Final

PBA 2008 Supplemental Investigation Sampling and Analysis Plan Addendum No.1

Ravenna Army Ammunition Plant
Ravenna, Ohio

December 23, 2009

Contract No. W912QR-04-D-0028
Delivery Order No. 0001

Prepared for:

United States Army Corps of Engineers
Louisville District

Prepared by:

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1526.20091223.001

REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 0704-0188

1. REPORT DATE *(DD-MM-YYYY)*	2. REPORT TYPE	3. DATES COVERED *(From - To)*
23-12-2009	Technical	December 2009

4. TITLE AND SUBTITLE
Final
PBA 2008 Supplemental Investigation SAP Addendum
Ravenna Army Ammunition Plant
Ravenna, Ohio

5a. CONTRACT NUMBER W912QR-04-D-0028
5b. GRANT NUMBER NA
5c. PROGRAM ELEMENT NUMBER NA

6. AUTHOR(S)
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5d. PROJECT NUMBER Delivery Order No. 0001
5e. TASK NUMBER NA
5f. WORK UNIT NUMBER NA

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)
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8. PERFORMING ORGANIZATION REPORT NUMBER
1526.20091223.001

9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)
USACE - Louisville District
U.S. Army Corps of Engineers
600 Martin Luther King Jr., Place
PO Box 59
Louisville, Kentucky 40202-0059

10. SPONSOR/MONITOR'S ACRONYM(S)
NA

11. SPONSOR/MONITOR'S REPORT NUMBER(S)
NA

12. DISTRIBUTION/AVAILABILITY STATEMENT
Reference distribution page.

13. SUPPLEMENTARY NOTES
None.

14. ABSTRACT
This sampling and analysis plan outlines the field activities that will be implemented to obtain data in support of the 2008 Performance-Based Acquisition for Environmental Investigation and Remediation at the Ravenna Army Ammunition Plant (RVAAP). This plan describes soil, sediment, surface water, and groundwater sampling that will be performed at seventeen areas of concern (AOCs) at RVAAP. Results and data obtained from the sampling activities will be incorporated into remedial investigation reports and feasibility studies for the AOCs.

15. SUBJECT TERMS
sampling and analysis, data quality, quality control, quality assurance, soil, sediment, groundwater, monitoring wells

16. SECURITY CLASSIFICATION OF: a. REPORT	b. ABSTRACT	c. THIS PAGE	17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON	19b. TELEPHONE NUMBER *(Include area code)*
NA	NA	NA	NA	449	NA	NA

CONTRACTOR STATEMENT OF INDEPENDENT TECHNICAL REVIEW

Science Applications International Corporation (SAIC) has completed the Final PBA 2008 Supplemental Investigation Sampling and Analysis Plan Addendum No. 1 at the Ravenna Army Ammunition Plant, Ravenna, Ohio. Notice is hereby given that an independent technical review has been conducted that is appropriate to the level of risk and complexity inherent in the project. During the independent technical review, compliance with established policy principles and procedures, utilizing justified and valid assumptions, was verified. This included review of data quality objectives; technical assumptions; methods, procedures, and materials to be used; the appropriateness of data used and level of data obtained; and reasonableness of the results, including whether the product meets the customer's needs consistent with law and existing USACE policy.

Jennifer Loerch
Study/Design Team Leader

12/18/09
Date

W. Kevin Jago, P.G.
Independent Technical Review Team Leader

12-18-09
Date

Significant concerns and the explanation of the resolution are as follows:

Internal SAIC Independent Technical Review comments are recorded on a Document Review Record per SAIC quality assurance procedure QAAP 3.1. This Document Review Record is maintained in the project file. Changes to the report addressing the comments have been verified by the Study/Design Team Leader. As noted above, all concerns resulting from independent technical review of the project have been considered.

Scott Armstrong
Principal w/ A-E firm

Dec. 18, 2009
Date

Final

PBA 2008 Supplemental Investigation Sampling and Analysis Plan Addendum No. 1

Volume One - Main Report

Ravenna Army Ammunition Plant
Ravenna, Ohio

Contract No. W912QR-04-D-0028
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for the
Final PBA 2008 Supplemental Investigation Sampling and Analysis Plan Addendum No. 1
Ravenna Army Ammunition Plant
Ravenna, Ohio

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NGB = National Guard Bureau
Ohio EPA-NEDO = Ohio Environmental Protection Agency-Northeast District Office
Ohio EPA-SWDO = Ohio Environmental Protection Agency-Southwest District Office
OHARNG = Ohio Army National Guard
RVAAP = Ravenna Army Ammunition Plant
USACE = United States Army Corps of Engineers
USAEC = United States Army Environmental Command
REIMS = Ravenna Environmental Information Management System
SAIC = Science Applications International Corporation

Part I

Final

Field Sampling Plan
for the
PBA 2008 Supplemental Investigation Sampling and Analysis Plan
Addendum No. 1

Ravenna Army Ammunition Plant
Ravenna, Ohio

GSA Contract No. W912QR-04-D-0028
Delivery Order No. 0001

Prepared for:
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ACRONYMS AND ABBREVIATIONS

ACM	Asbestos-Containing Material
AOC	Area of Concern
BGS	Below Ground Surface
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CIH	Certified Industrial Hygienist
COPC	Chemical of Potential Concern
CSP	Certified Safety Professional
CUG	Cleanup Goal
DFFO	Director's Final Findings and Orders
DoD	U.S. Department of Defense
DQO	Data Quality Objective
FS	Feasibility Study
FSP	Field Sampling Plan
FWCUG	Facility-Wide Cleanup Goal
FWGWMP	Facility-Wide Groundwater Monitoring Program
HGM	Hydrogeomorphic
HI	Hazard Index
IDW	Investigation-Derived Waste
IRP	Installation Restoration Program
K_d	Distribution Coefficient
MARC	Multiple Award Remediation Contract
MCL	Maximum Contaminant Level
MEC	Munitions and Explosives of Concern
MI	Multi-increment
MRS	Munitions Response Site
NACA	National Advisory Committee on Aeronautics
NADB	National Archeological Data Base
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NGB	National Guard Bureau
NTU	Nephelometric Turbidity Units
OAC	Ohio Administrative Code
OE	Ordnance and Explosives
OHARNG	Ohio Army National Guard
Ohio EPA	Ohio Environmental Protection Agency
ORAM	Ohio Rapid Assessment Method
OSC	Operations Support Command
OVA	Organic Vapor Analyzer
PAH	Polycyclic Aromatic Hydrocarbon
PBA	Performance-Based Acquisition
PCB	Polychlorinated Biphenyl
PG	Professional Geologist

ACRONYMS AND ABBREVIATIONS (CONTINUED)

PID	Photoionization Detector
PMP	Project Management Plan
PP	Proposed Plan
PPE	Personal Protective Equipment
PRG	Preliminary Remediation Goal
QA	Quality Assurance
QAPP	Quality Assurance Project Plan
QC	Quality Control
RCRA	Resource Conservation and Recovery Act
RI	Remedial Investigation
ROD	Record of Decision
RRSE	Relative Risk Site Evaluation
RVAAP	Ravenna Army Ammunition Plant
SAIC	Science Applications International Corporation
SAP	Sampling and Analysis Plan
SESOIL	Seasonal Soil Compartment
SLERA	Screening Level Ecological Risk Assessment
SVOC	Semivolatile Organic Compound
TAL	Target Analyte List
TBD	To Be Determined
TCE	Trichloroethene
TCLP	Toxicity Characteristic Leaching Procedure
TNT	2,4,6-trinitrotoluene
TPH	Total Petroleum Hydrocarbons
UCL	Upper Confidence Limit
USACHPPM	United States Army Center for Health Promotion and Preventive Medicine
USACE	U.S. Army Corps of Engineers
USAEHA	U.S. Army Environmental Hygiene Agency
USATHAMA	U.S. Army Toxic and Hazardous Materials Agency
USEPA	United States Environmental Protection Agency
USGS	U.S. Geological Survey
VOC	Volatile Organic Compound
VSP	Vitrified Clay Sewer Pipe
WBG	Winklepeck Burning Grounds
WOE	Weight-of-Evidence

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1.0 PROJECT DESCRIPTION

1.1 INTRODUCTION

Science Applications International Corporation (SAIC) has been contracted by the United States Army Corps of Engineers (USACE) Louisville District to execute the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) process and ultimately complete an approved Record of Decision (ROD) for specified environmental media at 17 areas of concern (AOCs) at the Ravenna Army Ammunition Plant (RVAAP) in Ravenna, Ohio (see Figures 1-1 and 1-2). The 17 AOCs to be addressed in this Performance Based Acquisition (PBA) 2008 Supplemental Investigation Sampling and Analysis Plan (SAP) Addendum No. 1 (herein referred to as this SAP Addendum) are as follows:

- RVAAP-06: C-Block Quarry;
- RVAAP-12: Load Line 12;
- RVAAP-13: Building 1200;
- RVAAP-19: Landfill North of Winklepeck Burning Grounds (WBG);
- RVAAP-29: Upper and Lower Cobbs Ponds;
- RVAAP-33: Load Line 6;
- RVAAP-38: National Advisory Committee on Aeronautics (NACA) Test Area;
- RVAAP-39: Load Line 5;
- RVAAP-40: Load Line 7;
- RVAAP-41: Load Line 8;
- RVAAP-42: Load Line 9;
- RVAAP-43: Load Line 10;
- RVAAP-44: Load Line 11;
- RVAAP-45: Wet Storage Area;
- RVAAP-46: Buildings F-15 and F-16;
- RVAAP-48: Anchor Test Area; and
- RVAAP-50: Atlas Scrap Yard

The primary objectives of this SAP Addendum are:

1. To conduct surface and subsurface soil and groundwater sampling to define nature and extent of contamination and finalize the Remedial Investigation (RI) for each AOC.

2. To conduct surface water and wet sediment sampling to define the nature and extent of contamination to the point of confluence (the point at which streams merge or flow together, and where any chemical contribution from each can be accounted).

3. To collect data to support the Feasibility Study (FS) for each AOC.

The media addressed in this SAP Addendum include soil (surface and subsurface), surface water, wet sediment, and groundwater at all AOCs except Load Line 12. The only media addressed in this SAP Addendum at Load Line 12 are surface water and wet sediment. More details about the media are provided in Section 3.1. Throughout this SAP Addendum, the term "surface soil" is inclusive of "dry sediment," which is defined as:

> *Unconsolidated inorganic and organic material on the surface of the ground that occasionally may be covered with water, usually following a precipitation event. Dry sediments are not covered with water for extended periods and typically are dry within seven days. Dry sediments do not function as permanent habitat for aquatic organisms although they may serve as a natural medium for the growth of terrestrial organisms. These sediments are essentially soil that due to its location may be covered with water occasionally.*

This work is being performed under a firm fixed price basis in accordance with USACE Louisville District, Multiple Award Remediation Contract (MARC) W912QR-04-D-0028, Delivery Order No. 0001, under a PBA. Planning and performance of all elements of this PBA will be in accordance with the requirements of the Ohio Environmental Protection Agency (Ohio EPA) Director's Final Findings and Orders (DFFO) for RVAAP, dated June 10, 2004 (Ohio EPA 2004). The elements of work included in this PBA are to develop a RI/FS, Proposed Plan (PP), ROD, and a remedy for each AOC at the RVAAP in conformance with CERCLA and the National Contingency Plan (NCP).

1.2 FACILITY DESCRIPTION AND HISTORY

When the RVAAP Installation Restoration Program (IRP) began in 1989, the RVAAP was identified as a 21,419-acre installation. The property boundary was resurveyed by the Ohio Army National Guard (OHARNG) over a two year period (2002 and 2003), and the actual total acreage of the property was found to be 21,683.289 acres. As of February 2006, a total of 20,403 acres of the former 21,683 acre RVAAP have been transferred to the National Guard Bureau (NGB) and subsequently licensed to the OHARNG for use as a military training site, the Camp Ravenna Joint Military Training Center (Camp Ravenna). The current RVAAP consists of 1,280 acres in various parcels throughout the OHARNG Camp Ravenna.

Camp Ravenna is located in northeastern Ohio within Portage County and Trumbull County, approximately 3 miles (4.8 km) east-northeast of the city of Ravenna and approximately 1 mile (1.6 km) northwest of the city of Newton Falls. The RVAAP portions of the property are solely located within Portage County. Camp Ravenna is a parcel of property approximately 11 miles (17.7 km) long and 3.5 miles (5.6 km) wide bounded by State Route 5, the Michael J. Kirwan Reservoir, and the CSX System Railroad on the south; Garret, McCormick, and Berry roads on the west; the Norfolk Southern Railroad on the north; and State Route 534 on the east (see Figures 2-1 and 2-2). Camp Ravenna is surrounded by several communities: Windham on the north; Garrettsville 6 miles (9.6 km) to the northwest; Newton Falls 1 mile (1.6 km) to the southeast; Charlestown to the southwest; and Wayland 3 miles (4.8 km) to the south.

The entire 21,683-acre parcel was an industrial facility that was government-owned and contractor-operated when the RVAAP was operational (Camp Ravenna did not exist at that time). The RVAAP IRP encompasses investigation and cleanup of past activities over the entire 21,683 acres of the former RVAAP; therefore, references to the RVAAP in this document indicate the historical extent of the RVAAP, which is inclusive of the combined acreages of the current Camp Ravenna and RVAAP, unless otherwise specifically stated.

Industrial operations at the former RVAAP consisted of 12 munitions-assembly facilities referred to as “load lines.” Load Lines 1 through 4 were used to melt and load 2,4,6-trinitrotoluene (TNT) and Composition B into large-caliber shells and bombs. The operations on the load lines produced explosive dust, spills, and vapors that collected on the floors and walls of each building. Periodically, the floors and walls were cleaned with water and steam. Following cleaning, the waste water, containing TNT and Composition B, was known as “pink water” for its characteristic color. Pink water was collected in concrete holding tanks, filtered, and pumped into unlined ditches for transport to earthen settling ponds. Load Lines 5 through 11 were used to manufacture fuzes, primers, and boosters. Potential contaminants in these load lines include lead compounds, mercury compounds, and explosives. From 1946 to 1949, Load Line 12 was used to produce ammonium nitrate for explosives and fertilizers prior to use as a weapons demilitarization facility.

In 1950, the facility was placed in standby status and operations were limited to renovation, demilitarization, and normal maintenance of equipment, along with storage of munitions. Production activities were resumed from July 1954 to October 1957 and again from May 1968 to August 1972. In addition to production missions, various demilitarization activities were conducted at facilities constructed at Load Lines 1, 2, 3, and 12. Demilitarization activities included disassembly of munitions and explosives melt-out and recovery operations using hot water and steam processes. Periodic demilitarization of various munitions continued through 1992.

In addition to production and demilitarization activities at the load lines, other facilities at RVAAP include AOCs that were used for the burning, demolition, and testing of munitions. These burning and demolition grounds consist of large parcels of open space or abandoned quarries. Potential contaminants at these AOCs include explosives, propellants, metals, and waste oils. Other types of AOCs present at RVAAP include landfills, an aircraft fuel tank testing facility, and various general industrial support and maintenance facilities.

