that its subcontractors, suppliers and support personnel comply with the approved APP and Site Safety and Health Plan (SSHP) per the guidance established in EM 385-1-1. The Army reserves the right to immediately stop work under this contract for observed safety concerns which may expose site personnel to an immediate hazard or any violations of the SSHP at no additional cost to the Army. Once the Army verifies through the COR that the violation has been corrected, the Contractor shall be allowed to continue work. The APP/SSHP shall contain the minimum elements required for compliance with EM 385-1-1 guidance. In addition to compliance with the approved APP/SSHP the Contractor will be responsible for conducting all work in accordance with the approved ESP provided by USACE. Additionally, the Contractor must adhere to all DoD and Department of the Army (DA) and USACE policies, procedures and regulations for munitions response.

Prior to beginning fieldwork, the Government will provide an approved Conventional Explosive Siting Plan (ESP) that will be prepared IAW EP 385-1-97 Errata 3 and DoD 6055.09-M. The ESP will describe, in detail, the appropriate safety criteria involved for the work included in this PWS. The Contractor will be responsible for conducting all work in accordance with the approved ESP. Additionally, the Contractor must adhere to all DOD and Department of the Army (DA) policies, procedures and regulations for munitions response. This requirement includes but is not limited to DODM 6055.09-M, Ammunition and Explosives Safety Standards; Army Regulation 385-10, the Army Safety Program; DA Pamphlet 385-63, Range Safety; DA Pamphlet 385-64, Ammunition and Explosives Safety Standards; and **EM 385-1-1; " US Army Corps of Engineers Safety and Health Requirements Manual (most recent version)."**

Personnel involved in certain munitions response activities will, as required, meet the qualifications of Department of Defense Explosives Safety Board (DDESB), Technical Paper (TP) 18, Minimum Qualifications for UXO Technicians and UXO-Qualified Personnel. Per EP 1110-1-18, the contractor will propose a workweek schedule for each project. The proposed schedule will be submitted to the Contracting Officer Representative (COR) for approval. The COR will seek the concurrence of the project development team (PDT) and resolve any other comments before making the decision to accept or reject the schedule. If the schedule is rejected, the contractor will propose a new schedule and the same process will be repeated until an acceptable schedule is approved.

The sites are not suspected to contain chemical warfare material (CWM); however, if suspect CWM is encountered during any phase of site activities the Contractor shall immediately halt operations and contact the COR for assistance and guidance.

All activities involving work in areas potentially containing MEC hazards shall be conducted in full compliance with Department of Army, state, and local requirements regarding personnel, equipment and procedures, and DoD Standard Operating Procedures and safety regulations.

6.5.1 Evacuation

The MRS includes some residential and commercial properties within the MRS, as well as a state highway and other roads. Intrusive investigations may require evacuation of residents, commercial properties, and roads located within exclusion zones required by the Government provided ESP. The government identified an option CLIN for Evacuation. Actual evacuation costs will be subject to Army approval prior to execution. Specific requirements include the following tasks, as required:

- Coordination and on-site support of evacuation efforts
- Printing and distribution of informational material
- Provide Hospitality Area (HosA), including transportation and logistics for the HosA, including food and drink.
- Sleeping Rooms (at the Government Per Diem rate)
- Transportation
- Pet Boarding
- Costs associated with road closure, such as sign rentals.

Upon completion of the Evacuation, the contractor will prepare a MEC Intrusive Investigation Technical Memorandum summarizing the results of completed evacuation activities.

6.6 Quality Management

The Contractor must ensure that the quality of all work performed or produced under this contract meets Army approval. A task will be considered complete and acceptable once all task objectives are achieved, all minimum quality requirements are met, and all task-specific deliverables receive Army approval, through the COR. Quality control/assurance plans must be prepared and approved by the COR prior to performance of physical work.

Since the technical approach for this PBA will be developed by the Contractor, the Contractor will also develop a strategy for Army Quality Assurance (QA), to be submitted with the PMP. The QA strategy should highlight key quality control activities or events the COR will use to determine when Army (Contracting Officer (KO) or COR) inspections can be conducted to assess progress toward milestones. Activities identified in the QA strategy should be appropriately coded in the project schedule to allow for planning of QA inspections. These activities will be incorporated into the Quality Assurance Surveillance Plan (QASP) that will be developed and implemented by the COR to determine when Army (COR) inspections can be conducted to assess progress toward and/or completion of milestones. The QASP will be made final within fifteen (15) calendar days of the final approved PMP.

6.7 Quality Control

Quality Control shall be provided whenever sampling or analysis for chemical constituents is required in order to achieve milestones. Quality control for traditional soils or geotechnical testing shall also be included. Effective October 1, 2009, laboratory (ies) to be used by the Contractor to perform testing in support of the DoD environmental restoration programs and that do not hold an unexpired DoD Component (Army) approval need to be accredited in accordance with DoD Environmental Laboratory Accreditation Program (ELAP). Laboratories that have DoD Component approvals in place prior to this date will be subject to DoD ELAP requirements when those approvals expire or when additions or modifications to their scope of approval are required. The Contractor may establish an on-site testing laboratory at the project site if determined necessary by the Contractor. However, on-site testing shall meet the requirements of USEPA, specific state regulator requirements, and all requirements of the most recently approved DoD Quality Systems Manual (QSM).

Following task order award and during project implementation, the Contractor shall develop and submit documentation of project-specific ~~quality assurance (QA) and~~QC activities prepared in accordance with the Uniform Federal Policy for Quality Assurance Project Plans (UFP-QAPP~~). The Government will review and return the quality systems documentation, with comments, indicating acceptance or rejection. If necessary, the Contractor shall revise the documentation to address all comments and shall submit the revised documentation to the Government for acceptance. In addition, the Contractor shall develop and submit Quality Control Summary Reports to summarize the quality control details of the task order project. The problems and successes of the work done to control the quality of the chemical measuring activities and other chemically related cleanup activities shall be included in the summary reports~~ and MR-QAPP. The Contractor shall identify QC issues and processes for corrective actions of field variances in accordance with the UFP QAPP.

The draft and final versions of the UFP QAPP are to be reviewed and approved by the USACE. Both the Draft and Final versions of the UFP QAPP are to be provided to the FUDSChem administrator (Synectics; fuds.support@synectics.net or phone 916.737.4010) for simultaneous review along with USACE. The contractor shall also be responsible for creating an eQAPP within FUDSChem as detailed in the PWS Section 6.17.1 Electronic Data Deliverables. Generally, the UFP QAPP and the eQAPP are developed in parallel since several QAPP worksheets may be automatically generated within FUDSChem. The contractor shall have a project chemist with analytical chemistry and data validation experience assigned to the project to oversee the DQO development, method selections, QAPP (and eQAPP) preparation, and all FUDSChem chemistry related activities. The laboratory chemist shall not serve as the project chemist. The contractor shall submit written qualifications of the designated project chemist to demonstrate appropriate analytical chemistry and data validation experience with their proposal for approval by USACE. A change in personnel during the course of the contract requires the submittal of qualifications for the newly designated project chemist for approval by USACE.

6.8 Project Repository and Administrative Record

The Contractor shall also update the Information Repository and the Administrative Record for CERCLA activities. There is currently no Information Repository at the site, but USACE will establish an Info Repository at a local public building near Suffolk County AAF FUDS (eg., local library). The Administrative Record is maintained by USACE New England District. The Information Repository and Administrative Record shall be updated by the Contractor, and made available to the public, for the duration of the contract. Final electronic document files must be in text-searchable PDF.

6.9 FUDS Management Information System Uploads

Once the remedial investigation for the MRS is complete (i.e., appropriate documentation is finalized), the Contractor shall be responsible for providing the COR with the data and documentation necessary for MRS updates to the FUDS Management Information System (FUDSMIS), including the results of the Munitions Response Prioritization Protocol (MRSPP) evaluation. USACE, through the COR, will provide data specifications for database requirements to the Contractor. The Contractor shall comply with all applicable requirements for data validation and submission.