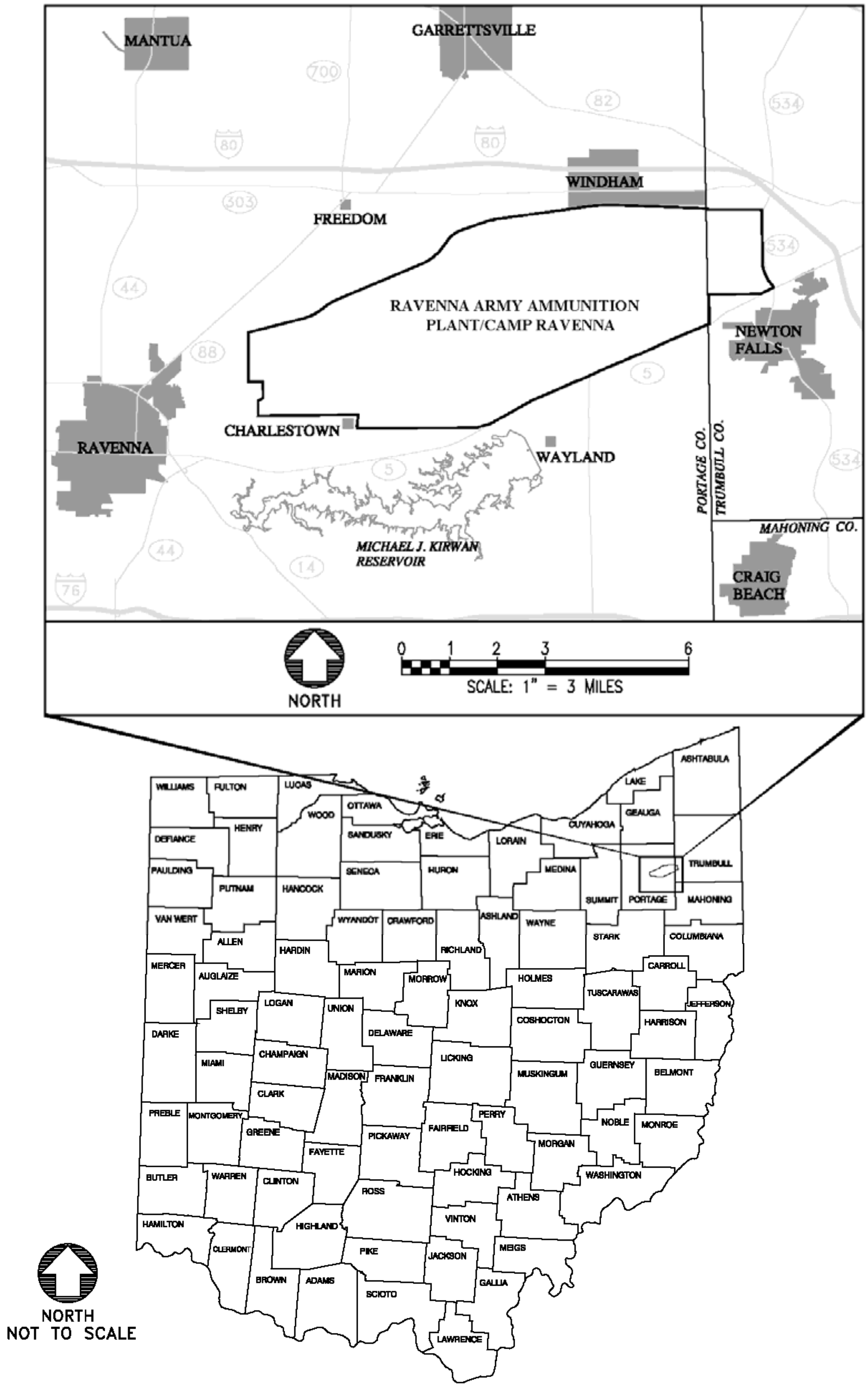

Figure 1-1. General Location and Orientation of the RVAAP/Camp Ravenna

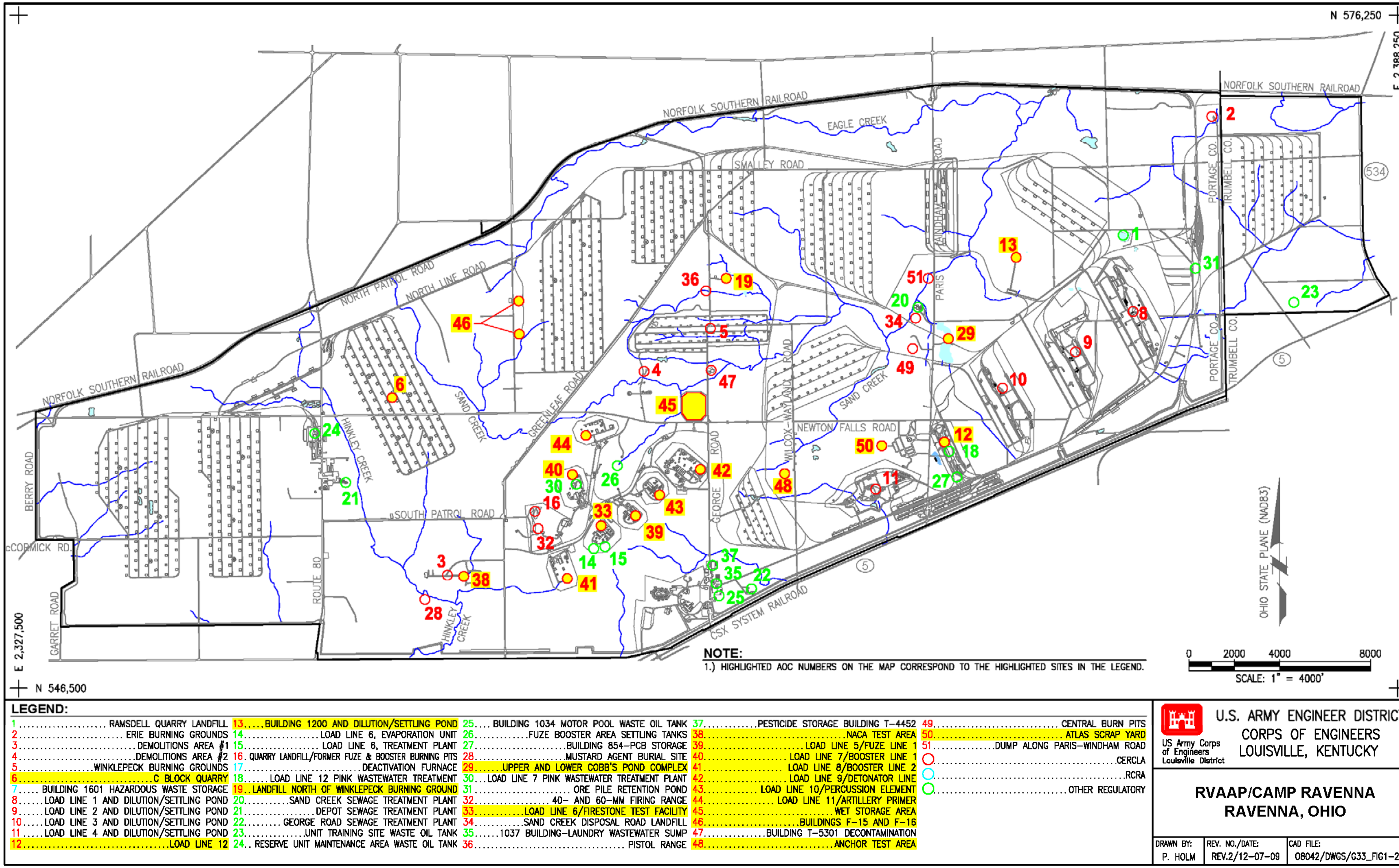

Figure 1-2. Location of 17 AOCs at RVAAP

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2.0 PROJECT ORGANIZATION

The overall project organization and responsibilities for the RVAAP 2008 PBA for Environmental Investigation and Remediation are presented in the Project Management Plan (PMP) (USACE 2008a). Key personnel and subcontractors implementing this SAP Addendum are listed in Table 2-1. The functional responsibilities of these key personnel are described in Section 2.0 of the Facility-Wide SAP.

Table 2-1. Project Organization for SAP Addendum

Position	Personnel
SAIC Project Manager	Kevin Jago, PG
SAIC Safety & Health Officer	Steve Davis, CIH, CSP
SAIC QA/QC Officer	Glen Cowart
SAIC Field Operations Manager	Heather Miller
Subcontractor Laboratory QA/QC Manager	Mark Loeb
SAIC Laboratory Coordinator	Jenny Vance
SAIC Field Personnel	TBD
Analytical Laboratory Services	White Water Associates/Test America
OE Avoidance Services	USA Environmental
Waste Disposal Services	The Environmental Quality Company

SAIC = Science Applications International Corporation
PG = Professional Geologist
CIH = Certified Industrial Hygienist
CSP = Certified Safety Professional
QA/QC = Quality Assurance/Quality Control
TBD = To Be Determined
OE = Ordnance and Explosives

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3.0 PROJECT SCOPE AND OBJECTIVES

3.1 SAMPLING AND ANALYSIS PLAN ADDENDUM SCOPE AND OBJECTIVES

The primary objectives of this SAP Addendum are:

1. To conduct surface and subsurface soil and groundwater sampling to define nature and extent of contamination and finalize the RI for each AOC.

2. To conduct surface water and wet sediment sampling to define the nature and extent of contamination to the point of confluence.

3. To collect data to support the FS for each AOC.

Each AOC has previously undergone at least one form of investigation (e.g., assessment, RI, characterization) to partially characterize the nature and extent of any potential contamination, as well as evaluate any associated human or ecological health risks. These investigations are summarized in Appendices A through Q. These previous sampling activities did not define the nature and extent of contamination; therefore, additional sampling will be performed. Investigation-specific objectives have been developed using the data quality objective (DQO) approach presented in the Facility-Wide SAP. The general DQOs and investigative approach for this SAP Addendum are discussed in Section 3.2; AOC-specific sampling objectives and designs are presented in Appendices A through Q, detailing the numbers, types, and locations of samples to be collected to accomplish these objectives.

The scope of this SAP Addendum includes activities to fully characterize and define the nature of extent of contamination in soil (surface [0 to 1 ft below ground surface (BGS)] and subsurface [1 to 13 ft BGS]), surface water, wet sediment, and groundwater for 16 of the 17 AOCs listed in Section 1.1. For Load Line 12, only surface water and wet sediment are addressed. Subsurface soil is defined as 1 to 13 ft bgs, as this is the range of soil depth to which a potential future receptor at RVAAP/Camp Ravenna may be exposed.

The implementation of this SAP Addendum also includes munitions and explosives of concern (MEC) clearance and avoidance to be performed by USA Environmental. MEC clearance and avoidance will be performed in accordance with the MEC Work Plan for the RVAAP 2008 PBA (USA Environmental 2009).

3.2 SAMPLING AND ANALYSIS PLAN ADDENDUM DATA QUALITY OBJECTIVES

3.2.1 General Investigation Decision Rules

The general decision rules applied to the investigation activities for all AOCs are presented for each media in the following sections. Each AOC is proceeding through the CERCLA process individually. Each AOC varies in regard to historic use, previous investigations, and data gaps. Therefore, the general decision rules are applied to each AOC individually to develop a specific sample design (provided in Appendices A through Q for each AOC).

3.2.2 Selection of Sampling Locations

For this SAP Addendum, the determination of the nature and extent of contamination is accomplished by comparing existing analytical data to chemical-specific screening criteria. The screening criteria used are the facility-wide cleanup goals (FWCUGs) developed in the Draft Facility-Wide Human Health Cleanup Goals Report for the RVAAP (USACE 2008b), herein referred to as the Draft FWCUG Report. The draft FWCUGs are subject to change as the Draft FWCUG Report is finalized. Therefore, revised or additional data comparisons for risk management decisions and evaluations may need to be conducted at a later point.

The chemical-specific FWCUGs at the 10^{-6} cancer risk level and non-carcinogenic risk Hazard Quotient (HQ) using the 0.1 risk value are the specific screening criteria used in this SAP Addendum. The FWCUGs were used to determine which analytes and which areas must be further evaluated to assess nature and extent of contamination. The use of the FWCUGs is consistent with guidance in USACE's Final RVAAP Position Paper for the Application and Use of Facility-Wide Human Health Cleanup Goals (USACE 2009b). The FWCUGs at these risk levels were developed in the Draft FWCUG Report for multiple receptors. In order to ensure the nature and extent of contamination is defined to the most restrictive future receptor/land use, the screening criterion for each chemical in each medium was the FWCUG with the least value for any of the receptors at these risk levels. It is assumed that the presence of concentrations at or less than their background value indicates the absence of contamination. If the screening criterion for an inorganic chemical was less than the background value, then the background value was used as the screening criterion for determining exceedances that need to be further investigated. The screening criteria values and their descriptions are presented in Table 3-1.

To ensure the full list of chemicals that might possibly be present at the AOCs are considered in the selection of sample locations, the chemical reduction process in Section 2.0 of USACE's Final RVAAP Position Paper for the Application and Use of Facility-Wide Human Health Cleanup Goals (USACE 2009b) was not completed on an AOC-specific basis at this phase. Instead, all chemicals detected in the existing data were compared to the screening criteria (FWCUGs). If an existing sample result exceeds the screening criteria for any of the chemicals listed in Table 3-1 and the exceedance is not currently bound (i.e., there is no sample less than the screening criteria to define the extent or source of contamination), then further extent delineation will be conducted during implementation of this SAP Addendum. The use of the term "exceedance" within this SAP Addendum refers to a sample result that is greater than the screening criteria presented in Table 3-1 for one or more chemicals. For groundwater, the maximum detected concentration at a well was used for the comparison against screening criteria.

If a sample result exceeded the screening criteria defined above, it was also compared to the FWCUG representing an HI of 1.0 or a Target Risk of 10^{-5} for the same receptor (from the Draft FWCUG

Report). This comparison was performed to facilitate the identification of potential source areas or "hot spots" that may require additional sampling specifically designed to refine the extent of a target source area. A comparatively small list of chemicals exceeded these FWCUGs (see Appendices A through Q).

In Appendices A through Q, which detail the AOC-specific sampling approaches, the FWCUGs representing an HI = 0.1 or Target Risk = 10^{-6} are referred to as the screening criteria, and the FWCUGs representing an HI = 1.0 or a Target Risk = 10^{-5} are referred to as the FWCUGs. While both sets of values are established as FWCUGs in the Draft FWCUG Report, distinguishing terms have been established in this SAP Addendum for ease of use based on the utilization of the values for the purpose of evaluating nature and extent.

3.2.3 Determination of AOC-Specific Chemicals of Potential Concern

Upon completion of data collection activities conducted as part of this SAP Addendum, all available chemical data, including newly acquired data, will be evaluated to determine chemicals of potential concern (COPCs) for each AOC. The process for determining AOC-specific COPCs will follow the procedures described in Section 2.0 of USACE's Final RVAAP Position Paper for the Application and Use of Facility-Wide Human Health Cleanup Goals (USACE 2009b), including the development of AOC-specific CUGs for additional chemicals if necessary.

3.2.4 Chemical Parameters to Be Analyzed

The chemical parameters to be analyzed at each AOC are presented in Appendices A through Q. Parameters were chosen based on the following criteria:

- Explosives will be analyzed in all samples.

- Soil and wet sediment samples will be analyzed for chemicals that have previously exceeded the screening criteria in a particular medium. For the purposes of determining analytical parameters, surface and subsurface soil are considered to be one medium. Therefore, an exceedance in surface soil would lead to the collection of that parameter suite in all surface and subsurface soil samples at that AOC.

- All surface water samples will be analyzed for the RVAAP full suite of parameters. The RVAAP full suite of parameters is listed in Table 2-1 of the Quality Assurance Project Plan (QAPP), Part II of this SAP Addendum.

- The RVAAP full suite of parameters will be analyzed for 10% or 15% of the soil and wet sediment samples (by medium) taken at each AOC. The determination of the 10% or 15% frequency was based on the previous sampling activities performed at each AOC. For AOCs that have undergone previous RIs (Landfill North of WBG; Upper and Lower Cobbs Ponds; Load Lines 6, 9, and 11; and NACA Test Area), 10% of the collected samples will be analyzed for the

RVAAP full suite. For AOCs not previously characterized extensively (C-Block Quarry; Load Lines 5, 7, 8, 10 and 12; Building 1200; Wet Storage Area; Buildings F-15/F-16; Anchor Test Area; and Atlas Scrap Yard), RVAAP full suite samples will be collected at a frequency of 15% to ensure adequate characterization of all chemicals.

- With the exception of Upper and Lower Cobbs Ponds, all of the SVOCs that exceeded screening criteria were polycyclic aromatic hydrocarbons (PAHs) (a subset of SVOC suite). Therefore, at AOCs where a PAH exceeded the screening criterion and no other SVOC exceeded screening criteria, all samples will be analyzed for PAHs and 10% or 15% will be analyzed for the RVAAP full suite of parameters (which includes all SVOCs).

- Groundwater will be analyzed for the RVAAP full suite of parameters.

Table 3-1. Draft Facility-Wide Cleanup Goals Used as Screening Criteria to Determine Exceedances[a]

Chemical[b] (mg/kg or mg/L)	Surface Soil	Type	Subsurface Soil	Type	Groundwater Unconsolidated[c]	Type	Groundwater Bedrock[c]	Type	Surface Water[d]	Type	Wet Sediment[e]	Type
Nitrate	12000	RFC	12000	RFC	1.7	RFC	1.7	RFC	25	RFC	None[f]	N/A
Aluminum	17700	BKG	19500	BKG	1	RFC	1	RFC	15	RFC	13900	BKG
Antimony	2.8	RFC	2.8	RFC	0.00039	RFC	0.00039	RFC	0.0049	RFC	2.8	RFC
Arsenic	15.4	BKG	19.8	BKG	0.0117	BKG	0.000056	RFA	0.0032	BKG	19.5	BKG
Barium	350	NGT	350	NGT	0.2	RFC	0.256	BKG	2.9	RFC	350	NGT
Cadmium	6.4	RFC	6.4	RFC	0.00046	RFC	0.00046	RFC	0.0041	NGT	6.4	RFC
Chromium[g]	17.4	BKG	27.2	BKG	0.0073	BKG	0.0027	RFC	0.025	NGT	18.1	BKG
Chromium, hexavalent[g]	1.6	NGT	1.6	NGT	None	N/A	None	N/A	0.025	NGT	1.6	NGT
Cobalt	10.4	BKG	23.2	BKG	0.021	RFC	0.021	RFC	None	N/A	9.1	BKG
Copper	310	RFC	310	RFC	None	N/A	None	N/A	0.61	RFC	310	RFC
Lead	400	TB	400	TB	0.015	MCL	0.015	MCL	0.015	TB	400	TB
Manganese	1450	BKG	3030	BKG	1.02	BKG	1.34	BKG	0.63	RFC	1950	BKG
Mercury	2.3	RFC	2.3	RFC	None	N/A	None	N/A	0.0044	RFC	2.3	RFC
Nickel	160	RFC	160	RFC	0.021	RFC	0.0834	BKG	0.31	RFC	160	RFC
Silver	39	RFC	39	RFC	None	N/A	None	N/A	0.077	RFC	39	RFC
Thallium	0.61	RFC	0.91	BKG	0.000083	RFC	0.000083	RFC	0.0012	RFC	0.89	BKG
Vanadium	45	RFC	45	RFC	0.0064	RFC	0.0064	RFC	0.057	NGT	45	RFC
Zinc	2300	RFC	2300	RFC	0.31	RFC	0.31	RFC	4.6	RFC	2300	RFC
1,3,5-Trinitrobenzene	230	RFC	230	RFC	None	N/A	None	N/A	None	N/A	None	N/A
1,3-Dinitrobenzene	0.77	RFC	0.77	RFC	0.0001	RFC	0.0001	RFC	None	N/A	None	N/A
2,4,6-Trinitrotoluene	3.7	RFC	3.7	RFC	0.00052	RFC	0.00052	RFC	0.0078	RFC	3.7	RFC
2,4-Dinitrotoluene	0.75	RFA	0.75	RFA	0.00012	RFA	0.00012	RFA	0.002	RFA	0.75	RFA
2,6-Dinitrotoluene	0.77	RFA	0.77	RFA	0.00012	RFA	0.00012	RFA	0.0021	RFA	None	N/A
2-Amino-4,6-Dinitrotoluene	1.5	RFC	1.5	RFC	0.00021	RFC	0.00021	RFC	0.0031	RFC	1.5	RFC
2-Nitrotoluene	3.9	RFC	3.9	RFC	0.00037	RFA	0.00037	RFA	0.0074	RFA	None	N/A
4-Amino-2,6-Dinitrotoluene	1.5	RFC	1.5	RFC	0.00021	RFC	0.00021	RFC	0.0031	RFC	1.5	RFC
4-Nitrotoluene	53	RFC	53	RFC	0.005	RFA	0.005	RFA	0.1	RFA	None	N/A
HMX	360	RFC	360	RFC	None	N/A	None	N/A	0.78	RFC	360	RFC

Table 3-1. Draft Facility-Wide Cleanup Goals Used as Screening Criteria to Determine Exceedances[a] (continued)