6.10 ~~Additional Site~~ Plans and Documents

~~Prior to beginning any field work, the Contractor shall prepare any additional plans or documents (e.g., sampling and analysis plans, quality assurance project plan, waste minimization plans, health and safety plans) consistent with **Section C** of the basic contract, the applicable regulatory drivers listed in **Section**~~

~~**2.0** of this Task Order, and any other agreements, orders, or regulations that apply to the FUDS property and sites. These plans and documents shall be subject to Army review and approval, through the COR.~~

6.10.1 Uniform Federal Policy Quality Assurance Project Plan (UFP-QAPP)

The contractor will prepare the UFP-QAPP in accordance with the MR-QAPP Toolkit Module 1; EM 200-1-15; EM 385-1-1; Intergovernmental Data Quality Task Force UFP-QAPP Manual, General Data Validation Guidelines and New York State regulatory guidance, as appropriate. Any necessary support plans should be provided as appendices to the UFP-QAPP

6.10.2 Remedial Investigation Report, Feasibility Study, Proposed Plan, Decision Document

The contractor will prepare the RI and FS reports in accordance with IGD 06-04, Army RI/FS Guidance, or another format approved by the PDT. The PP and DD will be prepared in accordance with ER 200-3-1, EPA 540-R-98-031, and CERCLA, as amended.

The RI Report will include a risk assessment in accordance with the following:

- Perform the ecological and human health risk assessment IAW the EPA Risk Assessment Guidance (RAGS) and USACE EM 200-1-4, Volumes I and II, as appropriate.
- Perform a baseline risk assessment for MEC in accordance with the 7 February 2019 USACE Headquarters (HQUSACE) memorandum, Subject: Trial Period Extension for Risk Management Methodology at FUDS MMRP Projects.

6.11 Rights of Entry

The FUDS property, by definition, is outside the control of DoD. The Government will procure all rights of entry (ROE). The Contractor shall not enter any property without an approved ROE and shall be required to comply with all conditions specified in the ROE, if such conditions prevail. The contractor will be required to assist the government in obtaining ROEs by maintaining all property GIS data within the project boundary and identifying specific properties for which ROE requests are required. The contractor shall preserve the privacy of property owners and not disseminate any information on property owner names in any documents.

6.12 Protection of Property

The MRS includes residential and commercial properties that may require intrusive investigations that damage property. Mobilization at intrusive investigation sites will be sequenced to ensure that all project activities minimize impact to residents and commercial property owners. Prior to any intrusive investigations at residential or commercial properties, the contractor will be responsible for completing a landscape survey by documenting on videotape all existing landscaping and vegetation. In addition, a qualified arborist shall be contracted to assess the property and inventory the flora if intrusive investigations may destroy any plants. This documentation will be consulted if any plants are destroyed and need to be replaced or the owner reimbursed for the loss. To the extent possible, disturbance to vegetation will be avoided during field activities. Plants and landscape features that do not require removal will be marked with yellow caution tape. Shrubs and small trees in the vicinity of the intrusive activities will be tied back to prevent damage. The location of temporary facilities will be selected to limit impacts to the area and to facilitate easy removal. All vehicles and trailers used at private properties will be parked on the street to minimize landscape destruction. Geotextile and plywood may be used on access roads to minimize impact on residential or commercial properties. Smaller sized excavation equipment and rubbertracked skid loaders will be used in residential areas to minimize damage. Pre-investigation documentation will also include photos and videos of the condition of any driveway, sidewalks, walkways, patios, yard ornaments, playsets, and other hardscape items at each property that could be impacted by the intrusive investigation.

Where intrusive activities have taken place, the contractor will be responsible for conducting post-restoration landscape surveying to determine the impact to properties, to assess any damage caused, and to estimate the costs for repairs. The contractor will be responsible for restoring sod and hardscape after completing intrusive investigation work.

A separate line item is identified in the attached CLIN structure to allow for reimbursement of landscape surveys, sod and hardscape restoration to the contractor, as needed, which will be applied after Government review and approval. The contractor will coordinate with USACE prior to finalizing the cost estimate for landscape surveying or sod and hardscape restoration. If soft-scape (eg, bushes) is damaged or destroyed during intrusive investigation, the contractor will be responsible for documenting the damage and estimating the cost for repair, replacement, or reimbursement, as described above. Upon completion of property restoration, the contractor will prepare a Property Restoration Technical Memorandum summarizing the completed property restoration activities with photos documenting evidence of the work completed.

Except where as noted above, the Contractor shall be responsible for any damage caused to property of the United States (Federal property) by the activities of the Contractor or its subcontractors under this contract and shall exercise due diligence in the protection of all property located on the premises against fire or other damage from any and all other causes. Any property of the United States damaged or destroyed by the Contractor or its subcontractors incident to the exercise of the privileges herein granted shall be promptly repaired or replaced by the Contractor to a condition satisfactory to the COR or reimbursement is made by the Contractor sufficient to restore or replace the property to a condition satisfactory to the COR in accordance with FAR Clause 52.245-2.

6.13 Project Stakeholders

For the purposes of this PWS, project stakeholders will include but are not limited to:

- the Army
- the NYSDEC
- the property owners ~~(spreadsheet including list of property owners is included as a reference document).~~ Information on property parcels is included in Worksheet #10. This was sent on 18 May via DoD SAFE. On: May 20 2020.

Specific Army stakeholders include the following: USACE, Department of Defense Explosives Safety Board (DDESB), US Army Technical Center for Explosive Safety (USATCES), US Army Public Health Center.

The Contractor will be responsible for obtaining comments with appropriate approval on project deliverables consistent with applicable regulatory drivers and agreements for each site.

6.14 Regulatory Involvement

All regulatory coordination shall be approved by USACE through the COR. The Contractor shall provide the necessary support to initiate, schedule, and address all regulatory aspects of the project (e.g., organizing discussions with regulators concerning site response objectives and completion requirements, obtaining regulator comments on site documents and appropriately addressing them, and obtaining written documentation of remediation completion from the regulators for all of the sites identified in this PWS). The COR, or designee, will attend and represent the Army at all meetings with the regulators. With approval of the COR, the contractor may also informally discuss remediation issues with regulators and provide an after-action report back to the COR. The Army will be the signature authority for all regulatory agreements and remediation documentation.

6.15 Public Involvement

All public participation coordination shall be approved by USACE through the COR. The Contractor shall 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, articles/public notices to news media, and notifications to RAB members). The Contractor shall be responsible for requesting and addressing all public comments. The COR, or designee, will attend and represent the Army at all meetings with the public.

Contractors should note that Suffolk County AAF FUDS currently has no Restoration Advisory Board (RAB). Should a RAB be formed, the contractor will be required to provide the necessary support (e.g., preparation of briefings, presentations, fact sheets, newsletters, and notifications to RAB members) for the MRS's and AOCs listed in this PWS. Activities required to support public meetings are included in this effort. The Contractor will be required to participate and provide presentations on sites listed in this PWS. The FUDS property will provide detailed information concerning the RAB's organization.

At this time, there is not sufficient community interest to establish and sustain a Restoration Advisory Board (RAB) or Technical Review Committee (TRC). The FUDS property will conduct biannual public interest assessments and if the assessments indicate adequate public interest exists, will establish a RAB and activities required to support the RAB meetings will be included in this effort.

The Contractor is responsible for developing an approved Community Relations Plan (CRP) for the Suffolk County AAF FUDS.

6.16 Communications

The Contractor shall not make available or publicly disclose any data or report generated under this contract unless specifically authorized by the KO through the COR. If any person or entity requests information from the Contractor about the subject of this scope of work or work being conducted hereunder, the Contractor shall refer them to the COR. All reports and other information generated under this scope of work shall become the property of the Government, and distribution to any other source by the Contractor is prohibited unless authorized by the KO.

The Contractor shall keep a record of each telephone conversation, written correspondence, and meeting minutes concerning this task order, in accordance with all appropriate DOD regulations. A copy of these records shall be attached to the monthly project status reports.