Chemical[b] (mg/kg or mg/L)	Surface Soil	Type	Subsurface Soil	Type	Groundwater Unconsolidated[c]	Type	Groundwater Bedrock[c]	Type	Surface Water[d]	Type	Wet Sediment[e]	Type
Nitrobenzene	None	N/A	None	N/A	0.00052	RFC	0.00052	RFC	None	N/A	None	N/A
Nitroglycerin	53	RFC	53	RFC	0.005	RFA	0.005	RFA	None	N/A	53	RFC
RDX	8	RFC	8	RFC	0.00077	RFA	0.00077	RFA	0.015	RFA	8	RFC
4,4'-DDD	None	N/A	None	N/A	0.000059	RFA	0.000059	RFA	None	N/A	None	N/A
4,4'-DDE	2.6	RFC	2.6	RFC	0.000047	RFA	0.000047	RFA	None	N/A	None	N/A
4,4'-DDT	None	N/A	None	N/A	0.000027	RFA	0.000027	RFA	0.0001	RFA	None	N/A
Aldrin	0.053	RFC	0.053	RFC	0.0000047	RFA	0.0000047	RFA	0.000073	RFA	None	N/A
Dieldrin	0.056	RFC	0.056	RFC	0.0000036	RFA	0.0000036	RFA	None	N/A	0.056	RFC
Endrin	1.1	RFC	1.1	RFC	None	N/A	None	N/A	None	N/A	None	N/A
Endrin aldehyde	None	N/A	None	N/A	None	N/A	None	N/A	None	N/A	None	N/A
Heptachlor	0.2	RFC	0.2	RFC	0.000014	RFA	0.000014	RFA	None	N/A	None	N/A
Heptachlor epoxide	0.098	RFC	0.098	RFC	0.0000094	RFA	0.0000094	RFA	0.00019	RFA	None	N/A
Lindane	None	N/A	None	N/A	0.000051	RFA	0.000051	RFA	None	N/A	None	N/A
PCB-1016	0.2	RFA	0.2	RFA	None	N/A	None	N/A	None	N/A	0.2	RFA
PCB-1242	None	N/A	None	N/A	0.00021	RFA	0.00021	RFA	None	N/A	None	N/A
PCB-1248	0.2	RFA	0.2	RFA	None	N/A	None	N/A	None	N/A	None	N/A
PCB-1254	0.12	RFC	0.12	RFC	0.000021	RFC	0.000021	RFC	0.00031	RFC	0.12	RFC
PCB-1260	0.2	RFA	0.2	RFA	0.00021	RFA	0.00021	RFA	None	N/A	0.2	RFA
Toxaphene	None	N/A	None	N/A	0.000048	RFA	0.000048	RFA	None	N/A	None	N/A
alpha-BHC	None	N/A	None	N/A	0.000014	RFA	0.000014	RFA	None	N/A	None	N/A
alpha-Chlordane	None	N/A	None	N/A	None	N/A	None	N/A	None	N/A	None	N/A
beta-BHC	0.5	RFC	0.5	RFC	0.000047	RFA	0.000047	RFA	0.00095	RFA	None	N/A
gamma-Chlordane	None	N/A	None	N/A	None	N/A	None	N/A	None	N/A	None	N/A
1,4-Dichlorobenzene	None	N/A	None	N/A	None	N/A	None	N/A	0.019	RFA	None	N/A
2,4-Dimethylphenol	None	N/A	None	N/A	None	N/A	None	N/A	0.25	RFC	None	N/A
2-Methylnaphthalene	31	RFC	31	RFC	None	N/A	None	N/A	None	N/A	None	N/A
4-Chloro-3-methylphenol	None	N/A	None	N/A	None	N/A	None	N/A	None	N/A	None	N/A
4-Methylphenol	None	N/A	None	N/A	None	N/A	None	N/A	0.068	RFC	None	N/A
4-Nitrobenzenamine	None	N/A	None	N/A	0.0031	RFC	0.0031	RFC	None	N/A	None	N/A

Table 3-1. Draft Facility-Wide Cleanup Goals Used as Screening Criteria to Determine Exceedances[a] (continued)

Chemical[b] (mg/kg or mg/L)	Surface Soil	Type	Subsurface Soil	Type	Groundwater Unconsolidated[c]	Type	Groundwater Bedrock[c]	Type	Surface Water[d]	Type	Wet Sediment[e]	Type
4-Nitrophenol	61	RFC	61	RFC	None	N/A	None	N/A	None	N/A	None	N/A
Benz(a)anthracene	0.22	RFA	0.22	RFA	0.0000039	RFA	0.0000039	RFA	0.000014	RFA	0.22	RFA
Benzo(a)pyrene	0.022	RFA	0.022	RFA	0.00000023	RFA	0.00000023	RFA	0.0000008	RFA	0.022	RFA
Benzo(b)fluoranthene	0.22	RFA	0.22	RFA	0.0000023	RFA	0.0000023	RFA	0.0000079	RFA	0.22	RFA
Benzo(k)fluoranthene	2.2	RFA	2.2	RFA	None	N/A	None	N/A	0.023	RFA	2.2	RFA
Bis(2-chloroethoxy)methane	23	RFC	23	RFC	None	N/A	None	N/A	None	N/A	None	N/A
Bis(2-ethylhexyl)phthalate	None	N/A	None	N/A	0.0009	RFA	0.0009	RFA	0.0035	RFA	None	N/A
Carbazole	45	RFC	45	RFC	None	N/A	None	N/A	None	N/A	None	N/A
Chrysene	22	RFA	22	RFA	None	N/A	None	N/A	0.0014	RFA	None	N/A
Dibenz(a,h)anthracene	0.022	RFA	0.022	RFA	0.00000015	RFA	0.00000015	RFA	0.00000052	RFA	0.022	RFA
Dibenzofuran	15	RFC	15	RFC	None	N/A	None	N/A	None	N/A	None	N/A
Fluoranthene	160	RFC	160	RFC	None	N/A	None	N/A	None	N/A	None	N/A
Fluorene	240	RFC	240	RFC	None	N/A	None	N/A	None	N/A	None	N/A
Indeno(1,2,3-cd)pyrene	0.22	RFA	0.22	RFA	0.0000023	RFA	0.0000023	RFA	0.0000078	RFA	0.22	RFA
N-Nitroso-di-n-propylamine	0.12	RFC	0.12	RFC	None	N/A	None	N/A	None	N/A	None	N/A
Naphthalene	120	RFC	120	RFC	None	N/A	None	N/A	None	N/A	None	N/A
Nitrobenzene	None	N/A	None	N/A	0.00052	RFC	0.00052	RFC	None	N/A	None	N/A
Pentachlorophenol	2.1	RFA	2.1	RFA	0.000074	RFA	0.000074	RFA	0.00028	RFA	None	N/A
Pyrene	120	RFC	120	RFC	None	N/A	None	N/A	0.47	RFC	None	N/A
bis(2-Chloroethoxy)methane	23	RFC	23	RFC	None	N/A	None	N/A	None	N/A	None	N/A
1,1,2,2-Tetrachloroethane	None	N/A	None	N/A	0.000069	RFA	0.000069	RFA	0.00039	NGT	None	N/A
1,2-Dichloroethane	None	N/A	None	N/A	0.00016	RFA	0.00016	RFA	None	N/A	None	N/A
1,2-Dichloroethene	None	N/A	None	N/A	None	N/A	None	N/A	0.12	RFC	None	N/A
1,4-Dichlorobenzene	None	N/A	None	N/A	None	N/A	None	N/A	0.019	RFA	None	N/A
Benzene	None	N/A	None	N/A	0.00043	RFA	0.00043	RFA	None	N/A	None	N/A
Carbon tetrachloride	None	N/A	None	N/A	0.0002	RFA	0.0002	RFA	None	N/A	None	N/A
Chloroform	None	N/A	None	N/A	0.00021	RFA	0.00021	RFA	0.001	NGT	None	N/A
Methylene chloride	None	N/A	None	N/A	0.0053	RFA	0.0053	RFA	0.046	NGT	None	N/A
Tetrachloroethene	None	N/A	None	N/A	0.000098	RFA	0.000098	RFA	0.00083	RFA	None	N/A

Table 3-1. Draft Facility-Wide Cleanup Goals Used as Screening Criteria to Determine Exceedances[a] (continued)

Chemical[b] (mg/kg or mg/L)	Surface Soil	Type	Subsurface Soil	Type	Groundwater Unconsolidated[c]	Type	Groundwater Bedrock[c]	Type	Surface Water[d]	Type	Wet Sediment[e]	Type
Trichloroethene	None	N/A	None	N/A	0.000031	RFA	0.000031	RFA	0.00016	NGT	None	N/A
cis-1,2-Dichloroethene	None	N/A	None	N/A	None	N/A	None	N/A	0.16	RFC	None	N/A

[a]This table lists all chemicals for which CUGs were developed in the Draft FWCUG Report (USACE 2008b). Screening criteria are based on the CUG for Hazard Index (HI)=0.1 and Target Risk=10^{-6}. Values were rounded to two significant figures. When background values were higher than the screening criteria based on the CUG (HI=0.1/Target Risk=10^{-6}), the background value became the screening criterion. Background values were not rounded to two significant figures and were obtained from the April 2001 Phase II Winklepeck Remedial Investigation Report (USACE, 2001b). Additional comparisons were performed against the CUGs for HI=1.0 and Target Risk=10^{-5}. A comparatively small list of facility-wide COPCs exceeded these CUGs (see Appendices A through Q). Generally, the CUG (HI=1.0 or Target Risk=10^{-5}) can be calculated by multiplying the screening criteria by 10 (one exception to this rule is for metal background values which are not based on risk and therefore are the same for both the screening criteria and CUG).

[b]Although a CUG was developed for iron in the September 2008 Draft Facility-Wide Human Health Cleanup Goals for RVAAP, iron was not screened against a CUG as this chemical has historically been considered an essential nutrient at RVAAP. The RVAAP Risk Manual identifies iron as one of the essential elements that should not be evaluated as a COPC as long as it is present at low concentrations (e.g., below 100,000 to 180,000 mg/kg). The maximum detection of iron from previous sampling at these subject AOCs is 76,000 mg/kg.

[c]Groundwater screening criteria and background values provided are representative of filtered groundwater samples. Unfiltered groundwater samples were not evaluated.

[d]Surface water screening criteria and background values are representative of unfiltered water. Filtered surface sample results were not evaluated.

[e]Wet sediment screening criteria are equal to surface soil screening criteria with the exception of when background values were greater than the CUG-based screening criteria.

[f]"None" indicates no CUG was developed in the Draft FWCUG Report. In the event a chemical without a screening value is determined to be a COPC, a CUG will be developed.

[g]Chromium speciation samples will be collected in accordance with Section 4.1.3 of this SAP to evaluate the concentration ratio of hexavalent chromium to total chromium. These sample results will provide guidance for future remedial decisions and remedial actions at these areas of concern.

TB = technology-based screening level
CUG = Cleanup Goal
BKG = Background
N/A = not applicable
NGT = National Guard Trainee
RFA = Resident Subsistence Farmer Adult
RFC = Resident Subsistence Farmer Child

3.2.5 Medium-Specific Decision Points

The following sections discuss the decision points specific to each environmental medium being investigated under this SAP Addendum.

3.2.5.1 Surface Soil

Surface soil (0 to 1 ft bgs) sampling methods used during previous investigations vary for each AOC. At some AOCs, the multi-increment (MI) sampling method was used, and at other AOCs, discrete samples were collected. In both cases, previous investigations at the AOCs addressed under this SAP Addendum biased the sample locations to areas with the greatest likelihood of contamination (e.g., adjacent to production buildings or within sediment accumulation areas such as ditches). In order to maintain consistency at each AOC and avoid mixing of sample types in future risk management decisions, the former sampling approaches (MI or discrete) at each AOC are continued in this SAP Addendum.

At AOCs where MI surface soil sampling was previously conducted, each MI sample result was evaluated separately against the screening criteria and CUGs for each chemical analyzed. Additional surface soil sampling to define the lateral extent of contamination will be conducted according to the following decision rules:

- If an MI sample result is greater than the screening criteria, then further sampling is required to define the lateral extent of a surface soil chemical exceeding the screening criteria around the MI area. The extent of contamination outside the MI area will be defined by collecting additional MI samples in immediate proximity to the original MI area. The additional MI sample areas may be small and specific or large and more general, depending on the historical use of the area and the previous sampling locations and results.

- If an MI sample result is greater than both the screening criteria and CUG, additional MI samples will be collected to further define the potential source area or "hot spot." The MI areas proposed to bound the extent of surface soil contamination greater than the CUGs are generally located 15 ft away from the previous MI area that exceeded a screening criterion and CUG and are approximately 15 ft wide. The lengths of these areas vary based on the size and shape of the former MI areas, as well as the proximity of any adjacent former MI area that had no chemicals detected above screening criteria or CUGs.

- In cases where the MI area containing chemicals greater than CUGs is larger than approximately 0.1 acre, it will be split into subareas within which additional MI samples will be collected to refine the distribution of contamination and determine if it is confined to only a portion of the MI area.

- If all results for an MI sample are less than the screening criteria, then no extent definition is necessary. No further investigation within or around that MI area will be conducted.

- If there are areas of the AOC not characterized during previous investigations (typically non-production areas of the AOC), then these uninvestigated areas are split into large MI areas for characterization based on historic land use and site characteristics. These MI areas were designed to represent areas with relatively uniform historical operations (i.e., the areas are not known to have supported historical operations that may have contaminated the soil).

At AOCs where discrete surface soil sampling was previously used (Load Lines 6, 9, and 11; Cobbs Ponds; and NACA Test Area) each sample result was evaluated separately against the screening criteria and CUGs for each chemical analyzed. Additional surface soil sampling to define the lateral extent of contamination will be conducted according to the following decision rules:

- If the sample result were greater than the screening criteria, then the results were evaluated to determine whether or not nature and extent has been defined by other previous samples. If necessary, additional surface samples will be collected to define the lateral extent of surface soil contamination at the location. If the sample result is potentially indicative of a source area or "hot spot" (i.e., it also exceeded the CUG, contains multiple chemicals exceeding the screening criteria, or is located within a small area of several exceedances of the same chemical), additional samples will be collected to further characterize and refine the potential source area.

- If the sample result were less than the screening criteria, then no lateral extent definition is necessary and no further surface soil sampling will be conducted relative to that sample location.

Surface soil samples will also be collected at each subsurface soil boring location (Section 3.2.5.2). Surface soil sampling procedures are provided in Section 4.1.1.

3.2.5.2 <u>Subsurface Soil</u>

Subsurface soil to various depths was previously investigated at the following AOCs:

- Landfill North of WBG;
- NACA Test Area;
- Load Line 11;
- Load Line 6;
- Load Line 9; and
- Anchor Test Area.

Previous investigations have defined the vertical extent of contamination at the Landfill North of WBG, and no additional samples are planned. The subsurface soil samples at the other five AOCs were not adequate to define the vertical nature and extent of contamination at these AOCs; therefore, additional subsurface soil samples will be collected. Subsurface soil samples will also be collected at AOCs where no previous subsurface investigation has been performed.

All prior subsurface investigations were performed using discrete borings. For this SAP Addendum, the use of discrete samples from soil borings to characterize subsurface soil will be continued. The subsurface soil decision rules are based upon prior surface and subsurface soil sampling results to define the vertical extent of contamination. The subsurface soil at each AOC will be adequately characterized through the placement of borings in various areas of the AOC, including areas with previous results greater than the screening criteria and CUG, areas with previous results only slightly greater than the screening criteria, and areas not previously sampled. Subsurface soil sampling will be conducted according to the following decision rules:

- If an MI or discrete surface soil result was greater than the screening criteria, then the results were compared to the CUG to determine whether or not a potential source area or "hot spot" exists. If necessary, additional samples are proposed to define the vertical extent of chemicals. A representative number of soil boring locations have been chosen at or near previous surface soil screening criteria exceedances to characterize the vertical extent of contamination.

- If a previous subsurface soil sample was greater than the screening criteria, the results were compared to the CUG to determine whether or not a potential source area or "hot spot" exists. If necessary, additional samples are proposed to further define the vertical extent of chemicals. A representative number of sample locations have been chosen at or near previous subsurface soil CUG exceedances to characterize the vertical extent of contamination.

- Areas of the AOC not characterized during previous investigations will be further characterized with a limited number of subsurface soil locations.

In all cases, subsurface borings are biased toward areas where contamination from historic uses or site drainage may be likely. The number of subsurface borings required is dependent upon the amount of previous subsurface soil sampling and the number of surface and subsurface soil exceedances.

The sample intervals that will be collected at each subsurface soil boring location are 0 to 1 ft (surface soil), 1 to 4 ft, 4 to 7 ft, and 7 to 13 ft bgs. The samples collected from 0 to 1 ft, 1 to 4 ft, and 4 to 7 ft will be submitted for laboratory analysis; the 7 to 13 ft interval will be archived onsite (samples for VOC analyses that have a 14-day holding time will not be archived). The 4 to 7 ft interval will undergo expedited analysis to determine whether or not analysis of the 7 to 13 ft interval is necessary. If no chemicals exceed the screening criteria from the 4 to 7 ft sample, then the 7 to 13 ft sample will not be analyzed because the vertical extent of contamination will already be defined. However, if there is at least one exceedance of screening criteria in the 4 to 7 ft sample, then the 7 to 13 ft sample will be sent to the laboratory for analysis. In addition, at least 10% of all subsurface samples from 7 to 13 ft will be submitted for laboratory analysis in order to ensure characterization of subsurface soil to 13 ft bgs (Section 3.2.4).

In the event a new chemical is detected in the 4 to 7 ft sample and a screening criterion does not exist, the chemical concentration will be compared to the USEPA nationwide regional screening levels (RSLs) to determine whether or not the 7 to 13 ft sample requires analysis. If the chemical concentration exceeds the RSL, the 7 to 13 ft sample will be analyzed. This approach is consistent with the use of RSLs to initially evaluate data and identify COPCs that require development of CUGs.

Subsurface geotechnical samples will be collected from some of the AOCs in order to obtain physical soil characterization data for Seasonal Soil Compartment Model (SESOIL) and other modeling activities (Section 4.12). Shelby tubes for geotechnical analysis will be collected at 4 ft bgs and just above the water table. If bedrock is encountered first, then the sample will be collected just above bedrock. Sample collection for geotechnical analysis is described in Section 4.5.2.