6.17 Deliverable Requirements

All documents must be produced in preliminary-draft, draft, draft final, and final versions in both hard copy andelectronic (PDF) format. ~~The Contractor will provide a sufficient number of~~ Hard copies of ~~each submittal as requested by~~ final work plans and reports are required for the ~~various project stakeholders~~ Administrative Record and Information Repository. The COR will provide consolidated USACE comments on preliminary-draft documents to the Contractor within thirty (30) business days. Once comments on the preliminary-draft are addressed, the Contractor will provide draft submittals to Army stakeholders for review (eg. USACE EMCX and USAPHC, as applicable). After comments on the draft are addressed, the Contractor will provide draft final submittals to NYSDEC and property owners. After comments on the draft final are addressed to the COR's satisfaction, the Contractor will finalize the document. Final documents will be submitted to the Information Repository and Administrative Record.

The Contractor will conform to US Army Corp of Engineers (USACE) requirements or a similar approach that addresses all subject matter areas prescribed in the most recent version of USACE requirements at the time of task order award will apply.

The Contractor shall use the proposed milestone payment schedule in Section 6.2 for purposes of preparing a price proposal. The contractor may propose an alternate milestone payment schedule as part of its draft PMP, and if approved by the Army, included as part of the final PMP. Final decisions regarding the adequacy of milestone and deliverable completion resides with the COR (see ***Section 6.2***, *Milestone Presentations*) and will be based on the appropriate acceptance and approval of required documentation by Regulatory Agencies, consistent with CERCLA and the NCP.

Key Deliverables

- Project Management Plan
- Community Relations Plan
- Remedial Investigation Work Plan (Quality Assurance Project Plan)
- Remedial Investigation Report
- Feasibility Study
- Proposed Plan
- Decision Document
- ~~Technical~~ Systematic Project Planning (~~TPP~~SPP) Meeting Materials
- Meeting Minutes
- Monthly Status Reports
- MEC Intrusive Investigation Evacuation Technical Memorandum (if needed)
- Property Restoration Technical Memorandum (if needed)
- Electronic Data Deliverables/Geospatial Data (FUDSCHEM)
- Evaluations of the MRS using the Munitions Response Site Prioritization Protocol (MRSPP) (included in the RI Report)

6.17.1 Electronic Data Deliverables

~~The following sections describe quality control testing and submission requirements for the following categories of Electronic Data Deliverables:~~

- ~~Chemistry Electronic Data Deliverables to be uploaded to the Formerly Used Defense Site Chemical (FUDSCHEM) Database, located at www.FUDSCHEM.com~~
- ~~Other Types of Electronic Non-Laboratory Chemistry Data Deliverables to be uploaded to FUDSCHEM~~
- ~~Other Types of Data not currently supported in FUDSCHEM~~

~~Data shall be managed and submitted in accordance with the New England District Data Management Plan (April 2016), which also includes detailed FUDSCHEM upload instructions.~~

All environmental data collected during the course of the FUDS study is to be transferred to the FUDSChem database located at www.fudschem.com. The following data types, if collected on this project, are also to be included/loaded into FUDSChem:

- Geological
- Hydrogeological
- Geophysical
- Chemical

Location data are fundamental to environmental data storage/retrieval and the contractor must upload the relevant location information for each task that includes the collection of field data. This includes all data collected on the project for which spatial information is appropriate (i.e., may not apply to reconnaissance activities, and will not in most cases apply to drum waste characterization samples). At project initiation, database workspace will be established for the project and project personnel will be provided general user permissions to access the workspace. The New England District Data Management Plan (CE NAE, 2016) provides guidance for the storage of all types of data (geophysical, geological, hydrogeological, chemical, GIS, etc.).

The FUDS program requires the Contractor to complete a project eQAPP that is fully compliant with a project UFP QAPP, incorporating all methods, sample types, and quality specifications (LOD, LOQ, Holding Time, QC Sample Acceptance Limits, etc.). The pre-population of sampling event information (location information, sample type, matrix, methods, etc.) is also required to ensure accurate database field matching and allows status tracking within FUDSChem. The FUDSChem administrator is available to support in these planning activities at no cost to the contractor.

6.17.1.1 Chemistry Electronic Data Deliverables

~~For all analytical services procured through the Contractor's laboratory or through a subcontracted laboratory under this contract, the laboratory shall report data using the Staged Electronic Data Deliverable (SEDD) format~~Chemical and ancillary (solids/TSS, pH, etc.) data are to be submitted by the contract laboratory in accordance with the most recently published ~~version (currently~~SEDD specification (e.g., specification 5.2~~). The minimum~~ and data MUST be error-free (all SEDD errors MUST be corrected by the contract laboratory). Furthermore, Contractors MUST confirm all warnings generated by FUDSChem are adequately addressed and approved by the USACE chemist. A description of SEDD is available at www.epa.gov/clp/staged-electronic-data-deliverable-sedd as well as within FUDSChem. A list of valid values (VVLs) is available within FUDSChem. The SEDD deliverable (SEDD stage) is to be clearly defined in the UFP QAPP (the current deliverable requirement for the laboratory is the delivery of a SEDD Stage 2a~~deliverable and a .pdf document file~~. Additionally, a PDF of the laboratory's final data report that includes supporting documentation such as chromatograms and instrument calibrations shall be uploaded to FUDSChem. Contractors/Laboratories shall submit a SEDD file for each SDG unless pre-approved by the Corps Chemist.

~~The contract laboratory will upload the SEDD file directly into FUDSCHEM. All SEDD errors relating to laboratory input will be corrected by the contract laboratory. The Contractor shall electronically review the files to check project data quality requirements using an Automated Data Review (ADR) software program which will accept and generate SEDD files and is able to upload an eQAPP (electronic project QAPP). The contractor can utilize the ADR software free of charge when working on USACE FUDS projects as the ADR is part of the FUDSCHEM database. The contractor must upload the UFP QAPP (Uniform Federal Policy for Quality Assurance Project Plans) to FUDSCHEM as well as provide it to the USACE chemist at the same time for review. Once the draft UFP QAPP is approved by both USACE and Synectics, Synectics will then create the associated eQAPP.~~

~~The contractor must develop a comprehensive ADR project eQAPP for all of the methods to be analyzed on the project. The eQAPP will accurately reflect all of the analytical criteria in the DOD Environmental Laboratory Accreditation Program (ELAP) accredited method in place at the contractor's laboratory and any subcontracted laboratory. The eQAPP shall be provided to the USACE for approval prior to field sampling.~~Unless approved by the USACE FUDSChem Implementation Team (POC: Mike Kulbersh at 978-318-8088 or via email: michael.r.kulbersh@usace.army.mil or Carol Charette 978-318-8605 or via email: carol.a.charette@usace.army.mil), as an exception to policy, Contractors must use the Automated Data Review (ADR) function within FUDSChem and provide a complete data validation report (DVR). The DVR narrative, comments and other project information are to be entered into the FUDSChem system (i.e., per the FUDSChem Review Checklist). Synectics is available for assistance with SEDD file structure and valid value compliance and (license-free) ADR processing as needed.