Subsurface soil sampling procedures are provided in Section 4.1.2.

3.2.5.3 Surface Water and Wet Sediment

During previous investigations, discrete surface water and discrete and MI wet sediment samples have been collected for characterization purposes, although very few MI wet sediment samples have been collected at these AOCs. Additional samples will be collected within and outside of the AOC boundaries as part of this SAP Addendum for two general reasons. The first reason is to support the ecological weight-of-evidence (WOE) evaluation described in Section 4.13. The second reason is to define nature and extent of contamination, if present, in these media.

The following general decision points and rationale were used to determine which AOCs required additional surface water or sediment sample collection in order to support the WOE evaluation:

- If no data are available, or existing data are deemed to be nonrepresentative of current conditions, additional samples will be collected. At some of the AOCs, the previous data are up to eight years old (e.g., Cobbs Ponds and Load Line 12) and contemporaneous data are needed to fill data gaps.

- If previous sampling has not been conducted at the ingress and egress points of an AOC (i.e., ditches or other runoff pathways), samples will be collected to characterize any potential migration of contaminants from the AOC. Specifically, Landfill North of WBG, NACA Test Area, Load Line 8, and Load Line 11 were lacking this data.

- At AOCs where a significant change (usually demolition) has occurred since the previous sampling (Load Lines 8, 11, and 12), additional samples will be collected to document any resulting changes that have occurred and to confirm concentrations have decreased.

- For the AOCs at which ecological resources are geographically proximate (Cobbs Ponds, Landfill North of WBG, and NACA Test Area), additional documentation is needed to document that these resources are not exposed.

- At AOCs where overland flow of contaminants could occur to nearby perennial streams, those streams will be sampled. The sample locations may be outside of the AOC boundaries but the samples represent the areas potentially impacted by the AOCs (Load Lines 5, 6, 7, 9, 10, and Wet Storage Area).

- No samples will be collected at AOCs where previous sampling satisfies data needs for definition of nature and extent, the distance to any water body is 1,500 or more feet and migration is not likely. For these reasons, no samples are proposed at six AOCs (C-Block Quarry, Building 1200, Buildings F-15 and F-16, Anchor Test Area, Atlas Scrap Yard, and Load Line 6).

- For AOCs that contain no permanent water bodies (Load Lines 5 and 7), no surface water or wet sediment samples will be collected, as there is nothing to measure in terms of those media. While ditches are present in these AOCs, they typically contain water only a small part of the year and meet the definition of dry sediment.

The second reason for collecting surface water and sediment samples is to characterize the nature and extent of contamination at the AOCs. The following general decision points and rationale were used to determine which AOCs required additional surface water or sediment sample collection in order to characterize nature and extent of contamination:

- If a previous sample result is greater than the screening criterion and CUG, then another sample may be collected at or near that location to confirm the previous exceedance, if additional data are necessary. In addition, deeper sediment samples will be collected at Cobbs Ponds in order to determine the vertical extent of contamination.

- At points where contamination may migrate out of the AOC area, such as a ditch or a stream near the AOC boundary, samples will collected to characterize current conditions and determine whether contaminant migration may occur at surface water runoff exit points from the AOCs and at points further downstream of the AOC. Existing data from other investigations, such as the RVAAP Facility-Wide Biological and Water Quality Study (USACE 2005a), were incorporated into sample planning to help define downstream areas that may require additional sampling.

In this SAP Addendum, wet sediment samples will be collected as composite samples from discrete sample locations. Discrete samples rather than MI samples will be utilized for the collection of wet sediment for the following reasons:

- At six of the ten AOCs where wet sediment samples will be collected (Upper and Lower Cobbs Ponds; Load Lines 6, 9, 11, and 12; and NACA Test Area), only discrete sampling methods were utilized in past investigations. The continued utilization of this approach will maintain consistency with previous investigations and data.

- At two of the ten AOCs where wet sediment samples will be collected (Load Line 10 and Wet Storage Area), no wet sediment samples have previously been collected (other than sewer or sump samples). Therefore, discrete sample methods will be used to maintain consistency with the six AOCs mentioned above.

- At one of the ten AOCs where wet sediment samples will be collected (Landfill North of WBG), both MI and discrete samples have been collected during previous investigations. The wet sediment samples to be collected at this AOC are meant to be co-located with surface water; therefore, discrete sample collection points are more appropriate. This approach also maintains consistency with all other AOCs where wet sediment samples will be collected.

- At the one remaining AOC where wet sediment samples will be collected (Load Line 8), only MI samples have been collected during previous investigations. The wet sediment samples to be collected at this AOC are meant to be co-located with surface water; therefore, discrete sample collection points are more appropriate. This approach also maintains consistency with all other AOCs where wet sediment samples will be collected.

Specific sampling activities and rationale for each AOC are detailed in Appendices A through Q. In addition to the samples to be collected within the AOC boundaries, surface water and wet sediment samples are proposed at potential exit points from the Fuze and Booster Hill area (which includes Load Lines 5, 6, 7, 8, 9, 10, and 11) and near the southern boundary of RVAAP/Camp Ravenna to determine nature and extent. These sample locations will also augment the ecological data set for the WOE evaluation. A total of four surface water and co-located composite wet sediment samples will be collected from these areas in order to characterize current conditions, assess potential exit pathways from the area, and provide data for the ecological WOE evaluation. All samples will be analyzed for the RVAAP full suite of parameters. The sample locations are shown on Figure 3-1 and described below:

- One surface water and co-located composite wet sediment sample will be collected from the drainage conveyance to the northeast from the Fuze and Booster Hill area. A previous wet sediment sample collected in 2003 from this location (facility-wide sample location S3, just north of the Newton-Falls Road intersection) indicated that benzo(a)pyrene is greater than the screening criteria and CUG (resident subsistence farmer) at this location. No further sampling downstream is necessary at this time, as the next facility-wide sampling point (S4) had no detections above screening criteria. However, it should be noted that laboratory detection limits were greater than screening criteria but less than CUGs for SVOCs in surface water and wet sediment and PCBs in surface water.

- One surface water and co-located composite wet sediment sample will be collected from the drainage conveyance to the southeast, approximately centered between Load Lines 5 and 10. No previous facility-wide samples have been collected along this conveyance.

- One surface water and co-located composite wet sediment sample will be collected from the drainage conveyance to the southeast, approximately centered between Load Lines 5 and 6. No previous facility-wide samples have been collected along this conveyance.

- One surface water and co-located composite wet sediment sample will be collected from the drainage conveyance to the south of Load Line 6. No previous facility-wide samples have been collected along this conveyance.

Wet sediment and surface water sampling procedures are provided in Sections 4.2 and 4.3, respectively.

3.2.5.4 Groundwater

In order to complete the definition of nature and extent of characterization, groundwater evaluation is required at the 16 AOCs addressed by this SAP Addendum (groundwater at Load Line 12 is being addressed under a separate investigation at an accelerated schedule). Under the current Facility-Wide Groundwater Monitoring Program (FWGWMP), groundwater monitoring well sampling has been or is currently being conducted at 13 of the 16 AOCs. In October 2008, all of the wells in the following AOCs had four quarters of sampling completed under the FWGWMP:

- C-Block Quarry;
- Building 1200;
- Landfill North of WBG;
- Upper and Lower Cobbs Ponds;
- Load Line 6 (wells LL6mw-001, LL6mw-002, LL6mw-003, and LL6mw-004 only);
- NACA Test Area;
- Load Line 5; and
- Load Line 11 (wells LL11mw-2 and LL11mw-7 only).

The remaining wells at Load Line 6 (LL6mw-005, LL6mw-006, and LL6mw-007) and Load Line 11 (LL11mw-1, LL11mw-3, LL11mw-4, LL11mw-5, LL11mw-6, LL11mw-8, LL11mw-9, and LL11mw-10) are currently being sampled under the FWGWMP, and four quarters of sampling will be completed in October 2009. The following five AOCs were added to the FWGWMP in April 2009 and four quarters of sampling will be completed in January 2010:

- Load Line 7;
- Load Line 8;
- Load Line 9;
- Load Line 10; and
- Atlas Scrap Yard.

During a quarterly event, each well is sampled for water quality parameters, explosives, propellants, target analyte list (TAL) metals, cyanide, nitrate, semi-volatile organic compounds (SVOCs), polychlorinated biphenyls (PCBs), pesticides, and volatile organic compounds (VOCs). The current groundwater sampling conducted under the FWGWMP will provide sufficient data to evaluate nature

and extent of contamination in groundwater for these 13 AOCs. Therefore, no additional sampling is required as part of this SAP Addendum.
Historic groundwater data from each AOC and chemicals that have exceeded screening criteria in soil are presented in Appendices A through Q.

Currently, subsurface soil or groundwater data does not exist for the three AOCs listed below since monitoring wells have not been installed:

- Wet Storage Area;
- Buildings F-15 and F-16; and
- Anchor Test Area.

Installation of groundwater monitoring wells is not planned for these three AOCs for the following reasons:

- It is unlikely that contaminants will migrate through the soil column and into the groundwater. Screening criteria exceedances consisted of low levels of metals and SVOCs in surface soil (Appendices N, O, and P). The arsenic concentration in surface soil at each of these AOCs was near or below the RVAAP facility-wide background value (15.4 mg/kg). Manganese was detected above its screening criteria in surface soil at Anchor Test Area, but the average result (912 mg/kg) was well below background (1450 mg/kg). Additionally, SVOCs were detected above the screening criteria at Buildings F-15 and F-16 but below the CUG. Only benzo(a)pyrene was detected in two soil samples above screening levels. The maximum detected benzo(a)pyrene result (0.11 mg/kg) in soil exceeded the USEPA risk-based soil screening level for the protection of groundwater (0.0046 mg/kg), but was well below the MCL (maximum contaminant level)-based soil screening level (0.31 mg/kg). These data indicate that leaching of benzo(a)pyrene from soil to groundwater at concentrations above the MCL is not likely to occur; therefore, installation of monitoring wells at this AOC is not considered necessary. One sample location at Wet Storage Area exceeded both the screening criteria and the CUG for PAHs. Metals and PAHs have an extremely high distribution coefficient (K_d) and therefore a high affinity to soil particulates, resulting in extremely low mobility in soil.

- Subsurface soil sampling will determine whether or not any chemicals exceed screening criteria and CUGs at various depths.

- Soil column modeling using SESOIL will be used in accordance with Section 4.12 to evaluate the migration potential of all chemicals that may be present at the AOCs.

The subsurface soil sampling and modeling results will indicate whether or not additional installation of groundwater wells at these three AOCs will be required in order to obtain groundwater data. If exceedances are present in subsurface soil samples or the vadose zone model predicts a potential pathway to groundwater, the installation of additional monitoring wells will be required. If required, monitoring wells would be installed under a separate SAP Addendum.

3.2.6 AOC-Specific Data Quality Objectives and Investigation Activities

AOC-specific DQOs and planned investigation activities are presented in Appendices A through Q. The appendices include an AOC description and a summary of previous investigations highlighting previous results greater than screening criteria or CUGs. Each appendix also details the types and locations of samples to be collected at each AOC.

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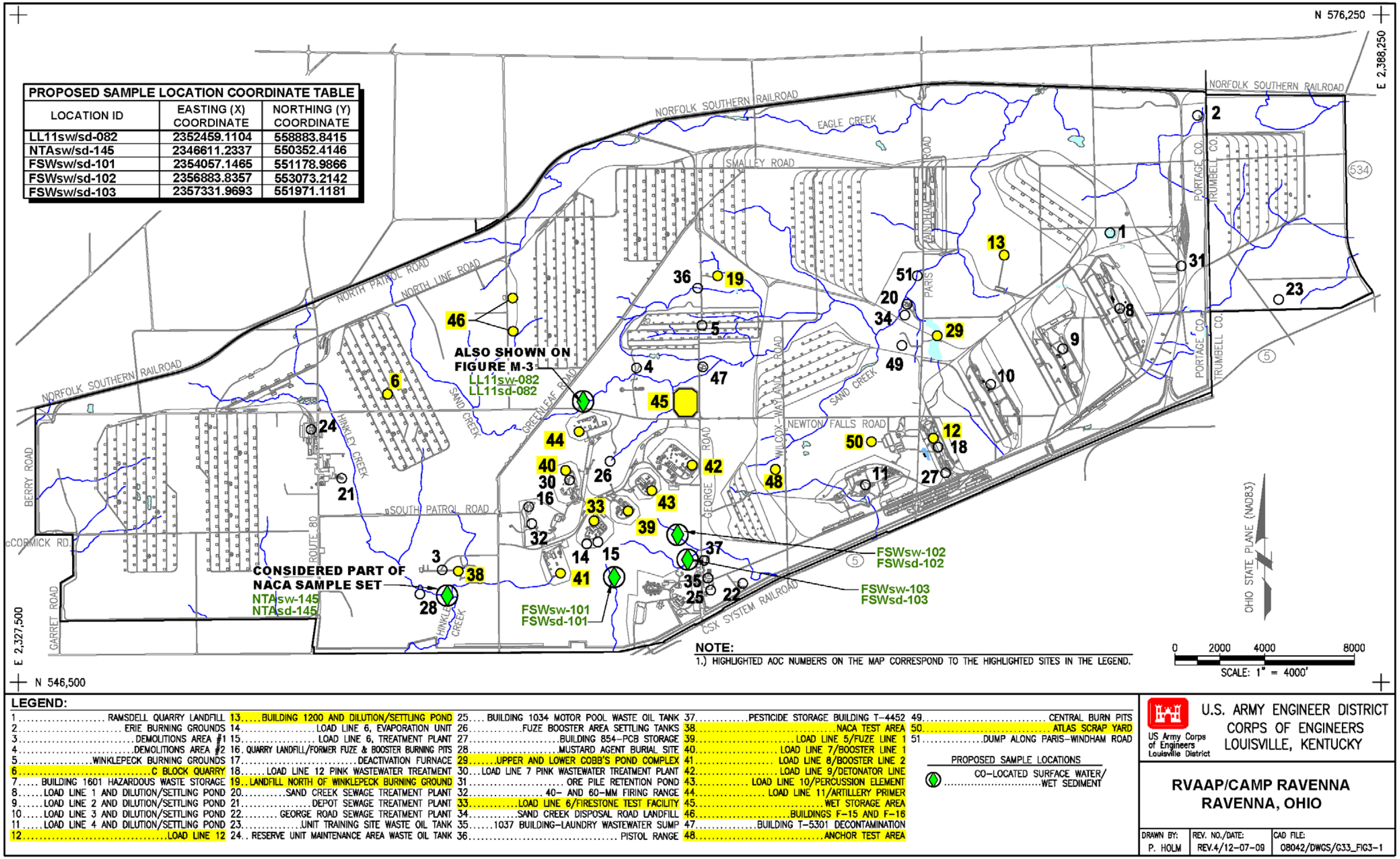

Figure 3-1. Fuze and Booster Hill Sample Locations at RVAAP

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4.0 PROCEDURES AND METHODS

All field activities and sampling procedures will be accomplished in accordance with Section 4.0 of the Facility-Wide SAP. Where changes or unique elements not addressed in the Facility-Wide SAP have been identified, they are provided here.

The general rationale for sample types, quantities, and locations is provided in Section 3.2; AOC-specific details are presented in Appendices A through Q.

4.1 SOIL

4.1.1 Surface Soil Sampling Procedures

Surface soil samples will be collected using both MI and discrete sample methods during the implementation of this SAP Addendum. These two methods are described below. Parameters to be analyzed vary by AOC (Appendices A through Q).

4.1.1.1 Discrete Surface Soil Sampling

Discrete surface soil samples will be collected from 0 to 1 ft bgs in accordance with the bucket hand auger method described in Section 4.5.2.1.1 of the Facility-Wide SAP. Surface soil samples will also be collected in conjunction with subsurface soil samples collected using the hollow stem auger drilling or hydraulic direct-push sampler (e.g. Geoprobe) methods described in Section 4.4.2.1 of the Facility-Wide SAP.

Samples will be collected in accordance with established protocols for the specific chemical analysis (e.g. VOCs, explosives, propellants) as described in Section 4.5.2.5 of the Facility-Wide SAP.

Field instruments (e.g. PID, FID, XRF) will not be used for the measurement of chemical concentrations or biased sample collection during the implementation of this SAP Addendum unless it is determined that chemical concentration measurements are needed for the protection of workers' health and safety.

For discrete surface soil sampling locations, composite samples for fixed-base laboratory analyses of explosives (for all samples) and propellants (collected as part of the 10% or 15% RVAAP full suite samples per AOC) will be collected. These composite samples will be derived from three subsamples collected from about 0.9 m (3 ft) from one another in a roughly equilateral triangle pattern following protocols in Section 4.5.2.5 of the Facility-wide SAP. Samples for all analyses other than explosives or propellants will be collected from a point in the approximate center of the three triangular points from which the composite samples noted above are collected.

4.1.1.2 Multi-Increment Samples

An MI sample is a sample of 30 aliquots collected from random points within a designated MI sampling area. The 0 to 1 ft sample aliquots are collected at random from the surface soil within the defined area. Any point on the ground surface within the boundary of the MI area is a possible sample location, and each point has an equal chance of being selected.

The corners of each of the designated MI sampling areas will be located using digital global positioning system and marked using wooden stakes. Approximately equal sample volume aliquots will be collected using a small-diameter push tube or bucket hand auger in accordance with Section 4.5.2.1.1. A sufficient number of aliquots will be collected to provide statistical confidence that the average concentration of a particular constituent within a designated area is represented by the composite sample. No less than 30 aliquots for each MI sample will be collected to provide the requisite statistical confidence (95%).

These aliquots will be selected on a random basis over the ground surface of the designated MI area. This assures coverage over the entire sample area and the randomness provides repeatability and accuracy. The aliquot locations will be selected by sample personnel walking over the entire sample area and randomly selecting aliquot locations, which will be marked with flagging. Sample points will not be pre-located using a random grid.

All aliquots collected from each MI sample area will be placed in a labeled container for transport to the laboratory. At the laboratory, the sample will be dried, sieved, and finely ground for specified non-volatile constituent analyses.