Field sampling shall not proceed without an approved UFP QAPP and eQAPP in place unless a prior agreement has been reached with the USACE New England District FUDSChem Implementation Team (POC: Mike Kulbersh at 978-318-8088 or via email: michael.r.kulbersh@usace.army.mil or Carol Charette 978-318-8605 or via email: carol.a.charette@usace.army.mil), as an exception to policy, and chain-of-custody documentation must be uploaded to FUDSChem & reconciled within 5-days of each sample collection. Any updates to the eQAPP will be made by either the USACE project chemist or the contractor ~~and~~chemist but both must be in agreement on any changes will be communicated to and. Once approved ~~by~~, the ~~USACE project chemist. The~~ eQAPP will be available from the ~~FUDSCHEM~~FUDSChem portal to the sub-contract laboratory for use in screening the SEDD submittals. The laboratory must review the eQAPP generated reports to verify that the ~~eQAPP that the~~laboratory's exact analytical criteria for accuracy and precision, all QC, holding times and reporting limits for all target analytes are in agreement with the eQAPP. ~~The Contractor must ensure that laboratory reporting limits for all analytes in the eQAPP are as low as possible and adequately below any state and federal action levels. This information will be accessible to the laboratory and all project participants in a readable format on FUDSCHEM. There is no need to download the eQAPP file as screening against the criteria it contains is performed directly through FUDSCHEM.~~
The contractor shall then review the SEDD file(s) utilizing ADR software to check for compliance using the same version of the ADR eQAPP used by the laboratory, and that is maintained on the FUDSCHEM portal. The contractor will ensure that a qualified chemist reviews the ADR output against the PDF report, ~~supplementing~~ and, if specified in the UFP QAPP, supplements the FUDSChem ADR with a manual review where necessary, and ~~will~~generate a written summary report ~~summarizing the findings. This report can be generated electronically from FUDSCHEM if the contractor uses the FUDSCHEM ADR system. The contractor shall import the ADR reviewed SEDD file and field data directly into the Formerly Used Defense Site Chemical Database online, FUDSCHEM at www.FUDSCHEM.com if the contractor is utilizing an ADR function outside of FUDSCHEM.~~using the FUDSChem validation reporting tools.
~~Regardless of the system used to perform ADR, the contractor shall upload a final PDF of their data review report, signed by the review chemist, to FUDSCHEM along with the reviewed SEDD file.~~

The ~~below~~following section describes other field parameters, types of data, and associated tables that the contractor is responsible for uploading to FUDSChem. Prior to uploading the data to ~~FUDSCHEM~~FUDSChem, the contractor will identify one or more individuals who will be responsible for uploading the data. The identified individuals will be given appropriate access to ~~FUDSCHEM~~FUDSChem for the specific project they are assigned to by the ~~FUDSCHEM~~FUDSChem administrator. ~~The Contractor identified personnel shall also be required to attend and be trained by Synectics on how to upload various types of data in FUDSCHEM. Training in all probability will be web based at no cost to Contractors and Laboratories.~~ Contractor and Laboratory personnel are responsible ~~to troubleshoot~~for troubleshooting any data issues/problems or discrepancies concerning the data being uploaded into ~~FUDSCHEM. The Contractor and/or Laboratory will~~FUDSChem and should work with Synectics to resolve any ~~and all~~data issues associated with the data deliverable t~~hey are uploading into FUDSCHEM. The support from Synectics~~. Chemical data delivery is ~~at no cost~~ to complete after the ~~Contractors or Laboratories working on USACE FUDS contracts. The~~ laboratory ~~shall deliver~~ successfully uploads the ~~original~~ error-free SEDD file and the ~~PDF~~ laboratory PDF report to the ~~FUDSCHEM~~ portal; FUDSChem project-specific library, the contractor ~~will review~~ reviews the data processed by ADR,

~~complete~~ in FUDSChem, completes the data validation process, and ~~deliver~~ completes the final data validation report ~~via the FUDSCHEM electronic library~~.in FUDSChem.

NOTE: ~~This feature~~FUDSChem is not intended to load or store all project documents.~~It is simply a place to document share.~~ All Final project documents are permanently stored in the FUDS Record Management Database (FRMD) and are not meant to be duplicated here.

~~All electronic data submitted by the contract laboratory is required to be error-free, and consistent with the hardcopy data such that a manual data validation of the pdf laboratory report will be consistent with the automated data review. The contract laboratory, and/or the Contractor, at their cost, will correct any errors identified by the Contractor or USACE, New England District.~~

~~Information on SEDD can be obtained by going to the EPA's Superfund Analytical Services/Contract Laboratory Program (CLP) web site at: http://www.epa.gov/osainter/fem/sedd.htm~~

~~Use and training pertaining to FUDSCHEM shall be provided by Synectics at no cost to Contractors and Laboratories working on USACE FUDS Projects. Assistance in loading data to the various FUDSCHEM tables/portal will be provided by Synectics and they may be reached at fuds.support@synectics.net or 916-737-4010 between the hours of 6AM and 6PM Pacific Time.~~

~~Support for SEDD file compliance, use of license-free ADR, or FUDSCHEM log-in questions, please contact Synectics at fuds.support@synectics.net or 916-737-4010 between the hours of 6AM and 6PM Pacific Time. You can also contact the USACE, New England District PDT Chemist.~~

6.17.1.2 Other Types of Electronic Non-Laboratory Chemistry Data Deliverables

The intent of ~~FUDSCHEM~~FUDSChem is to make all project data available to the project teams for planning and report purposes. To that extent, the following, although not all-inclusive, is a list of the types of data that each contractor will be expected to upload directly into ~~FUDSCHEM. This is not an all-inclusive list, but provides a good starting point for the most likely forms of data that will be expected to be uploaded. Other types of data in addition to the analytical chemistry samples, tests and results include the following: spatial~~ FUDSChem when they apply:

- Spatial information pertaining to sample locations (northing, easting, and elevation~~), hydrogeological~~);
- Hydrogeological information and physical parameters (groundwater samples - pH, temperature, conductivity, turbidity~~), monitoring~~);
- Soil/sediment grainsize;
- Monitoring well construction information such as monitoring point elevations, screen intervals, depth to water and other aspects of well construction (sand pack, bentonite seal, etc~~), including soil.)~~;
- Soil lithology and logged geologic stratigraphy,~~ environmental monitoring data, and unexploded~~; and
- Unexploded ordnance (UXO) data.

These data are to be loaded into ~~FUDSCHEM~~FUDSChem pursuant to the Data Management Plan using on-line templates or uploaded directly to ~~FUDSCHEM~~FUDSChem using comma separated ~~variable~~values (csv) or fixed width files. The NAE Data Management Plan provides data table specifications as an appendix to the document which outlines the approved structure of the tables and approved VVLs for use. Note that the data specifications and VVLS are query-able and downloadable from FUDSChem. Other non-chemical data collected as part of the field efforts such as pressure transducer data used as part of aquifer pump tests/slug tests/oil transmissivity tests, borehole geophysical data, surface geophysical data, and LiDAR, CADD, and ARCGIS Map packages are to be zipped and uploaded to the ~~FUDSCHEM~~FUDSChem Library for archival retrieval. KML files may be loaded directly to the project directory. Similarly, hard-copy boring, monitoring well construction forms, grain size distribution curves are to be imported into the ~~FUDSCHEM~~FUDSChem Library for ready retrieval.

FUDS Final Work Plans and Reports are archived in the FUDS Record Management Database (FRMD) and are not to be uploaded to ~~FUDSCHEM~~FUDSChem other than for document sharing purposes. ~~The New England District Data Management Plan provides further guidance and requirements and upload instructions regarding all possible types of data that the lab and/or contractor will be expected to be uploaded to FUDSCHEM. This document will be made available to each contractor as a reference.~~

6.17.1.3 Other Types of Data Not Currently Supported in FUDSCHEM:

If a contractor ~~comes across an issue uploading~~identifies a particular type of data that is not currently supported by ~~FUDSCHEM~~FUDSChem, the content should be loaded to the ~~FUSDCHEM~~FUDSChem library, ~~however, the contractor may bring this~~and brought to the attention of the New England District ~~FUDSCHEM~~FUDSChem Implementation Team (POC: Mike Kulbersh at 978-318-8088 or via email: michael.r.kulbersh@usace.army.mil or Carol Charette 978-318-8605 or via email: carol.a.charette@usace.army.mil).

Use and training pertaining to FUDSCHEM shall be provided by Synectics at no cost to Contractors and Laboratories working on USACE FUDS Projects. Assistance in loading data to the various FUDSCHEM tables/portal will be provided by Synectics and they may be reached at fuds.support@synectics.net or 916-737-4010 between the hours of 6AM and 6PM Pacific Time.

6.17.2 Geophysical Data Deliverables:

All geophysics shall be IAW EM 200-1-15 and site-specific Standard Operating Procedures (SOPs), with the following exceptions and additions: raw ASCII data from advanced sensors shall be in a .csv or HDF5 format that can be imported directly into UX-Analyze (latest version) without need of external or additional formatting; final, processed, advanced sensor data shall be delivered in Geosoft databases that can be opened and viewed using UX-Analyze (latest version) without need of external or additional formatting; inversion results (if calculated) shall be delivered in Geosoft database(s) that can be opened and viewed using a UX-Analyze version without need of external or additional formatting; and all data packages will be made available at the electronic data delivery system developed for the project.

6.18 Geographic Information System

The Contractor shall adhere to all applicable federal, DoD, and Army geospatial data standards for tasks and deliverables in this PWS. Spatial data must be compliant with the Spatial Data Standards for Facilities, Infrastructure, and Environment ~~v2.6. Spatial data must meet the requirements of the associated Quality Assurance Plan (QAP)~~.V4.0.2. Each geospatial data set shall be accompanied by metadata conforming to the Federal Geographic Data Committee~~ (FGDC)~~ Content Standard for Digital Geospatial Metadata~~ (CSDGM)~~ and the Army Installation Geospatial Information & Services ~~(IGI&S)~~ Metadata Standard, v1. The horizontal accuracy of any geospatial data created by the ~~contractor~~Contractor shall be tested and reported in accordance with the National Standard for Spatial Data Accuracy ~~(NSSDA)~~, and the results shall be recorded in the metadata. All data must have a datum of WGS84 and a projection of Universal Transverse Mercator ~~(UTM~~) Zone 18N. Army technical experts will independently review Contractor work to ensure compliance with all spatial data requirements.

Any data with a vertical component must be referenced to the North American Vertical Datum of 1988 (NAVD88). The spatial reference must have a precision of 1000.

All GIS data will be provided to USACE upon completion of the performance objectives as established in Table 1, or as requested by USACE.

6.19 ~~Technical~~Systematic Project Planning

The contractor shall conduct ~~Technical~~Systematic Project Planning, as necessary, in accordance with Munitions Response (MR)-QAPP Toolkit Module 1: RI/FS, UFP-QAPP Manual, U.S. Environmental Protection Agency (EPA) QA/G-4, Engineering Manual (EM) 200-1-2, and as further described in EM 200-1-15 for MMRP projects.
The ~~TPP~~SPP process is an approach involving a series of meetings during which the project goals and objectives, the CSM, project data needs and data collection methods, and DQOs are discussed and agreed upon by project stakeholders.

6.20 Digital Advanced Geophysical Classification Accreditation Program (DAGCAP).

The ~~contractor~~Contractor, or subcontractor, in charge of ~~advanced geophysical classification~~, performing the AGC shall be accredited in accordance with the ~~DoD~~DOD Advanced Geophysical Classification Accreditation Program (DAGCAP). DAGCAP accreditation and AGC requirements shall be in compliance with the Office of the Secretary of Defense (OSD) Policy Memo dated 11 April 2016 and the FUDS AGC Policy Memo dated 6 January 2017. The DAGCAP accreditation must be current at the time of signing the final QAPP and throughout all fieldwork, analysis, data usability assessment, and reporting. The DAGCAP quality control (QC) geophysicist will review and accept all data collected to support AGC, including detection surveys and intrusive investigation. The Contractor shall notify ~~their~~ ~~AB~~USACE of each validation seed failure in accordance with the requirements of their accreditation. If, for any reason, the DAGCAP accredited geophysical classification organization (GCO) responsible for the advanced geophysical classification has their accreditation suspended or revoked, the contractor shall identify an alternate DAGCAP accredited GCO to complete the task order at no extra cost to the Government.

~~The work plan shall be in the Uniform Federal Policy Quality Assurance Plan (UFP-QAPP) format.~~

~~The contractor shall identify any variations to this template deemed necessary to implement classification as part of this characterization effortThe contractor shall identify personnel with experience in AGC (minimum Experience described in section 7.1; explain how AGC will be implemented to include equipment, planning documents, site preparation, seeding programs, survey, cue and classification.~~ To the maximum extent practicable the contractor should conduct the field investigation by gathering advanced geophysical classification data in addition to all other data that is digitally recorded and geo-referenced for each item recovered.

7.0 Expertise and Necessary Personnel

The Contractor shall provide the necessary personnel and equipment to execute this PWS successfully. The Contractor is responsible for determining the requirements for licensed professionals and certifications.

The Contractor shall furnish all plant, labor, materials and equipment necessary to meet the performance objectives. The Contractor shall provide personnel trained as required by the Occupational Safety and Health Administration (OSHA) and all other applicable federal and state regulations. The Contractor shall provide all support activities necessary to ensure the safe and effective accomplishment of all work. For all work performed under this contract, the Contractor shall also develop and implement quality control measures consistent with all applicable federal and state regulatory requirements and standards.

7.1 Key Personnel

The Army requires that the following positions, at a minimum, be designated as "key personnel", subject to the terms and conditions for such set forth in the basic contract. The Contractor will notify the COR of any changes in key personnel. The change of key personnel is subject to approval by the KO, although such approval will not be unreasonably withheld provided replacement personnel are of the same quality as originally proposed.

- Program (Task Order) Manager
- Project Manager
- Senior UXO Supervisor
- ~~Site Safety and Health Officer~~
- Risk Assessor
- Project Chemist
- Biologist

In addition to the above key personnel, additional key personnel will be identified and will meet the following requirements as described in the USACE Memorandum: SUBJECT: Advanced Geophysical Classification (AGC) Implementation at Formerly Used Defense Sites (FUDS) Military Munitions Response Program (MMRP) Projects (24 April 2017)

- **Project Manager (PM).** The PM shall be responsible for implementing specific work under this contract. He/she shall evaluate the requirements of the contract and shall develop and implement a plan to meet those requirements. The PM shall be the primary point-of-contact for the contract. The PM should have, as a minimum the following qualifications:
  - At least one (1) advanced classification project to include management at the field operational level; or
  - Five (5) years' experience managing environmental or munitions projects at the field operational level.
- **Senior Project Geophysicist.** At a minimum, the Senior Project Geophysicist shall be responsible for geophysical survey design, dynamic data collection, cued data collection, development of a validation plan, and all other plans and reports supporting the Advanced Geophysical Classification process. The Senior Project Geophysicist shall have, at a minimum, the following qualifications:
  - A degree in geophysics, engineering geophysics, or closely related field or equivalent demonstrated proficiency with advanced geophysical methods (if part of the Contractor's technical approach) and concepts related to munitions response and possess 5 years of directly related UXO geophysical experience.
  - Experience with the theoretical and practical aspects of detecting and selecting a wide range of targets of interest (TOI) and non-targets of interest (non-TOI).
  - Experienced in the selection and utilization of various types of geophysical instruments and ancillary components to include high-precision global positioning systems, inertial motion sensors and the software used to control and integrate the geophysical system as a whole.
  - Shall be a member(s) of the Project Geophysicist personnel cited in the contractor's or subcontractor's DAGCAP accreditation.

- **Quality Control Geophysicist.** At a minimum, the QC geophysicist shall be responsible for the quality of all aspects of quality control except those relating to UXO operations and which fall under the responsibility of the UXOQCS. The QC Geophysicist shall have, at a minimum, the following qualifications:
  - A degree in geophysics, engineering geophysics, or closely related field or equivalent demonstrated proficiency with advanced geophysical methods (if part of the Contractor's technical approach) and concepts related to munitions response and possess 5 years of directly related UXO geophysical experience.
  - Must be experienced with the theoretical and practical aspects of detecting and selecting a wide range of targets of interest (TOI) and non-targets of interest (non-TOI).
  - Experienced in the selection and utilization of various types of geophysical instruments and ancillary components to include high-precision global positioning systems, inertial motion sensors and the software used to control and integrate the geophysical system as a whole.
  - The QC Geophysicists shall be a member of the QC personnel cited in the contractor's or subcontractor's DAGCAP accreditation

- **Field Geophysicist.** The field geophysicist(s) shall be responsible for proper operation of advanced geophysical EMI systems and performing quality control during advanced EMI system surveys. Field Geophysicist(s) shall have, at a minimum, the following qualifications:
  - One year of directly related UXO geophysical experience.
  - Documented or independently verifiable experience operating an advanced geophysical EMI system to include the geophysical instruments, high-precision global positioning systems, inertial motion sensors and the software used to control and integrate the geophysical system as a whole.