Duplicate QC and QA split samples will be collected from the MI sample areas at the frequency listed in Section 4.6. The field duplicates and split samples are samples taken from the same source that equally represent the medium at a given time and location. The field duplicate samples are to be submitted as "blind" to the laboratory and are used to determine whether the field sampling technique is reproducible and as an indicator of sample heterogeneity. Matrix spikes (MSs) and matrix spike duplicates (MSDs) will be used to verify the accuracy of the laboratory results. The QC sample will be sent to the laboratory under contract with SAIC. The QA split samples will be sent to a U.S. Army QA laboratory for independent analysis and evaluation of analytical results by the contracted laboratory.

The collection of the QA and QC samples requires the three portions of soil to be as similar as possible. Therefore, when collected, all three of these sample types will be collected from the same soil aliquots within the MI area. At the time of collection, each of the 30 aliquots within the MI area will be individually placed into a stainless steel bowl and homogenized. Then the homogenized aliquot of soil will be divided into three portions and placed into three separate, labeled containers for transport to the laboratories. This process will be continued for each aliquot, placing a third of each into the three labeled laboratory containers.

The MI sampling method will not be utilized for VOC analysis. If a sample is designated for VOC analysis, one discrete sample will be collected from within the MI area using the bucket hand auger method (Section 4.1.1.1). The specific location of the discrete sample will be biased toward the area most likely to contain volatile compounds, or if no such area is observed, the location will be randomly chosen. Soil portions designated for VOC analysis will be placed directly in the sample container and will not be composited or further processed in the field.

Field instruments (e.g. PID, FID, XRF) will not be used for the measurement of chemical concentrations or biased sample collection during the implementation of this SAP Addendum, unless it is determined that chemical concentration measurements are needed for the protection of workers' health and safety.

4.1.2 Subsurface Soil Sampling Procedures

Subsurface soil will be collected by means of hollow stem auger drilling or hydraulic direct-push samplers (e.g., Geoprobe) to a maximum sampling depth of 13 feet below grade. In the event that the sample location cannot be accessed with the drill rig or Geoprobe, subsurface soil will be collected using a bucket hand auger. The procedures for hollow stem auger drilling, hydraulic direct-push, and bucket hand auger sampling are discussed in Sections 4.4.2.1.2, 4.4.2.1.5, and 4.4.2.1.4 of the Facility-Wide SAP, respectively.

Field instruments (e.g. PID, FID, XRF) will not be used for the measurement of chemical concentrations or biased sample collection during the implementation of this SAP Addendum, unless it is determined that chemical concentration measurements are needed for the protection of workers' health and safety.

4.1.3 Chromium Speciation

In this SAP Addendum, historical chemical concentrations were screened against total chromium background values and the hexavalent chromium screening criteria (HI=0.1, Target Risk=10^{-6}). Previous samples at each AOC have been analyzed for total chromium with the exception of C-Block Quarry, Upper and Lower Cobbs Ponds, and Atlas Scrap Yard, where soil or wet sediment samples were analyzed for both hexavalent chromium and total chromium concentrations. Existing historical data at the three AOCs indicates chromium exists predominantly in the trivalent state, rather than the more toxic hexavalent state. In order to determine an appropriate risk at the other AOCs, chromium speciation samples will be collected to determine the ratio of hexavalent chromium to total chromium.

Chromium speciation evaluates the concentration ratio of hexavalent chromium to total chromium. This ratio will be calculated by collecting and analyzing three samples per AOC for both hexavalent chromium and total chromium. Two samples will be collected from areas previously identified as having elevated total chromium concentrations and one will be collected from an area identified having chromium concentrations near background levels. Should analytical data indicate the ratio of hexavalent chromium to total chromium is 1:6 (i.e., 14%) or less, the CUG for total chromium will be used for risk calculations This process has been approved and was documented in the Remedial Investigation Report Addendum No. 1 for the RVAAP-49 Central Burn Pits (USACE 2008c). Field duplicate samples will not be collected for chromium speciation samples.

4.2 WET SEDIMENT

Wet sediment samples will be collected as composite samples using ten aliquots per sample. Ten separate aliquots will be collected to the same depth within an area with an approximately 5-ft radius. These ten aliquots will be composited in a stainless steel bowl, then composited samples will be transferred to the appropriate sample container(s).

The aliquots for the composite wet sediment samples will be collected using two possible methods. The trowel method (Section 4.5.2.2.1 of the Facility-Wide SAP) will be used when the water depth above the sediment sample location is less than six inches. The hand core sampler method (Section 4.5.2.2.2 of the Facility-Wide SAP) will be used when the depth of water above the sediment sample location is greater than six inches. Parameters to be analyzed vary by AOC (Appendices A through Q).

The composite sampling method will not be utilized for VOC analysis. If a sample is designated for VOC analysis, one discrete sample/aliquot will be collected from within the 5-ft radius sample area using one of the methods listed above. Wet sediment portions designed for VOC analysis will be placed directly in the sample container and will not be composited or further processed in the field.

4.3 SURFACE WATER

Surface water samples will be collected in accordance with Section 4.6.2.1 of the Facility Wide SAP, using either the hand-held bottle method (Section 4.6.2.1.1 of the Facility-Wide SAP) or the dipper and pond sampler method (Section 4.6.2.1.2 of the Facility-Wide SAP). Parameters to be analyzed vary by AOC (Appendices A through Q). Field measurements will be performed in accordance with Section 4.6.2.3 of the Facility Wide SAP and will include the determination of pH, conductivity, dissolved oxygen, turbidity, and temperature.

4.4 GROUNDWATER

Groundwater sampling of monitoring wells will follow the procedures for low-flow (micro-purge) sampling presented in Section 4.3.4.2 of the Facility-Wide SAP. All groundwater samples will be analyzed for the RVAAP full suite of parameters.

4.4.1 Water Level Measurements

Water level measurements will follow the procedure presented in Section 4.3.2.6 of the Facility-Wide SAP.

4.4.2 Field Measurement Procedures and Criteria

All field measurement procedures and criteria will follow Section 4.3.3 of the Facility-wide SAP. All monitoring wells will be field screened for VOCs using a PID or organic vapor analyzer (OVA) during groundwater sample collection. Screening will be accomplished by monitoring the headspace vapors at the top of the riser pipe.

4.4.3 Well Purging Methods

4.4.3.1 Monitoring Well Development

Groundwater monitoring well development and purging will be conducted consistent with the *Technical Guidance Manual for Hydrogeologic Investigations and Groundwater Monitoring* (Ohio EPA 1995). Monitoring well development techniques (e.g. bailer, submersible pump, etc.) are stated in Section 4.3.2.3.11 Facility-Wide SAP.

Monitoring well development purging will be conducted on newly installed wells, or on existing wells where sediment thickness is greater than or equal to 10% of the total screen length. Development purging will continue until the following conditions are met (Ohio EPA 1995):

- Water can enter as readily as hydraulic conditions allow.

- At least three consecutive groundwater quality parameter readings indicate the groundwater quality has stabilized (one set of parameter readings will be collected per well volume). In accordance with requirements in *Technical Guidance Manual for Hydrogeologic Investigations and Ground Water Monitoring* (Ohio EPA 1995), groundwater quality parameters and respective stabilization requirements include:

    - pH (±0.1);
    - Temperature (±10%);
    - Specific conductance (±10%); and
    - Turbidity (clear to un-aided eye [≤ 5 Nephelometric Turbidity Units (NTU)], or ±10% if > 5 NTU).

- The sediment thickness remaining in the well is less than 1% of the screen length or less than 0.1 ft (3 cm) for screens equal to or less than 10 feet.

- A minimum of five times the standing water volume in the well (including the well screen, casing, and saturate annulus assuming 30% annular porosity) is removed as stated in Section 4.3.2.3.11.2 of the Facility-Wide SAP. Further volumetric removal will be considered if fluids were utilized during well drilling and installation.

If the turbidity remains high (> 5 NTU, or visible sediment) after the above criteria have been met, development can cease if all of the following additional conditions are met (Ohio EPA 1995):

- Several procedures have been tried;
- Proper well construction has been verified;
- Turbidity has stabilized to within ±10% over three successive well volumes; and
- pH and Specific conductance have stabilized over at least three successive well volumes.

4.4.3.2 Monitoring Well Sampling

Groundwater purging and sampling may commence approximately 24 hours after the monitoring well has been developed according to the *Technical Guidance Manual for Hydrogeologic Investigations and Ground Water Monitoring* (Ohio EPA 1995). Groundwater sample collection will commence immediately following well purging. If the well is bailed dry during purging, sampling will commence within 24 hours. The groundwater quality parameter readings and respective stabilization requirements included are the same as for groundwater development.

In order to minimize the quantity of liquid investigation-derived waste (IDW) generated as a result of well purging, wells will be purged using micro-purge methods where conditions permit, in accordance with Ohio EPA technical guidance (Ohio EPA 1995), as follows:

- A dedicated bladder or submersible pump is used for purging.

- The purge rate should not exceed 100 ml/min unless it can be shown that higher rates will not disturb the stagnant water column above the well screen (i.e., will not result in water level drawdown).

- The volume purged is either two pump and tubing volumes or a volume established through in-line monitoring and stabilization of water quality indicators such as dissolved oxygen and specific conductance.

- Sample collection should occur immediately after purging.

Where micro-purging cannot be accomplished for any reason, purging and sampling of all monitoring wells installed during the Phase I RI will be conducted in accordance with conventional procedures discussed in Section 4.3.4.1 of the Facility-Wide SAP.

4.4.4 Sampling Methods for Groundwater – Filtration

Only filtered groundwater samples for dissolved TAL metals will be collected per Section 4.3.5 of the Facility-Wide SAP. Filtered samples will be collected using 0.45-µm, disposable, in-line pore filter attached to the return line of the bladder pump used for micropurging. If conventional purging and sampling is required, filtration will be performed by using a negative pressure, hand-operated vacuum pump and collection flask and a disposable 0.45-µm pore size filter assembly. In the case of either method, filters will be replaced as they become restricted by solids buildup, as well as between sample collection sites.

4.5 SAMPLE COLLECTION FOR FIELD AND LABORATORY ANALYSIS

For discrete samples stations, geotechnical logging, including estimates of USCS classification, will be performed for all soil and sediment samples. For MI samples, each aliquot will not be logged and described separately. Instead, a general description will be developed for the entire MI area, noting any variances.

4.5.1 Sampling for Chemical Analysis

The following chemical analyses will be conducted for soil, surface water, and wet sediment samples:

- All samples will be analyzed for explosives.
- Soil and wet sediment samples will also be analyzed for chemicals that exceeded screening criteria on an AOC-specific basis (Section 3.2.4). Parameters are detailed for each AOC in Appendices A through Q.
- All surface water samples will be analyzed for the RVAAP full suite of parameters.
- As discussed in Section 3.2.4, 10-15% of the soil and wet sediment samples at each AOC will be analyzed for the RVAAP full suite of parameters (Table 2-1 of the QAPP).
- As discussed in Sections 4.1.1.2 and 4.2, MI soil and composite wet sediment samples will not be analyzed for VOCs; instead, a discrete sample will be collected and specially handled for VOC analysis.

4.5.2 Sampling for Geotechnical Analysis

At a selection of subsurface soil locations, samples will be collected for geotechnical analysis. The geotechnical parameters are listed in Table 2-1 of the QAPP. Sampling procedures for geotechnical analysis are presented in Section 4.5.2.4 of the Facility-wide SAP. Disturbed samples for geotechnical analyses will be collected at specified discrete surface soil locations from homogenized soil mixtures.

4.5.3 Sample Container Preservation Techniques

Sample container and preservation technique requirements will follow those prescribed in Table 4-1 of the QAPP.

4.6 FIELD QC SAMPLING PROCEDURES

QA/QC samples will be collected during the implementation of this SAP Addendum for the various AOCs. QC duplicate samples will be collected at a frequency of 10% (1 per 10 environmental samples) for each medium (soil, surface water, wet sediment, and groundwater). Matrix spike/matrix spike duplicate samples will be collected at a rate of 5% (1 per 20) of the total samples per medium. QA split samples will be submitted to the USACE contract laboratory for independent analyses at a frequency of 10% (1 per 10). Duplicate and split samples will be derived from the same sampling station, selected on a random basis, and submitted for the same analyses as the environmental samples. Two rinsate blanks will be collected for surface soil/sediment equipment per field cycle. Trip blanks will accompany all shipments containing VOCs.

One source blank will be collected from the potable water source, which will be used for all potable wash and rinse water for equipment decontamination during the implementation of this SAP Addendum. One source blank will also be collected from the deionized/distilled (American Society of Testing and Materials Type I) water source used. The source blanks will be analyzed for the RVAAP full suite of analyses.

Section 5.0 and the QAPP addendum (Section 4.0) summarize QA/QC sampling requirements. Quantities of QA/QC samples are presented in Table 2-1 of the QAPP.

4.7 DECONTAMINATION PROCEDURES

The decontamination procedure for non-dedicated surface water and groundwater sampling equipment is presented in Section 4.3.8 of the Facility-Wide SAP. Non-dedicated equipment used for surface soil, subsurface soil, or wet sediment sampling shall be decontaminated as described in Section 4.4.2.8 of the Facility-Wide SAP. All non-dedicated equipment will be decontaminated at the completion of sampling activities at each sampling location, with the exception of subsurface equipment, which will be decontaminated after each use during borehole interval sampling. A final decontamination inspection of any equipment leaving RVAAP at the end of field activities will be conducted to ensure proper decontamination.

4.8 SITE SURVEY

Following sampling activities, the horizontal coordinates of all sampling locations and the corners of MI sample areas will be determined to within 0.3 m (1 ft). For discrete soil sampling stations, the ground elevations will be determined at the point of collection to within 0.06 m (0.2 ft). The ground elevation for MI sample areas will be determined from one point within the area.

All locations will be conveyed in Ohio State Plane Coordinates (NAD83). The vertical datum for all elevations will be 1929 National Geodetic Vertical Datum. All coordinates and elevations will be recorded on the boring logs upon receipt of quality assured survey results. In addition, electronic results will be provided to USACE and RVAAP in ASCII format.

4.9 ARCHEOLOGICAL SURVEYS

The following steps will be taken in order to complete an archeological survey for the AOCs:

- Search the National Archeological Data Base (NADB) for references pertaining to the RVAAP;
- Contact the Ohio Historic Preservation Office for any reports or manuscripts on file for RVAAP;
- Perform a local document search at the Ravenna Public Library and Portage County Historical Office for any information regarding artifacts and reports at the RVAPP; and
- Contact the OHARNG and review Cultural Resources Management Plan (if considered final and available to contractors) for RVAAP and Camp Ravenna.

Should the document search reveal that an AOC has not been previously surveyed; a Phase I Archeological Survey will be performed in compliance with sections 106 and 110 of the National Historic Preservation Act. Information from both the records review as well as any Phase I Archeological survey will be submitted to the Ohio Historical Preservation Office for permit approval prior to any ground disturbance.

4.10 MEC CLEARANCE

The protocols for MEC clearance during sampling activities are presented in the MEC Work Plan for the RVAAP 2008 PBA (USA Environmental 2009).

4.11 VADOSE ZONE SOIL LEACHING MODEL

SESOIL will be employed for vadose zone soil leaching modeling. Vadose zone soil leaching modeling simultaneously evaluates water transport, sediment transport and pollutant fate. The results will be used as a screening tool to assess contaminant fate and transport for risk analysis.

Data collected during the subsurface soil sampling and the historic surface soil sampling will be used to construct the SESOIL model to evaluate any potential future impacts from chemicals in soil to groundwater. The SESOIL model will predict the rate of contaminant migration through the unsaturated zone to the water table based on leaching from contaminated soils to groundwater. The results of the SESOIL modeling will be used in the groundwater transport model to simulate lateral transport of contaminants from source areas (AOCs) to receptor locations.

4.12 ANALYTICAL GROUNDWATER TRANSPORT MODEL

AT123D groundwater flow and fate and transport numerical model will be used to conduct particle track modeling to evaluate potential rates and likely direction of chemical transport in the groundwater system.

The model will use existing groundwater contaminant concentrations and/ or predicted concentrations in groundwater based on SESOIL model output. The results can be evaluated at receptor locations and can assist in determination of monitoring well locations.

4.13 ECOLOGICAL WOE

The ecological resources at each AOC have already been partly characterized and also a screening ecological risk assessment (SERA) has been performed for soil (except at one AOC) and where applicable for wet sediment and surface water. These findings are found in various previous reports and the findings will be summarized in the RI addenda for each of the 17 AOCs. Historical soil samples are adequate for ecological risk assessment. New samples of wet sediment and surface water will be taken during the implementation of this SAP Addendum to update relatively old data (some from as long ago as 1999); however, no new SERAs (except the one AOC) will be performed. Instead, the direction (higher, equivalent, or lower) and degree of difference (much, approximately equal, or little) of new concentrations will be compared to the older data. Then it will be evaluated whether concentrations have increased, stayed about the same, or decreased. It is expected that the concentrations will have decreased, due to natural attenuation and weathering of contaminants over time.

SERAs have been performed at all AOCs included in this SAP Addendum, with the exception of NACA Test Area. Each SERA reported some risk from metals and organics; however, often the risk consisted of only a few metals or a few organics and when compared to background concentrations or when the exposure assumptions were made less conservative (maximum to 95% upper confidence limit [UCL] of mean) these risk concerns sometimes diminished to be of no to little concern as reported in the previous RIs. Thus, a number of scientific management decision points are available for risk managers. One exception to this generalization is soil at NACA Test Area; no SERA was ever performed for this medium at this AOC. Therefore, a SERA (Ohio EPA Levels I and II guidance) is needed and will be performed for this AOC. If during the WOE evaluation it is determined that additional data is needed, the data will be collected through a survey of the AOC.

The above summarized ecological risk findings will be added to the WOE assessment which means the systematic assembly, discussion, and assessment of various qualities and quantities about various environment topics or elements. The WOE rationale to be used was developed in conjunction with the Ohio EPA and was previously applied successfully at other AOCs such as Erie Burning Grounds. The WOE elements consist of:

- Significance of ecological resources;
- Habitats or ecosystems functioning (despite contamination);
- Confirmation of quality habitat surrounding the AOCs;
- Limited contamination;
- No to little contaminant migration; and
- Trade-off or comparison of the benefit of chemical risk gained relative to harming or destruction of physical/biological environment due to a remedial action.

Together, these WOE elements constitute additional scientific management decision points that will be used to evaluate whether cleanup goals are necessary for the protection of ecological resources at the 17 AOCs.

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5.0 SAMPLE CHAIN OF CUSTODY DOCUMENTATION

5.1 FIELD LOGBOOK

All field logbook information will follow structures identified in Section 5.1 of the Facility-Wide SAP.

5.2 PHOTOGRAPHS

Information regarding the documentation of photographs during AOC-specific investigations is presented in Section 4.3.2.4.3 of the Facility-Wide SAP. Representative photographs will be taken of the investigative measures during the fieldwork and any significant observations that are made during the field effort. Photographs will be suitable for presentation in a public forum, as well as for documenting scientific information. Attempts will be made when taking photographs to document sampling points to include two or more permanent reference points to facilitate relocating.

5.3 SAMPLE NUMBERING SYSTEM

The sample numbering system that will be used to identify samples collected during the implementation of this SAP Addendum is outlined in Section 5.3 and Figure 5-1 of the Facility-Wide SAP. Specific sample identifying information that will be used to implement the sampling scheme is presented in Figure 5-1. Samples will be identified sequentially using the identification number system consistent with the remedial investigations. If a sample is not collected or is reassigned to a different location, a specific reason and notation will be noted in the project field books.

Sample Station Location Identification: XXXmm-NNN(n)-####-tt	
XXX = Area Designator	
CBL = C-Block Quarry	LL9 = Load Line 9
B12 = Building 1200	LL10 = Load Line 10
LNW = Landfill North of WBG	LL11 = Load Line 11
ULCP = Upper and Lower Cobbs Ponds	LL12 = Load Line 12
LL6 = Load Line 6	F15 = Buildings F-15 and F-16
NTA = NACA Test Area	ATA = Anchor Test Area
LL5 = Load Line 5	ASY = Atlas Scrap Yard
LL7 = Load Line 7	WSA = Wet Storage Area
LL8 = Load Line 8	
mm = Sample Location Type	
mw = Groundwater Monitoring Well	sw = Surface Water
so = Soil Boring/Subsurface Soil	sd = Sediment
ss = Surface Soil Sample Location	
NNN = Sequential Sample Location Number Unique, sequential number for each sample location beginning with the following number from the last number used from previous investigation stations and extending into any subsequent investigative phases (i.e., 001 – 999)	
(n) = Special Identifier Optional use (as needed) to identify special sample matrices or sample location characteristics M = Multi-increment Sample	
#### = Sequential Sample Identification Number Unique, sequential number for each sample beginning with last sampling locations, specific to each AOC, and extending into any subsequent investigative phases (i.e., 0001 – 9999)	
tt = Sample Type	
so = Soil Sample	gw = Groundwater Sample (unfiltered)
tb = Trip Blank	gf = Groundwater Samples (filtered)
fb = Field Blank	sw = Surface Water
er = Equipment Rinsate	sd = Sediment

Figure 5-1. Sample Identification System

5.4 SAMPLE DOCUMENTATION

All sample label, logbook, field record, and field form information will follow structures identified in Chapter 5.0 of the Facility-Wide SAP.

5.5 DOCUMENTATION PROCEDURES

Documentation and tracking of samples and field information will follow the series of steps identified in Section 5.5 of the Facility-Wide SAP.

5.6 CORRECTIONS TO DOCUMENTATION

Any corrections to documentation will follow guidance established in Section 5.6 of the Facility-Wide SAP.

5.7 MONTHLY REPORTS

Monthly reports are submitted as part of implementation of SAIC's PBA. This monthly report will be submitted on the 10th day of each month to both the USACE and Ohio EPA. The content of the reports will have content similar to that specified in Section 5.7 of the Facility-Wide SAP.

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6.0 SAMPLE PACKAGING AND SHIPPING REQUIREMENTS

Sample packaging and shipping shall generally follow Chapter 6.0 of the Facility-Wide SAP.

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7.0 INVESTIGATION-DERIVED WASTE

All IDW, including auger cuttings, personal protective equipment (PPE), disposable sampling equipment, and decontamination fluids, will be properly handled, labeled, characterized, and managed in accordance with Section 7.0 of the Facility-Wide SAP. At the conclusion of field activities for the project, a letter report will be submitted to Ohio EPA, USACE and RVAAP Facility Manager documenting the characterization and classification of the wastes. Upon approval of the IDW classification report, all solid and liquid IDW will be removed from the site and disposed of by a licensed waste disposal contractor. All shipments of IDW off site will be coordinated through the RVAAP Facility Manager.

The following three types and estimated quantities of IDW are anticipated:

- Soil, from the unconsolidated surficial and subsurface material derived during soil boring activities (estimated eighteen 55-gallon drums).
- Decontamination fluids, including those derived from decontamination of sampling equipment and drilling equipment (estimated four 55-gallon drums and two small containers of spent chemical rinse agents [e.g., acid, alcohol]).
- Expendables/solid wastes, including PPE and disposable sampling equipment (estimated two 55-gallon drums).

Each of the three types of IDW will be contained separately. Characterization and classification of the different types of IDW will be based on the specific protocols described below. Expendable solid waste will be not sampled for characterization purposes. Only soil IDW will be segregated by AOC, as the other types of IDW are not considered representative of AOC-specific conditions.

- **Soils:** Drill cuttings will be placed in 55-gallon drums. Disposition of the drummed soil will be based on analytical results from toxicity characteristic leaching procedure (TCLP) samples collected.

- **Decontamination Fluids:** Decontamination fluids will be placed in drums or a polytank up to 1,500 gallons in size as needed. Disposition of decontamination liquid will be based on the collection and analysis of TCLP liquid sample(s).

Drummed soil and sediment will be transported to a location designated by the RVAAP Facility Manager, where it will be staged on wooden pallets. Decontamination fluids and field laboratory wastes will also be staged at the identified location within secondary containment structures. To avoid potential drum rupture due to freezing conditions, drums containing liquid will be filled only to 75% capacity.

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8.0 REFERENCES

Lakeshore Engineering Services, Inc. (LES) 2007. *Final Project Completion Report Munitions Response for demolition of Load Line 5, 7, Building 1039, Transite Removal at Building T-1604 Removal of Remaining Concrete and Miscellaneous Debris at Load Lines 6, 9, and 11 at Ravenna Army Ammunition Plant, Ravenna Ohio*, Contract No. W52H09-06-C-5009. December.

Metcalf & Eddy, Inc. (M&E) 1989. *RCRA Facility Assessment Draft RR/VSI Report for Ravenna Army Ammunition Plant, Ravenna, Ohio*, Contract No. 68-01-7351. October.

MKM Engineers, Inc. 2004. *Report LL-11 Interim Removal Action at Load Line 11 (AOC-44).* Final. March.

MKM Engineers, Inc. 2005. *Phase II Remedial Investigation at the Upper and Lower Cobbs Pond (AOC 29)*, Final. September.

MKM Engineers, Inc. 2005. *Report for the Remedial Investigation at Load Line 11 (AOC-44).* Final. September.

MKM Engineers, Inc. 2007a. *Final Characterization of 14 AOCs at Ravenna Army Ammunition Plant*, March.

MKM Engineers, Inc. 2007b. *Report for the Phase I Remedial Investigation of RVAAP-33 Load Line 6, Volume 1-4,* Final. August.

MKM Engineers, Inc. 2007c. *Report for the Phase I Remedial Investigation at RVAAP-42 Load Line 9, Volume 1-4.* Final. October.

Ohio Environmental Protection Agency (Ohio EPA) 1995. *Technical Guidance Manual for Hydrogeologic Investigations and Groundwater Monitoring.* February.

Ohio EPA 2004. Director's Final Findings and Orders (DFFO) for RVAAP, dated June 10, 2004.

USACE (U.S. Army Corps of Engineers) 1996a. *Action Plan for the Ravenna Army Ammunition Plant, Ravenna, Ohio*, DACA62-94-D-0029, DO 0009. Final. March.

USACE 1996b. *Preliminary Assessment for the Characterization of Areas of Contamination at the Ravenna Army Ammunition Plant, Ravenna, Ohio,* DACA62-94-D-0029, DO 0009. February.

USACE 1998. *Phase I Remedial Investigation Report for High Priority Areas of Concern at the Ravenna Army Ammunition Plant, Ravenna, Ohio, Volume I – Main Text*, DACA-62-94-D-0029, Dos 0010 and 0022, Final. February.

USACE 2001a. *Facility-Wide Sampling and Analysis Plan for Environmental Investigations at the Ravenna Army Ammunition Plant, Ravenna, Ohio*, DACA 62-00-0-0001, DO CY02. March.

USACE 2001b. *Phase I Remedial Investigation Report for the NACA Test Area at the Ravenna Army Ammunition Plant, Ravenna, Ohio*, DACA 62-94-D-0029, DO 0077. Final. December.

USACE 2004. *Phase II Remedial Investigation Report for Load Line 12 at the Ravenna Army Ammunition Plant, Ravenna, Ohio, Volume I – Main Text and Appendices A-H*. DACA62-00-D-0001, DO CY06, Final. March 2004.

USACE 2005a. *Facility-Wide Biological and Water Quality Study 2003, Ravenna Army Ammunition Plant, Part 1-Streams, Part 2 Ponds, Volumes I and II.* Final. November.

USACE 2005b. *Phase I Remedial Investigation Report for Ramsdell Quarry Landfill at the Ravenna Army Ammunition Plant, Ravenna, Ohio*, GS-10F-0076J, DO W912QR-05-F-003. September.

USACE 2005c. *Phase II Remedial Investigation Supplemental Report for Load Line 12 (RVAAP-12) at the Ravenna Army Ammunition Plant, Ravenna, Ohio*, GS-10F-00765, DO W012QR-05-F-0033, Final. November.

USACE 2005d. *RVAAP Facility Wide Human Health Risk Assessor Manual*, Amendment 1. November 2005.

USACE 2008a. *Final Project Management Plan for the 2008 Performance-based Acquisition of Environmental Investigation and Remediation, Revision 0, Ravenna Army Ammunition Plant, Ravenna, Ohio*, W912QR-04-D-0028, DO0001. December.

USACE 2008b. *Draft White Paper Ravenna Army Ammunition Plant (RVAAP) Facility-Wide Human Health Cleanup Goal Development*, W912QR-04-D-0019, DO 008. February.

USACE 2008c. Remedial Investigation Report Addendum No. 1 for the RVAAP- 49 Central Burn Pits at Ravenna Army Ammunition Plant, Ravenna, Ohio, GS-10F-0076J, DO W912QR-05-F-0033. Final. June.

USACE 2009a. *Final Investigation of the Under Slab Surface Soils Post Slab and Foundation Removal at RVAAP-39 Load Line 5, RVAAP-40 Load Line 7, RVAAP-41 Load Line 8, and RVAAP-43 Load Line 10 Volume One – Main Report Ravenna Army Ammunition Plant, Ravenna, Ohio*. Version 1.0. January.

USACE 2009b. *RVAAP Position Paper for the Application and Use of Facility-Wide Human Health Cleanup Goals*, Final. June 2009.

USACHPPM (U.S. Army Center for Health Promotion and Preventative Medicine) 1998. *Hazardous and Medical Waste Study No. 37-EF-5360-99 Relative Risk Site Evaluation for Newly Added Sites at Ravenna Army Ammunition Plant, Ravenna, Ohio.* October.

USA Environmental 2009. *Revised Final Work Plan 2008 Performance-Based Acquisition for Environmental Investigation and Remediation MEC Avoidance/Removal Services Ravenna Army Ammunition Plant Ravenna, Ohio.* Contract No. W912QR-04-D-0028.. September.

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APPENDIX A

C-Block Quarry (RVAAP–06)

A.0 C-BLOCK QUARRY (RVAAP-06)

A.1 AOC DESCRIPTION

This AOC is an abandoned quarry approximately 0.3 acres in size (Figure A-1). C-Block Quarry was used as a disposal area for annealing process wastes (chromic acid), spent pickle liquors from brass finishing, fill dirt, and miscellaneous construction and demolition material during the 1950s. The quarry bottom has a measured maximum depth of 25 ft below the surrounding grade and the fill material ranges from 1.5 to 5 ft thick. Currently, C-Block Quarry is heavily forested with trees of 1 ft diameter or larger.

A.2 PREVIOUS INVESTIGATIONS

Two investigations have been conducted at C-Block Quarry to characterize potential contamination, as well as evaluate any associated human or ecological health risks. In the RVAAP 1996 Relative Risk Site Evaluation (RRSE), completed by the U.S. Army Center for Health Promotion and Preventive Medicine (USACHPPM), C-Block Quarry was scored a "low" risk AOC based on three soil samples (USACE 1996a). The report concluded there was no evidence of contaminants migrating; however, there are no physical barriers to prevent receptors from entering the AOC (USACE 1996a).

A characterization was conducted from October 2004 through May 2005 (MKM 2007a). This characterization and investigation included the following field activities at C-Block Quarry:

- Collection of six multi-increment (MI) surface soil (0 to 1 ft) samples;
- Collection of four MI wet sediment (0 to 0.5 ft) samples from drainage pathways;
- Collection of four surface water samples from drainage pathways;
- Installation and sampling of four groundwater monitoring wells;
- Collection of geotechnical samples from two soil borings;
- Well slug tests; and
- Survey of C-Block Quarry identifying sampling and monitoring well locations.

The results of the investigation concluded that there were chemicals detected above the RVAAP-specific background values and USEPA Region 9 PRGs in all media sampled.

For this SAP Addendum, all historical sample results were compared to the preliminary RVAAP facility-wide screening criteria (Section 3.2.2 of the FSP). Table A-1 lists the chemicals that exceeded preliminary RVAAP facility-wide screening criteria in each medium, as well as the maximum and minimum concentration detected.

Figures A-1 and A-2 illustrate the type and location of historical samples and identify samples that exceeded screening criteria for metals or organics, respectively.

Table A-1. Chemicals Exceeding Screening Criteria at C-Block Quarry

Medium	Analyte	Units	Frequency of Detection	Minimum Detect	Maximum Detect	Average Result[a]	Screening Criteria[b]
Surface Soil	Arsenic	mg/kg	7/7	6.7	19	13.1	15.4
	Chromium	mg/kg	7/7	17	920	289	17.4
	Chromium,hexavalent	mg/kg	1/6	5.4	5.4	1.78	1.6
	2,4,6-Trinitrotoluene	mg/kg	4/7	0.09	22.0	3.21	3.7
Subsurface Soil	Not sampled	--	--	--	--	--	--
Wet Sediment	Aluminum	mg/kg	5/5	10000	14000	12000	13900
Surface Water	Arsenic	mg/L	4/5	0.004	0.011	0.006	0.0032
	Manganese	mg/L	5/5	0.690	4.100	2.000	0.63
	Thallium	mg/L	1/5	0.002	0.002	0.002	0.0012
	4-Methylphenol	mg/L	2/5	0.032	0.086	0.024	0.068
	Bis(2-ethylhexyl)phthalate	mg/L	1/5	0.130	0.130	0.032	0.0035
Groundwater	Benz(a)anthracene	mg/L	1/12	0.00016	0.00016	0.00011	0.0000039
	Benzo(a)pyrene	mg/L	1/12	0.00017	0.00017	0.00013	0.00000023
	Benzo(b)fluoranthene	mg/L	1/12	0.00013	0.00013	0.00013	0.0000023
	Bis(2-ethylhexyl)phthalate	mg/L	6/12	0.00130	0.40000	0.03960	0.0009
	Indeno(1,2,3-cd)pyrene	mg/L	1/12	0.00014	0.00014	0.00013	0.0000023

-- Not applicable.

[a]Average result equals the sum of the concentrations divided by the number of samples; the average includes non-detects at half the reporting limit and field duplicate samples. This can result in an average less than the range of detected values.

[b]Screening criteria are based on a hazard index (HI)=0.1 and Target Risk=10^{-6}

Previous surface soil sampling has been accomplished at C-Block Quarry at the 0-1 ft interval. Table A-2 summarizes the historical surface soil sampling conducted at C-Block Quarry and indicates whether sample results exceeded screening criteria.

Table A-2. C-Block Quarry Historical Soil Sampling Summary

Sample Location	Sample Number	Depth of Sample (ft bgs)	Analysis Performed				
			Metals	Explosives	VOCs	Pesticides/ PCBs	SVOCs
CBLss-001M	CBLss-001M-SO	0.0-1.0	**Y**	N	--	--	--
CBLss-002M	CBLss-002M-SO	0.0-1.0	Cr	N	--	--	--
CBLss-003M	CBLss-003M-DUP	0.0-1.0	Cr	N	--	--	--
	CBLss-003M-SO	0.0-1.0	Cr	N	--	--	--
CBLss-004M	CBLss-004M-SO	0.0-0.5	Cr	Y	--	--	--

Table A-2. C-Block Quarry Historical Soil Sampling Summary (continued)

Sample Location	Sample Number	Depth of Sample (ft bgs)	Analysis Performed				
			Metals	Explosives	VOCs	Pesticides/ PCBs	SVOCs
CBLss-005D	CBLss-005D-SO	0.0-1.0	--	--	N	--	--
CBLss-005M	CBLss-005M-SO	0.0-1.0	Cr	N	--	N	N
CBLss-006M	CBLss-006M-SO	0.0-1.0	Cr	N	--	--	--

Y = Analyte(s) greater than screening criteria.
Cr = Only chromium greater than screening criterion.
N = Non-detect or less than screening criteria.
-- = Analysis not performed.

A.3 PROPOSED SAP ADDENDUM CHARACTERIZATION ACTIVITIES

The objective of this SAP Addendum for C-Block Quarry is to define the nature and extent of chemicals at concentrations greater than the screening criteria and evaluate current concentrations of chemicals in groundwater.

The horizontal extent of soil contamination within C-Block Quarry has been defined. The horizontal extent of contamination in soil is constrained by the AOC physical characteristics (e.g., quarry highwall). There was no identified wet sediment or surface water within the quarry bottom during previous investigations or site walkovers in advance of this SAP Addendum. The vertical extent of arsenic, chromium, and explosives at concentrations greater than the screening criteria has not been fully delineated in previous investigations. Therefore, additional remedial investigative activities of subsurface soil are proposed.