8.0 Additional Requirements

8.1 Resources

8.1.1 Army Furnished Resources

The Army will provide the following resources to the Contractor:

- Access to Army-maintained records, reports, data, analyses, and information, in their current format (e.g., paper copy, electronic, tape, disks, CDs), as related to the MMRP Munitions Response Sites (MRSs).
- Access to DOD and Army policy and guidance documents.
- All Army owned property used for investigation purposes must be maintained by the Contractor in accordance with applicable maintenance requirements, and may not be replaced by the Army should new equipment be required.
- GIS database resources from the MMRP Reports will be provided by the COR following task order award.
- Government will provide an approved Conventional Explosives Siting Plan (ESP) that will be prepared IAW EP 385-1-97 Errata 3 and DOD 6055.09-M
- All ROEs, if required, will be executed by a Government Real Property Officer.
- The Government will be responsible for installing any required Quality Assurance (QA) seeds. Third party QA seeding is not required.

8.1.2 Contractor Furnished Resources

The Contractor will be responsible for providing the following:

- Coordination with the USACE in order to get access to the FUDS property, if necessary, as required for execution of this PWS
- Coordination with the USACE in order to gain access to available infrastructure (e.g., buildings, roadways, waste management units, other FUDS property facilities) and utilities (e.g., electric power and telephone lines, natural gas and water supply distribution pipelines, and wastewater discharge conveyances), as required for execution of this PWS.
- The contractor is responsible for disposal of all investigation derived waste generated under this contract including removal and disposal of munitions related debris, detonation and disposal of MEC.
- Site air monitoring for hazardous chemicals during intrusive activities, if applicable.
- Any munitions debris or scrap found will be collected and managed for proper disposal following DoD requirements.
- Any other necessary resources needed to achieve the defined performance objectives of this PWS.

8.2 Contractor's Guarantee

For the purposes of this PWS, the following definitions apply. The "Project Price" for each site (MRS) identified in this PWS will be equal to the approved proposed price for completion of performance objectives, the payment of which will be tied to one or more project milestones. The Contractor guarantees to complete and meet all of the performance objectives outlined in this PWS for all sites on the FUDS property at the Project Price.

8.3 Certification and Approval of Project Milestones and Deliverables

The COR will perform contract management, inspection, oversight, review, and approval activities. Certification and approval of project milestones by the COR is necessary before distribution of financing payments. Certification by the Army is also contingent upon the Contractor performing in accordance with the terms and conditions of the contract for this work, this PWS, and all amendments.

Representatives of the Army and the Contractor will have a conference with the COR in a manner and at a time agreed to by all parties after receipt of each status report to:

- Formally review the quantity and quality of services;
- Inspect work for compliance with this PWS, the associated Contractor's final proposal, and project documentation;
- Accept or reject milestones and deliverables completed since the previous review; and
- Prepare, approve and submit DD Form 250 “Material Inspection and Receiving Report” for financing payments in accordance with milestone completions and approvals to the COR.

8.4 Government Rights

The Army has unlimited rights to all documents/material produced under this contract. All documents and materials, to include the source codes of any software, produced under this contract shall be Army owned and are property of the Army with all rights and privileges of ownership/copyright belonging exclusively to the Army. These documents and materials cannot be used or sold by the Contractor without written permission from the KO. All materials supplied to the Army shall be the sole property of the Army and cannot be used for any other purpose. This right does not abrogate any other Army rights under the applicable Data Rights clauses.

8.5 Stop Work

Government personnel have the authority and responsibility to stop work immediately if the work is considered to be a serious threat to the safety or health of workers, other personnel, or to the environment. Authorized

Government personnel include, but are not limited to, Government OE Safety Specialists, FUDS property safety officers, and command personnel with responsibility for overall FUDS property operations. When work is stopped due to a hazard/threat to worker safety, health, or the environment, the situation and resolution must be documented and submitted to the KO immediately. Work must be stopped whenever chemical and biological warfare agents or radiological materials are discovered. In addition, the KO is the only one who has the authority to temporarily stop work on a project following a 24-hour (one working day) written notification to the Contractor. Stop work notices may be related to nonconformance to project specifications, lack of performance by the Contractor, financial considerations, funding considerations, and other circumstances outlined in the contract. Stop work notices may also be related to security levels that could prevent access to the FUDS property during a time of national crisis.

8.6 Environmental Responsibility Considerations

The Army will retain responsibility for any assessed natural resource damages that are attributed to historic releases of hazardous substances (prior to contract with the Contractor) and any injuries that are necessary and incidental to the reasonable implementation of a selected response or remedial action. The Contractor shall be responsible for any/all additional natural resource injuries and associated natural resource damages claims brought as a result of its actions (e.g. release of hazardous substance or unreasonable disturbance of natural resources as a result of construction activities).

The Army will retain all responsibility for third party liability for CWM or radiological material that are either targeted for or may be discovered during the course of remediation.

Response cost claims, property damage and personal injury claims brought due to contamination and hazardous substance releases that have occurred historically (prior to contract with the Contractor) and are not due to Contractor remediation activities are excluded from Contractor responsibility. The Contractor shall be responsible for and indemnify the Army for:

- Any response cost claims for any environmental remediation services which the Contractor has assumed responsibility for under this PWS;
- All costs associated with correction of a failure of any remedy implemented or operated and maintained by the Contractor to the extent such failure was caused by the willful or negligent acts or omissions of the Contractor in the course of performing the environmental services;
- All personal injury or property damage claims to the extent caused by the acts or omissions of the Contractor in the course of performing the environmental services;
- All natural resource damages pursuant to 42 U.S.C. Section 9607(a)(4)(C), to the extent that such damages were caused or contributed to by the actions of the Contractor or its successors in interest; and
- All costs associated with or arising from any negligent acts or omissions or willful misconduct of the Contractor in the course of performing the environmental services or implementing remedial actions.

8.7 Inspections

The Army technical experts will independently review Contractor work to ensure compliance with all applicable requirements.

Any service or submittal performed that does not meet Task Order requirements shall be corrected or re-performed by the Contractor and at no additional cost to the Government. Corrective action must be certified and approved by the COR. If the contractor performs any task unsatisfactorily and all defects are not corrected, the Government reserves the right to terminate the Task Order for default. In addition, the Government reserves the rights under

FAR clause 52.246-4, Inspection of Services – Fixed Price, for further remedies concerning a Contractor's failure to perform in conformance with contract requirements.

8.8 Organizational Conflicts of Interest

8.8.1 Disclosure

The Contractor shall provide a disclosure statement with its proposal, which concisely describes all relevant facts concerning any past or present organizational conflicts of interest relating to the work in each PWS. In the same statement, the Contractor shall provide the information required in the following paragraph to assure the Government that the conflicts of interest have been mitigated and/or neutralized to the maximum extent possible. If a conflict of interest is discovered after contract award, the Contracting Officer will make a decision whether to terminate or rescind the PWS and/or contract at that time.

8.8.2 Potential Conflicts of Interest

This request for proposals is open to any offeror to compete as a prime contractor, subcontractor or in any teaming arrangement. In order to avoid any organizational conflicts of interest, or even the appearance of any organizational conflicts of interest, any contractor performing environmental services work at the FUDS property under each contract will need to avoid, neutralize and/or mitigate - prior to contract award - significant potential conflicts of interest that may prejudice effective competition. The KO has determined that at a minimum contractors currently performing work on the identified FUDS property under each contract must ensure that all data pertaining to contamination at the sites compiled by or in the possession of such contractors shall be made available to all potential contractors in a timely fashion to the maximum extent possible by providing such data in to a data depository.

8.9 Antiterrorism / Operations Security

All contractor employees, to include subcontractor employees, requiring access to Army installations, facilities and controlled access areas shall complete AT (Anti-Terrorism) Level I awareness training within 30 calendar days after contract start date or effective date of incorporation of this requirement into the contract, whichever is applicable. The contractor shall submit certificates of completion for each affected contractor employee and subcontractor employee, to the COR within 5 calendar days after completion of training by all employees and subcontractor personnel. AT Level I awareness training is available at the following website: https://atlevel1.dtic.mil/at.

The contractor and all associated sub-contractors shall brief all employees on the local iWATCH, Corps Watch, or See Something, Say Something program (training standards provided by the requiring activity ATO). This locally developed training will be used to inform employees of the types of behavior to watch for and instruct employees to report suspicious activity to the COR. This training shall be completed within 30 calendar days of contract award and within 30 calendar days of new employees commencing performance with the results reported to the COR NLT 5 calendar days after contract award."

The Contractor must pre-screen Candidates using the E-verify Program http://www.dhs.gov/E-Verify) website to meet the established employment eligibility requirements. The Vendor must ensure that the Candidate has two valid forms of Government issued identification prior to ensure the correct information is entered into the E-verify system. An initial list of verified/eligible Candidates must be provided to the COR no later than 3 business days after the initial contract award."

8.10 Travel

Travel to/from the FUDS property and to other CONUS locations (locations within the continental United States) for such purposes as to attend meetings, briefings and/or presentations may be required incidental to this task order, the costs for which shall be included in the total price for the PWS.

8.11 Performance and Payment Bonds
In accordance with the base contract, the Contractor:
☒ is NOT required to furnish Performance and Payment Bonds on this PWS.
☐ is required to furnish Performance and Payment Bonds on this PWS in accordance with the following:

8.12 Warranty
In accordance with the base contract, the Contractor:
☒ is NOT required to provide a 5-year warranty for each site as specified in this PWS.
☐ is required to provide a 5-year warranty for each site as specified in this PWS.

9.0 Manpower and Monthly Progress Reporting Requirements

9.1 General
The Office of the Assistant Secretary of the Army (Manpower & Reserve Affairs) operates and maintains a secure Army data collection site where the contractor will report all contractor manpower (including sub-contractor manpower) required for performance of this contract. The contractor is required to completely fill in all information in the format using the following address: https://contractormanpower.army.pentagon.mil <https://contractormanpower.army.pentagon.mil/>.

The required information includes: (1) Contracting Office, Contracting Officer, Contracting Officer's Technical Representative; (2) Contract number, including task and delivery order number; (3) Beginning and ending dates covered by the reporting period; (4) Contractor name, address, phone number, e-mail address, identity of contractor employee entering data; (5) Estimated direct labor hours (including sub-contractors); (6) Estimated direct labor dollars paid this reporting period (including sub-contractors); (7) Total payments (including sub-contractors); (8) Predominant Federal Service Code (FSC) reflecting services provided by contractor (and separate predominant FSC for each sub-contractor if different); (9) Estimated data collection cost; (10) Organizational title associated with the Unit Identification Code (UIC) for the Army Requiring Activity (the Army Requiring Activity is responsible for providing the contractor with its UIC for the purposes of reporting this information); (11) Locations where the contractor and sub-contractors perform the work (specified by zip code in the United States and nearest city, country, when in an overseas location, using standardized nomenclature provided on the web site); (12) Presence of deployment or contingency contract language; and (13) Number of contractor and sub-contractor employees deployed in theater this reporting period (by country). As part of its submission, the contractor shall also provide the estimated total cost (if any) incurred to comply with this reporting requirement. Reporting period shall be the period of performance not to exceed 12 months ending 30 September of each Government fiscal year and must be reported by 31 October of each calendar year. Contractors may use the direct XML data transfer to the database server or fill in the fields on the website. The XML direct transfer is a format for transferring files from a contractor's systems to the secure web site without the need for separate data entries for each required data element at the web site. The specific formats for the XML direct transfer may be downloaded from the web site.

10.0 Monthly Status Reports

The contractor shall submit by the 10th day of each month a monthly progress report summarizing activities of the preceding month (if at least 15 days of contract performance occurred in that month) and planned activities for the following month. The report shall be a concise summary and include at a minimum, the following information:

(1) Contracting Office, Contracting Officer, Contracting Officer's Representative;
(2) Contract number, including task and delivery order number;
(3) Beginning and ending dates covered by the report;
(4) Date of the report;
(5) Contract completion date;
(6) Contractor name, address, phone number, e-mail address, identity of contractor employee entering data;
(7) Summary of accomplishments for the report month and planned accomplishments for the following month;
(8) Indicate whether you are on or off schedule; reason for delay if applicable.
(9) Problems encountered during the period. Problems resolved or still outstanding. Corrective action, if applicable.
(10) Safety reporting including field exposure hours and recordable and/or reportable accidents;
(11) Record of deliverables submitted;
(12) Record of communication, correspondence, and invoices;
(13) Estimate of percentage complete for each task and overall percentage complete;
(14) Personnel changes, and,
(15) If applicable an updated network analysis schedule.
Reports shall be submitted to the COR in hard copy as well as via email. Email attachments, if any, shall be in Adobe pdf or MS Word format only. Email submittals shall include the project manager and emdc.admin@usace.army.mil on the cc line. The subject of the email shall be the contract number with task order followed by "Monthly Progress Report" followed by the year and month of the report (for example "W912DR-99-D-9999 9999 Monthly Progress Report YYYY MM").

11.0 Method of Payment

The original invoice shall be submitted on ENGINEER (ENG) Form 93 (Mar 14) by the Contractor to:

U.S. Army Corps of Engineers
ATTN: CENAB-ENE-C
2 Hopkins Pl
Baltimore, MD 21201
Phone: 410-962-6735

A copy of each invoice will be emailed to the COR. Each invoice will be audited by the COR to ensure that sufficient progress has been made to support payment. Each invoice shall indicate the percentage of the total delivery order represented by the invoice, as well as an estimation of the percentage complete of the particular phase of the project represented by that invoice. The total cumulative amount shall not exceed the percentage or stage of work that has been completed on this study.

12.0 Contracting Officer's Representative [to be inserted upon issuance of contract]

Name: TBD
Organization: U.S. Army Corps of Engineers
Address: 2 Hopkins Pl
City, State, Zip Code: Baltimore, MD 21201
Telephone: 410-962-TBD
Facsimile: 410-962-2318
Email: TBD

Attachment A: Reference Documents

The Army believes that documentation provided with the solicitation represents the most recent and appropriate documentation available for Suffolk County AAF FUDS and sites identified in this contract. The Contractor is solely responsible for reviewing all available information and forming their independent, professional conclusions/interpretation of site conditions and requirements to meet the objectives of this contract. This information is not intended as a substitute for complete analysis of technical data available, nor is it intended to be a guide on how the Contractor should address achievement of the performance objectives/standards.

Specific documents may be made available following a request to the Contracting Officer, if the documentation can be distributed in a timely manner. Electronic format is not guaranteed.

There will be sixty-four (64) site specific project documents that will be provided in a zip file titled SUFFOLK_CO_AAF_PROJECT_REFERENCE_DOCUMENTS.zip via the DoD Safe File Transfer System. A separate index of files (in Excel format) will also be included in this zip file.