Table A-3 summarizes the chemicals that exceeded screening criteria and CUGs for each medium, the types and quantities of samples to be collected during the implementation of this SAP Addendum, and the rationale behind the proposed samples. The general approach for investigation activities is presented in Section 3.2 of the Field Sampling Plan (FSP). Figure A-3 illustrates the locations of the samples to be collected, as well as previous screening criteria and CUG exceedances.

Suspect asbestos-containing material (ACM) construction debris was observed in previous investigations. Therefore, a certified asbestos inspector will be present during soil sampling activities at C-Block Quarry. If the inspector determines the debris is ACM, the soil samples collected from the borings will be analyzed for asbestos. If it is observed by the inspector that these materials may represent an exposure hazard (i.e., friable ACM), the soil samples will be collected by the certified asbestos inspector.

Table A-4 presents the coordinates for the proposed sampling locations for this AOC. The locations may be altered during implementation of this SAP Addendum for a variety of reasons (e.g., soil boring refusal and MEC avoidance). The final coordinates of the sample locations (including elevations) will be presented in the RI Report.

Table A-3. Summary of Sampling at C-Block Quarry

Medium	Historical Sample Type	Historical Screening Criteria Exceedances	Number of SAP Addendum Sample Locations	Rationale for SAP Addendum Field Activities
Surface soil	MI	As **CBLss-001M** Explosives CBLss-004M	0	No additional horizontal nature and extent delineation is planned. Contamination is laterally confined within the quarry pit due to the topography of the AOC. Surface soils may be analyzed for asbestos if a certified asbestos inspector determines on-site construction debris is ACM.
	Cr speciation (MI)	Cr **CBLss-002M, 003M, & 005M** Cr^{+6} CBLss-003M	0	No additional chromium speciation sampling planned. Five samples were previously collected for total chromium and hexavalent chromium. Of the five samples collected, only one was above the detection limit for hexavalent chromium (5.4 mg/kg [J] at CBLss-003M). The percent ratio of hexavalent to total chromium is 2.25%, which is well below 14%.
Subsurface soil	N/A	N/A	5	A total of five boring locations are placed to further define the vertical extent of chromium in MI areas CBLss-002M, ss-003M, ss-004M, ss-006M; arsenic in MI area CBLss-001M; and explosives in MI area CBLss-004M. Contamination is assumed to be vertically confined within the quarry pit, due to the topography of the AOC and presence of shallow bedrock in the quarry bottom. All samples will be analyzed for TAL metals and explosives, and 15% (one sample) will be analyzed for the full suite of RVAAP COPCs. Subsurface soils may be analyzed for asbestos if a certified asbestos inspector determines on-site construction debris is ACM.
	Geotechnical	N/A	1	One sample shall be collected above bedrock to provide soil data for modeling.
Surface water	Discrete	As CBLsw-001, 002, 003 Mn CBLsw-001, 002, 003, 004 Tl CBLsw-002 SVOCs **CBLsw-001**, 003	0	No additional sampling. There is no surface water present at the AOC. Previous sample locations were within low-lying areas that potentially retain rainwater 1,000 to 1,600 feet upgradient of the AOC.

Table A-3. Summary of Sampling at C-Block Quarry (continued)

Medium	Historical Sample Type	Historical Screening Criteria Exceedances	Number of SAP Addendum Sample Locations	Rationale for SAP Addendum Field Activities
Wet sediment	MI	Al CBLsd-003M	0	No additional sampling. Refer to surface water above.
Groundwater	Discrete	SVOCs **CBLmw-001**, **002**, **003**, 004	0	No additional groundwater sampling is planned. Monitoring wells CBLmw-001, 002, 003 and 004 are currently being sampled under the FWGWMP. Four quarters of sampling were completed in October 2008. No additional sampling of groundwater is required for completion of the FS.

Bold indicates locations where concentration also exceeded the CUG (HI = 1.0, Target Risk = 10^{-5}) for the identified chemical.

Table A-4. Coordinates for Proposed Sampling Locations at C-Block Quarry

Sample Location ID	Sample Type	Easting	Northing
CBLsb-007	Grab	2343725.335	559645.7441
CBLsb-008	Grab	2343773.273	559549.9065
CBLsb-009	Grab	2343793.376	559525.1741
CBLsb-010	Grab	2343833.582	559401.5127
CBLsb-011	Grab	2343866.057	559401.5127
CBLsb-012	Grab	2343702.037	559540.5117

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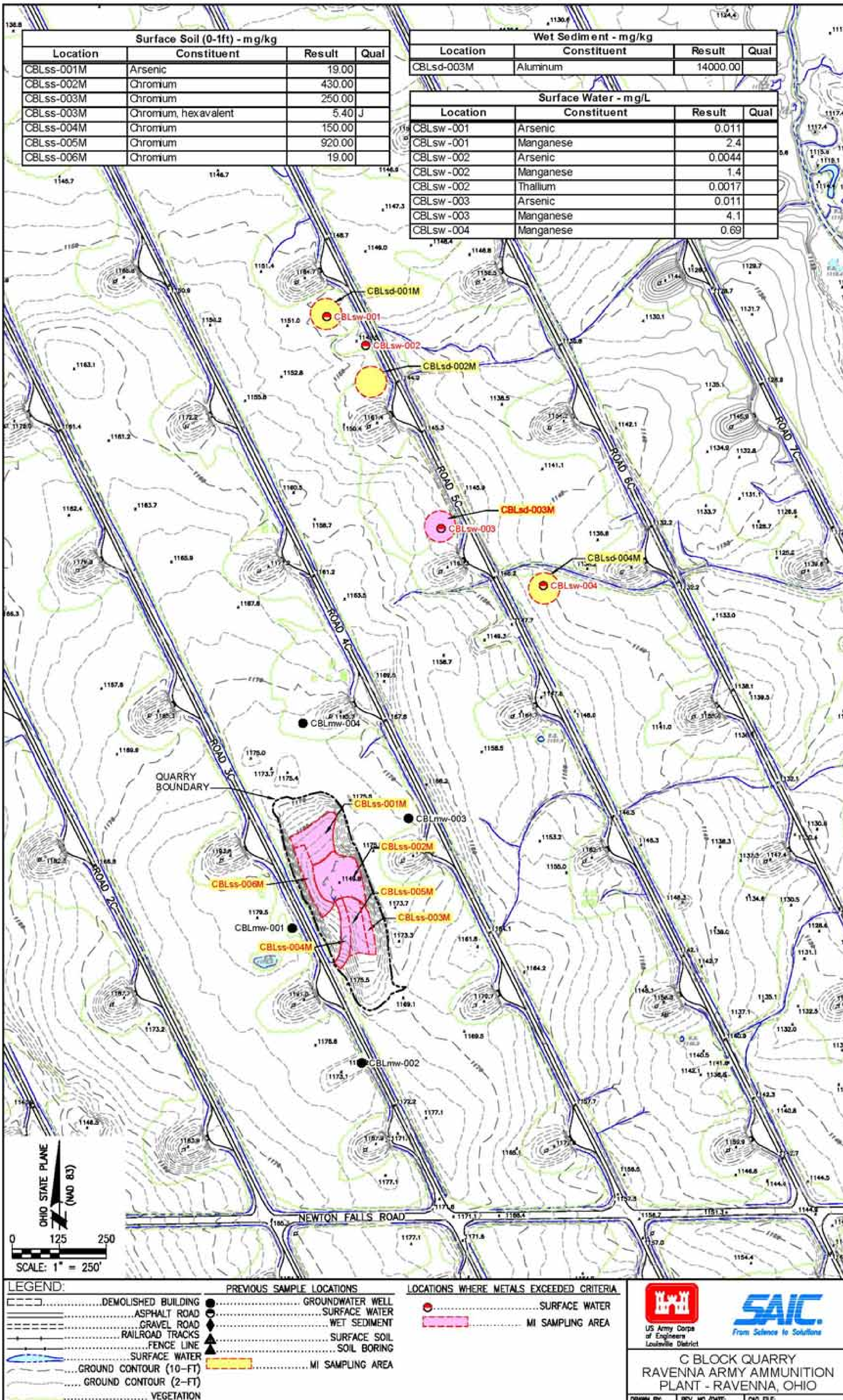
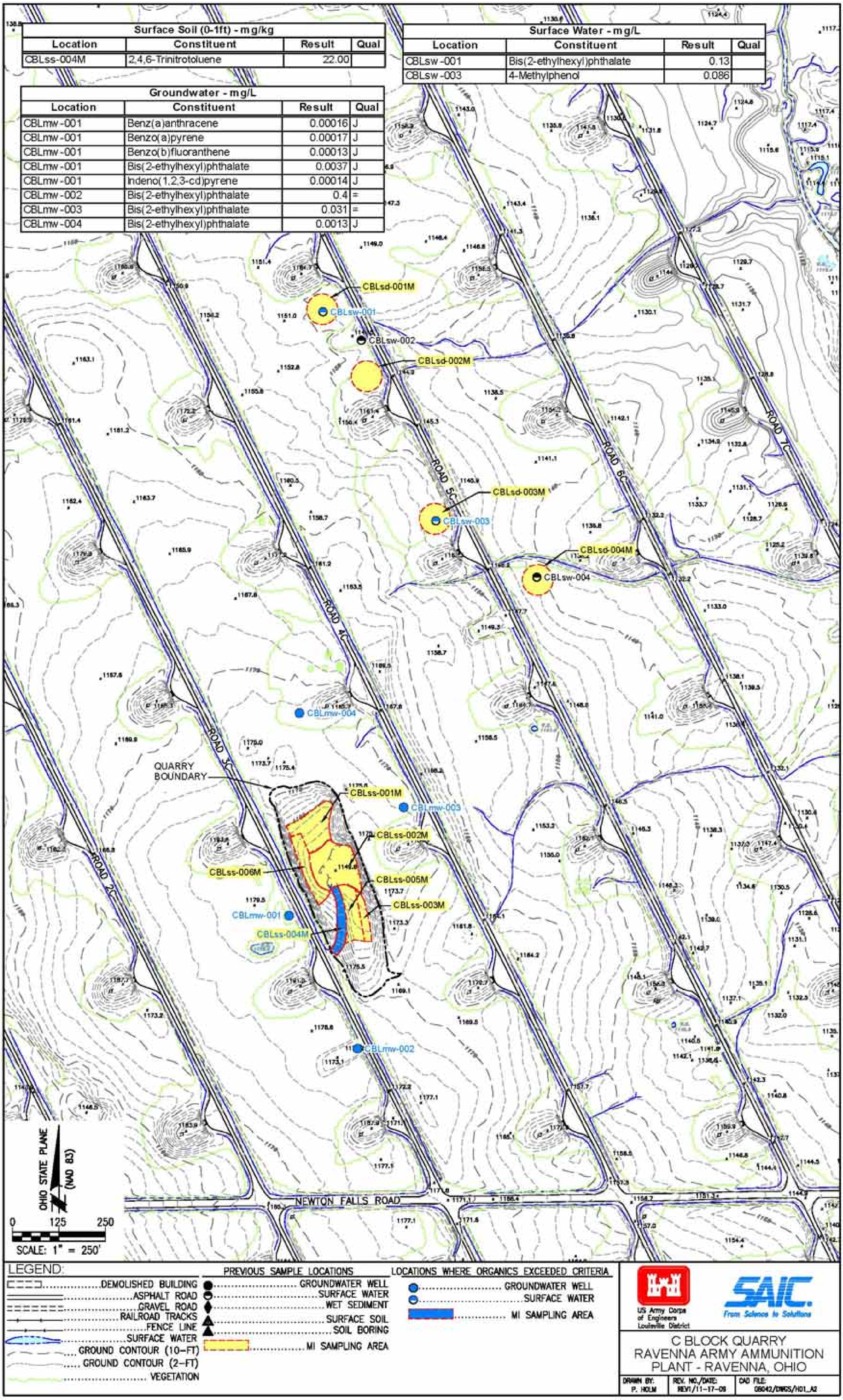


Surface Soil (0-1ft) - mg/kg			
Location	Constituent	Result	Qual
CBLss-001M	Arsenic	19.00	
CBLss-002M	Chromium	430.00	
CBLss-003M	Chromium	250.00	
CBLss-003M	Chromium, hexavalent	5.40	J
CBLss-004M	Chromium	150.00	
CBLss-005M	Chromium	920.00	
CBLss-006M	Chromium	19.00	

Wet Sediment - mg/kg			
Location	Constituent	Result	Qual
CBLsd-003M	Aluminum	14000.00	

Surface Water - mg/L			
Location	Constituent	Result	Qual
CBLsw-001	Arsenic	0.011	
CBLsw-001	Manganese	2.4	
CBLsw-002	Arsenic	0.0044	
CBLsw-002	Manganese	1.4	
CBLsw-002	Thallium	0.0017	
CBLsw-003	Arsenic	0.011	
CBLsw-003	Manganese	4.1	
CBLsw-004	Manganese	0.69	

Figure A-1. Historical Sampling and Metal Exceedance Locations at C-Block Quarry



Surface Soil (0-1ft) - mg/kg

Location	Constituent	Result	Qual
CBLss-004M	2,4,6-Trinitrotoluene	22.00	

Surface Water - mg/L

Location	Constituent	Result	Qual
CBLsw-001	Bis(2-ethylhexyl)phthalate	0.13	
CBLsw-003	4-Methylphenol	0.086	

Groundwater - mg/L

Location	Constituent	Result	Qual
CBLmw-001	Benz(a)anthracene	0.00016	J
CBLmw-001	Benzo(a)pyrene	0.00017	J
CBLmw-001	Benzo(b)fluoranthene	0.00013	J
CBLmw-001	Bis(2-ethylhexyl)phthalate	0.0037	J
CBLmw-001	Indeno(1,2,3-cd)pyrene	0.00014	J
CBLmw-002	Bis(2-ethylhexyl)phthalate	0.4	=
CBLmw-003	Bis(2-ethylhexyl)phthalate	0.031	=
CBLmw-004	Bis(2-ethylhexyl)phthalate	0.0013	J

Figure A-2. Historical Sampling and Organic Exceedance Locations at C-Block Quarry

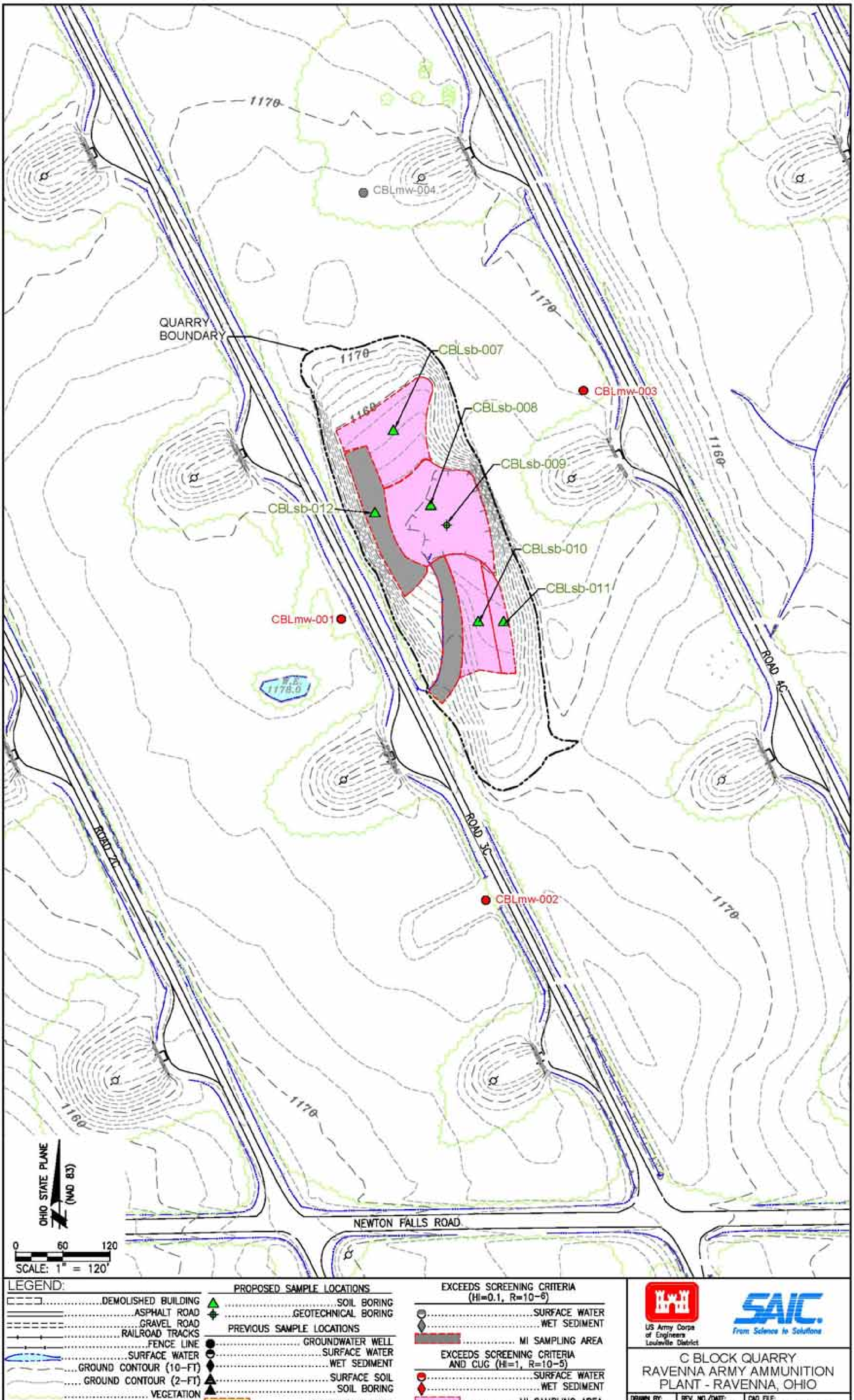


Figure A-3. Historical Exceedances and Proposed Sampling Locations at C-Block Quarry

APPENDIX B

Load Line 12 (RVAAP-12)

B.0 LOAD LINE 12 (RVAAP-12)

B.1 AOC DESCRIPTION

Load line 12 is an 80-acre former ammonium nitrate manufacturing facility operational from 1941 to 1946 (Figure B-1). From 1941 to 1943, explosive grade ammonium nitrate was manufactured at Load Line 12. Munitions renovation and demilitarization operations were performed at the AOC after the termination of ammonium nitrate production in 1943. Load Line 12 was leased by the Silas Mason Company from 1946 to 1949 to manufacture fertilizer grade ammonium nitrate. Building 904 was used for demilitarization work and bomb melt out from 1949 to 1993. A pink water treatment plant located near Building 904 was taken out of service in 2000. From 1965 to 1967, Hercules Alcor, Inc. leased Building FF-19 to produce aluminum chloride. A former steam plant located in the southern portion of the AOC used fuel oil and coal at various times over the years as fuel. All buildings have been demolished to grade. An explosives composting pilot study in 1999 involved removal of approximately 1,500 ft^3 of soil from four pits near Building 904, which was transported to a warehouse at Load Line 4 for composting. Soil/dry sediment and groundwater at Load Line 12 are being addressed under separate CERCLA decisions. This SAP Addendum focuses only on wet sediment and surface water.