In addition to the site specific project documents, the following General Reference materials will be provided in a zip file titled GENERAL_REFERENCE_DOCUMENTS.zip via the DoD Safe File Transfer System:

GENERAL REFERENCE DOCUMENTS:

TITLE	AUTHOR	DATE
Memorandum: Advanced Geophysical Classification (AGC) Implementation at Formerly Used Defense Sites (FUDS) MMRP Projects	USACE	Apr 2017
FUDSCHEM User Manual	USACE	Nov 2016
New England District FUDSCHEM Data Management Plan	USACE	May 2016
Memorandum: Trial Period Extension for Risk Management Methodology at FUDS MMRP Projects	USACE	Feb 2019
DoD Manual 4715.20 - Defense Environmental Restoration Program (DERP) Management	DoD	9-Mar-12
ER 200-3-1 - Formerly Used Defenses Sites (FUDS) Program Policy	USACE	10-May-04
EM 200-1-15 - Technical Guidance for Military Munitions Response Actions	USACE	30-Oct-~~15~~18
Munitions Response QAPP Toolkit Module 1: Remedial Investigation/Feasibility Study	DoD/EPA	Dec-18

Attachment B

Site-specific Government Expectations and Assumptions

- ~~The Suffolk County Bombing and Gunnery Range MRS includes some residential and commercial properties within the MRS, however the government does not anticipate that investigation of the residential and commercial properties will be required to meet the objectives of the RI. The contractor should assume that field investigation can be limited to undeveloped portions of the MRS, and risk conclusions for the residential and commercial properties can be determined based on investigations of the surrounding undeveloped property. The contractor should assume that the residential and commercial properties within the MRS will be included in the Feasibility Study, Proposed Plan, and Decision Document.~~

- ~~An OPTION has been identified in the event that the actual MRS boundaries extend beyond the current identified MRS boundaries. For the OPTION CLIN, the contractor should provide a fixed unit price per acre for investigation of areas outside of the current MRS boundary. The fixed unit price should be for actual investigation coverage area. For example, it may be determined that we need 25 acres of digital geophysical mapping (DGM) coverage to investigate 500 acres of potential range area. The contractor should provide the unit price for actual acres of coverage (25 in this example). The not to exceed amount for this option is identified as 100 acres.~~

- USACE identified a revised investigation area that is larger than the current MRS boundary. Based on a review of historical information, the new investigation area has a total of 4,297 acres. See Worksheet #10 for further description of this investigation area.

Attachment C: List of Acronyms

AOC	Area of Concern
CAIS	Chemical Agent Identification Set
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
COR	Contracting Officer's Representative
CTT	Closed, Transferred, and Transferring
CWM	Chemical Warfare Materiel
DDESB	Department of Defense Explosives Safety Board
DMM	Discarded Military Munitions
DOD	Department of Defense
DPW	Department of Public Works
DQO	Data Quality Objective
ESP	Explosive Site Plans
ESS	Explosive Safety Submission
FAR	Federal Acquisition Regulation
GIS	Geographic Information System
HRR	Historical Records Review
HTRW	Hazardous, Toxic, and Radioactive Waste
IRA	Interim Removal Action
IRP	Installation Restoration Program
KO	Contracting Officer
LTM	Long-Term Management
MC	Munitions Constituents
MEC	Munitions and Explosives of Concern
MMRP	Military Munitions Response Program
MR	Munitions Response
NCP	National Oil and Hazardous Substances Contingency Plan
NELAP	National Environmental Laboratory Accreditation Program
OSHA	Occupational Safety and Health Administration
PBA	Performance-Based Acquisition
PMP	Project Management Plan
POC	Point of Contact
PPE	Personal Protective Equipment
PWS	Performance Work Statement
QA	Quality Assurance
QIPR	Quarterly In Progress Review
RAB	Restoration Advisory Board
RCRA	Resource Conservation and Recovery Act
RI/FS	Remedial Investigation/Feasibility Study
SARA	Superfund Amendments and Reauthorization Act
SC	Site Close out
SI	Site Inspection
SSHP	Site Safety and Health Plan
USACE	United States Army Corps of Engineers
USAEC	United States Army Environmental Center
USATCES	U.S. Army Technical Center for Explosives Safety
USDA	United States Department of Agriculture
USEPA	United States Environmental Protection Agency
UXO	Unexploded Ordnance

Attachment D: Definitions

Activity-Based Schedule: Activities and milestones defined at the detail level and logically sequenced to support, and manage completion of the performance objectives.

Contractor's Project Costs: Costs incurred by the Contractor (including costs covered by insurance and the PMP) in executing the work required to achieve the performance objectives identified in the PWS for all sites identified in this contract/task order.

Chemical Warfare Materiel (CWM): An item configured as a munitions containing a chemical substance that is intended to kill, seriously injure, or incapacitate a person through its physiological effects. CWM also includes V- and G- services nerve agent, H-series blister agent, and lewisite in other than munitions configurations. Due to their hazards, prevalence, and military-unique application, Chemical Agent Identification Sets (CAIS) are also considered CWM. CWM does not include riot control agency, chemical herbicides, smoke and flame producing items, or soil, water, debris, or other media contaminated with chemical agent.

Deliverables: Documentation or data that support the completion of milestones or achievement of the performance objectives identified in this PWS.

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.

Explosive Ordnance Disposal (EOD) – The detection, identification, on-site evaluation, rendering safe, recovery, and final disposal of unexploded explosive ordnance. It may also include explosive ordnance that has become hazardous by damage or deterioration.

Milestones: Significant events or activities that occur in the course of the Contractor achieving the performance objectives identified in this PWS.

Military Munitions (MM) – All ammunition products and components produced or used by or for the DoD or the U.S. Armed Services for national defense and security, including MM under the control of the DoD, the U.S. Coast Guard, the U.S. Department of Energy, and National Guard personnel. The term military munitions includes: confined gaseous, liquid, and solid propellants, explosives, pyrotechnics, chemical and riot control agents, smokes, and incendiaries used by DoD components, 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. MM do not include wholly inert items, improvised explosive devices, and nuclear weapons, nuclear devices, and nuclear components thereof. However, the term does include non-nuclear components of nuclear devices, managed under DOE's nuclear weapons program, after all required sanitization operations under the Atomic Energy Act of 1954, as amended, have been completed.
Munitions Constituents (MC): Any materials originating from unexploded ordnance, DMM, or other military munitions, including explosive and non-explosive materials, and emission, degradation, or breakdown elements of such ordnance or munitions.

Munitions Debris (MD) – Remnants of munitions (e.g., fragments, penetrators, projectiles, shell casings, links, fins) remaining after munitions use, demilitarization, or disposal.

Munitions and Explosives of Concern (MEC): This term, which distinguishes specific categories of military munitions that may pose unique explosives safety risks, means UXO, as defined in 10 .SC 101(e)(5)(A) through (C);

DMM, as defined in 10 USC 2710(e)(2); or MC (e.g., TNT, RDX), as defined in 10 USC 2710(e)(3), present in high enough concentrations to pose an explosive hazard.

Munitions response – A response action, including investigation, removal actions, and remedial actions, to address the explosives safety, human health, and/or environmental risks presented by munitions and explosives of concern (MEC) and/or MC.

PMP Documents: The original PMP (including project schedule), revisions, and status reports.

Project Documents (CERCLA): Documentation and data required by CERCLA remediation. These documents include the additional site plans referenced in **Section 6.0** of this PWS.

Project Price: The approved proposed price for achieving completion of remediation services in accordance with the PWS, the payment of which will be tied to one or more project milestones. The Project Price does not include the cost of the PMP, insurance premiums or surplus line taxes, if applicable.

Project-related information: All previous environmental restoration documentation of a technical nature developed by the Army and previous Army contractors and subcontractors during their work at the sites specified in this PWS, and all the documentation developed by the Contractor in order to achieve the performance objectives specified in this PWS.

Response Complete (RC): The remedy is in place and the required remedial action-operations (RA-O) have been completed. If there is no RA(O) phase and all response action objectives have been achieved and documented, then the remedial action-construction end date will also be the RC date.

Site Close-Out: Site Close-Out signifies when the Army has completed active management and monitoring at an environmental cleanup site, no additional environmental cleanup funds will be expended at the site and the Army has obtained regulator concurrence. For practical purposes, Site Close-Out occurs when cleanup goals have been achieved that allow unrestricted use of the property (i.e., no further LTM, including institutional controls, is required). Site Close-Out may include, but not be limited to, the dismantling, removal, recycling, reclamation and/or disposal of all remedial activity systems and ancillary equipment above and underground to return the site to its natural state.

Unforeseen environmental issues: include unknown and/or varied concentrations of contaminants at cleanup sites (off-FUDS property areas included) identified in this PWS, but not unknown sites (e.g., sites not identified in this PWS). For sites addressed under the MMRP, unknown contaminants will be limited to MC and those chemicals reasonable associated with the identified munitions and munitions related activities.

*Unexploded ordnance (UXO)**:*** Military munitions that have been primed, fuzed, armed, or otherwise prepared for action; have been fired, dropped, launched, projected, or placed in such a manner as to constitute a hazard to operations, installations, personnel, or material; and remain unexploded either by malfunction, design, or any other cause.