B.2 PREVIOUS INVESTIGATIONS

Since 1996, Load Line 12 has been the subject of multiple investigation and/or assessments. In 1996 the U.S. Army Center for Health Promotion and Preventive Medicine (USACHPPM) conducted an relative risk site evaluation (RRSE). Results from that screening ranked the AOC as a "High" risk. Therefore, the AOC was included in the 1996 Preliminary Assessment at RVAAP and was assigned one of the highest risk ratings (USACE 1996).

A Phase I Remedial Investigation was conducted at Load Line 12 from July through August 1996. Results of this investigation concluded that Load Line 12 had elevated contaminant concentrations in soil and sediment and a Phase II Remedial Investigation was recommended (USACE 1998).

The Phase II Remedial Investigation evaluated the nature and extent of process related contaminants in surface and subsurface soil, wet sediment, surface water, and groundwater. The AOC was evaluated by dividing it into spatial aggregates based on former process operations and drainage areas. Ditches downstream of former Buildings FF-19 and 905, considered wet sediment, were mostly contaminated with metals. Upgradient wet sediment samples contained elevated concentrations of SVOCs. Surface water downstream of major source areas was mostly contaminated with metals.

Additional characterization was conducted at the AOC from October 2004 through February 2005 as part of the Final Characterization of 14 AOCs at RVAAP. During this investigation five groundwater monitoring wells were installed and sampled. However, no additional wet sediment or surface water characterization was conducted (MKM 2007a).

In 2009, USACE developed the *Record of Decision for Soil and Dry Sediment at the RVAAP-12 Load Line 12* to address chemical exposure in soil and dry sediment. The Main Ditch and Western Ditches aggregates are considered dry sediment and are being address under the record of decision (ROD). All other ditch aggregates are considered wet sediment and are undergoing further assessment under this SAP Addendum. The soil aggregates are also addressed in the ROD and will not undergo further investigation under this SAP Addendum.

For this SAP Addendum, all sample results were compared to the preliminary RVAAP facility-wide screening criteria (Section 3.2.2 of the FSP). Table B-1 lists the chemicals that exceeded preliminary RVAAP facility-wide screening criteria in surface water and wet sediment, as well as the maximum and minimum concentration detected.

Figures B-1 and B-2 illustrate the type and location of historical samples and identify samples that exceeded screening criteria for metals and organics, respectively.

Table B-1. Chemicals Exceeding Screening Criteria at Load Line 12[a]

Medium	Analyte	Units	Frequency of Detection	Minimum Detect	Maximum Detect	Average Result[b]	Screening Criteria[c]
Wet Sediment	Aluminum	mg/kg	23/23	6970	26300	14000	13900
	Antimony	mg/kg	820	0.77	3.2	1.24	2.8
	Arsenic	mg/kg	23/23	3.80	418.00	37.20	19.5
	Chromium	mg/kg	23/23	9.3	45.4	21.1	18.1
	Copper	mg/kg	20/20	12.8	481	94.5	1.6
	Silver	mg/kg	6/23	2.10	534.00	42.70	39
	Thallium	mg/kg	16/20	0.43	1.3	0.702	0.89
	PCB-1016	mg/kg	1/20	3.30	3.30	0.19	0.2
	PCB-1254	mg/kg	5/20	0.07	11.00	0.60	0.12
	Benz(a)anthracene	mg/kg	6/20	0.09	4.90	0.50	0.22
	Benzo(a)pyrene	mg/kg	6/20	0.09	4.40	0.48	0.022
	Benzo(b)fluoranthene	mg/kg	9/20	0.08	6.40	0.56	0.22
	Dibenz(a,h)anthracene	mg/kg	1/20	0.67	0.67	0.33	0.022
	Indeno(1,2,3-cd) pyrene	mg/kg	4/20	0.07	3.90	0.46	0.22
Surface Water	Arsenic	mg/L	1/16	0.00790	0.00790	0.00330	0.0032
	Lead	mg/L	5/16	0.00290	0.02200	0.00524	0.015
	Manganese	mg/L	16/16	0.02900	3.60000	1.12000	0.63
	Silver	mg/L	3/16	0.00240	0.09200	0.01070	0.77
	2,4,6-Trinitrotoluene	mg/L	6/16	0.00006	0.01100	0.00152	0.0078
	2,4-Dinitrotoluene	mg/L	7/16	0.00008	0.01200	0.00094	0.002
	2,6-Dinitrotoluene	mg/L	3/16	0.00012	0.00450	0.00038	0.0021
	Bis(2-ethylhexyl)phthalate	mg/L	2/16	0.00210	0.01000	0.00513	0.0035

[a] The data in this table includes samples classified as dry sediment that are being addressed under the *Record of Decision for Soil and Dry Sediment at the RVAAP-12 Load Line 12*.

[b]Average result equals the sum of the concentrations divided by the number of samples; the average includes non-detects at half the reporting limit and field duplicate samples. This can result in an average less than the range of detected values.

[c]Screening criteria are based on HI=0.1 and Target Risk=10^{-6}

B.3 PROPOSED SAP ADDENDUM CHARACTERIZATION ACTIVITIES

The objective of this SAP Addendum for Load Line 12 is to define the nature and extent of chemicals at concentrations greater than the screening criteria in surface water and wet sediment. To accomplish this further sampling and analysis of chemicals detected at concentrations greater than the screening criteria (metals, explosives, PCBs, and SVOCs) will be conducted.

Table B-2 summarizes the chemicals that exceeded the screening criteria and CUGs for surface water and wet sediment, the types and quantities of samples to be collected during the implementation of this SAP Addendum, and the rationale behind the proposed samples. The general approach for investigation activities is presented in Section 3.2 of the FSP. Figure B-3 illustrates the locations of the samples to be collected as well as previous screening criteria and CUG exceedances.

Table B-3 presents the coordinates for the proposed sampling locations for this AOC. The locations may be altered during implementation of this SAP Addendum for a variety of reasons (e.g., soil boring refusal and MEC avoidance). The final coordinates of the sample locations (including elevations) will be presented in the RI Report.

Table B-2. Summary of Sampling at Load Line 12

Medium	Historical Sample Type	Historical Screening Criteria Exceedances	Number of SAP Addendum Sample Locations	Rationale for SAP Addendum Field Activities
Surface water	Discrete	As L12-225 Pb **L12-213**, 214, 216 Ag L12-213 Explosives L12-213, 224 SVOCs L12-225	4	Four surface water and co-located composite wet sediment samples will be collected to characterize current conditions and assess potential entrance and exit pathways from the AOC. Previous surface water samples were collected in October 2000. Further, a major change at Load Line 12 (demolition of buildings in 1999) has occurred since or around the time that the wet sediment samples were taken (between 1996 and 2000). These sample locations are described below: 1. Ingress waterway from Atlas Scrap Yard at the western edge of Load Line 12 to confirm chemical concentrations. 2. Old settling pond in the middle of Load Line 12. No surface water samples have previously been collected with the settling pond. 3. Egress main ditch north of Newton Falls Road. Confirmatory documentation is needed of the egress (main ditch north of Newton Falls Road) towards Cobbs Ponds. 4. Tributary to Upper and Lower Cobbs Ponds to confirm chemical concentrations. Surface water samples will be analyzed for the RVAAP full suite. Composite wet sediment samples will be analyzed for explosives, TAL metals, PCBs, and SVOCs. The RVAAP full suite of parameters will be analyzed for 15% (i.e., one) of the composite wet sediment samples.
Wet sediment	Discrete	Al L12-208, 214, 216, 217, 223, 226, 228, 230 238 Sb L12-208 As L12-208, 226, 241 Cr L12-213, 223, 227, 228, 230, 241 Cu L12-208, 216 Ag **L12sd-213** Tl L12-214, 215, 216, 227 Pesticides/PCBs L12-208, 213, 216 SVOCs L12sd-208, 213, 225, 226, **228**	4	Refer to surface water above. Note: Sample locations L12-208, 214, 215, 216, 217, 226, 227, 241 are covered under the Record of Decision for Soil and Dry Sediment at RVAAP-12 Load Line 12.

Bold indicates locations where concentration also exceeded the CUG (HI=1.0, Target Risk=10^{-5}) for the identified chemical.

Table B-3. Coordinates for Proposed Sampling Locations at Load Line 12

Sample Location ID	Sample Type	Easting	Northing
L12sd-306	Composite	2368182.978	558566.3536
L12sw-306	Grab	2368182.978	558566.3536
L12sd-307	Composite	2368219.804	557828.2016
L12sw-307	Grab	2368219.804	557828.2016
L12sd-308	Composite	2367642.445	557592.5954
L12sw-308	Grab	2367642.445	557592.5954
L12sd-309	Composite	2368064.003	559231.7957
L12sw-309	Grab	2368064.003	559231.7957

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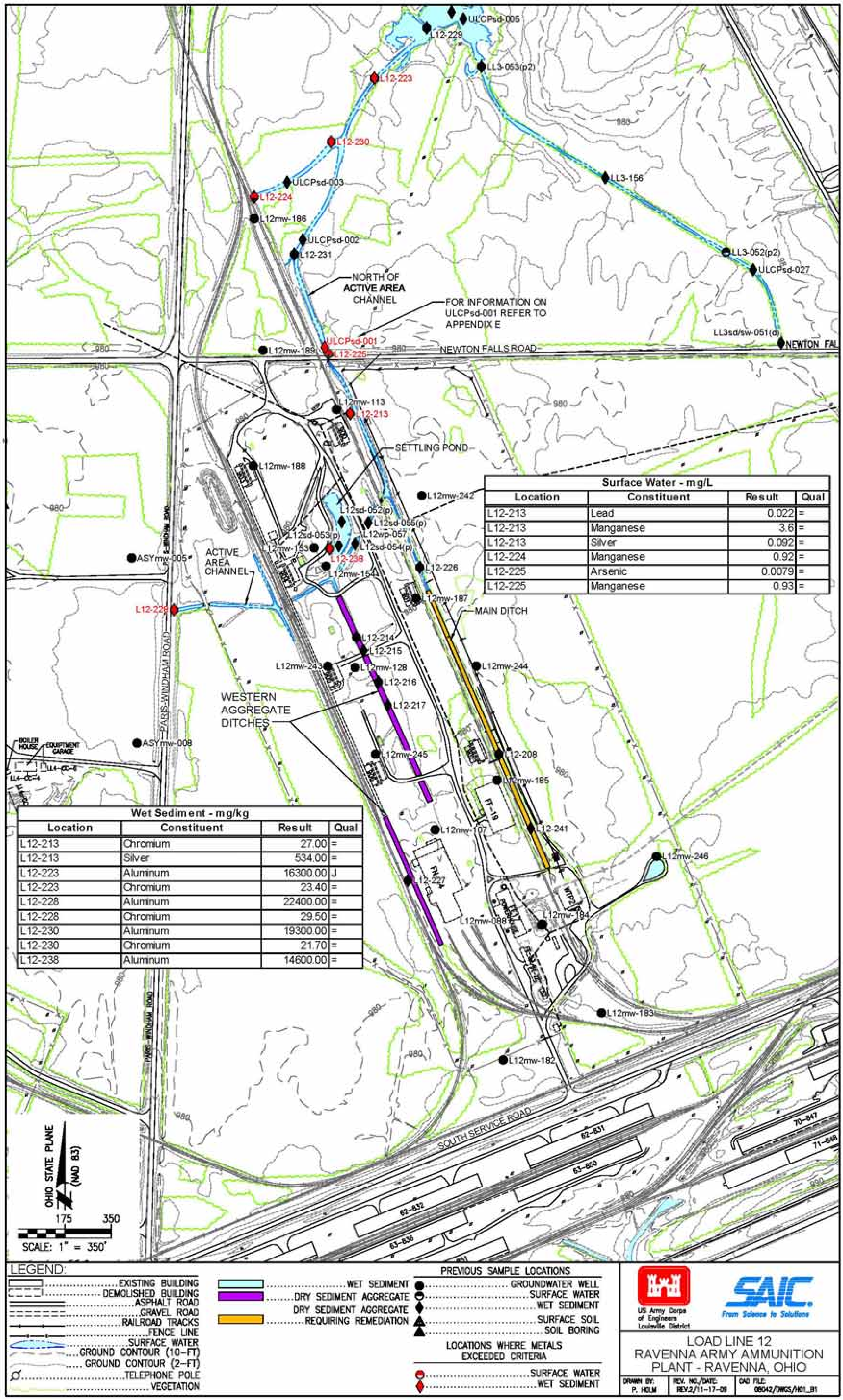


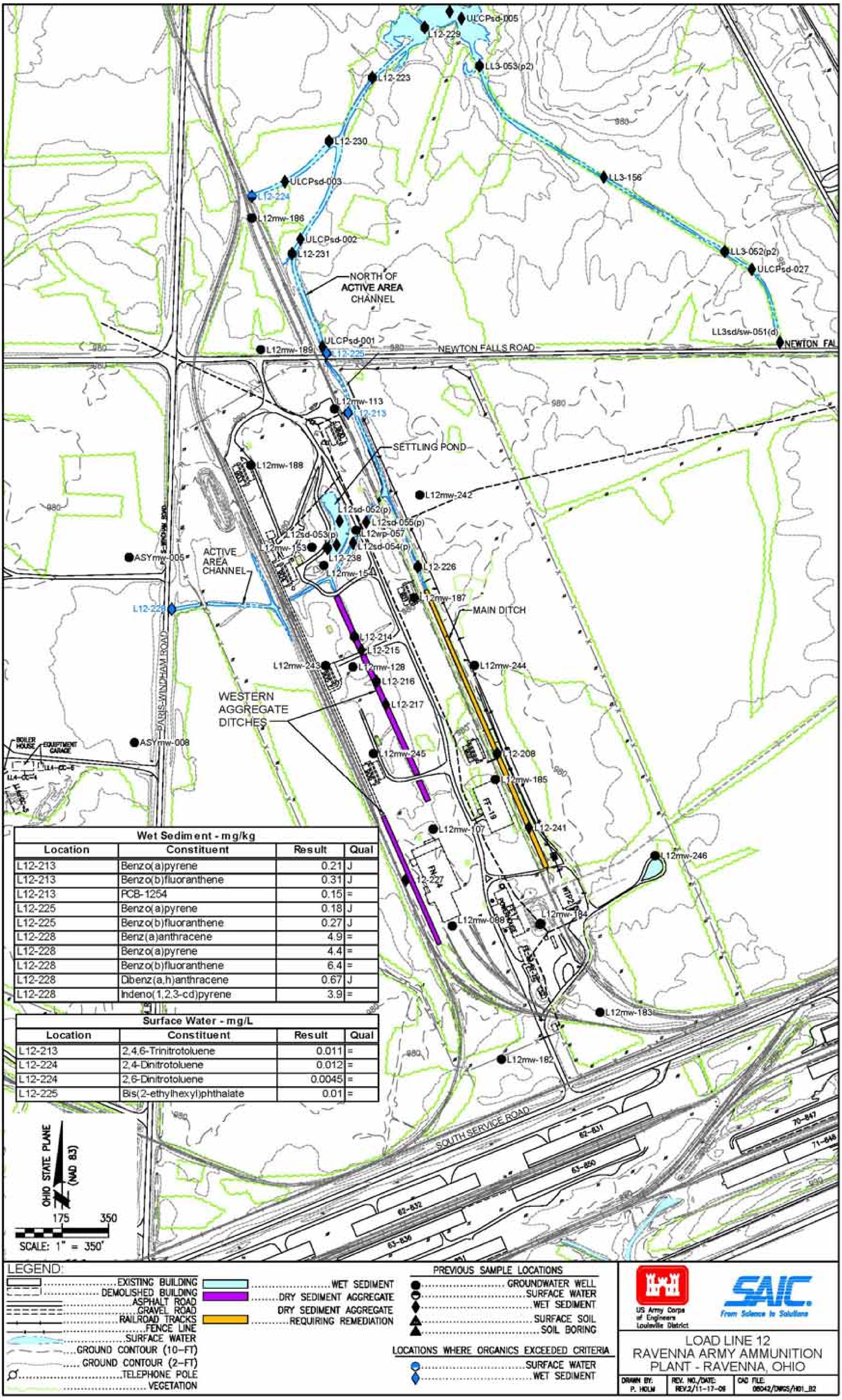
Surface Water - mg/L

Location	Constituent	Result	Qual
L12-213	Lead	0.022	=
L12-213	Manganese	3.6	=
L12-213	Silver	0.092	=
L12-224	Manganese	0.92	=
L12-225	Arsenic	0.0079	=
L12-225	Manganese	0.93	=

Wet Sediment - mg/kg

Location	Constituent	Result	Qual
L12-213	Chromium	27.00	=
L12-213	Silver	534.00	=
L12-223	Aluminum	16300.00	J
L12-223	Chromium	23.40	=
L12-228	Aluminum	22400.00	=
L12-228	Chromium	29.50	=
L12-230	Aluminum	19300.00	=
L12-230	Chromium	21.70	=
L12-238	Aluminum	14600.00	=

Figure B-1. Historical Sampling and Metal Exceedance Locations at Load Line 12



Wet Sediment - mg/kg			
Location	Constituent	Result	Qual
L12-213	Benzo(a)pyrene	0.21	J
L12-213	Benzo(b)fluoranthene	0.31	J
L12-213	PCB-1254	0.15	=
L12-225	Benzo(a)pyrene	0.18	J
L12-225	Benzo(b)fluoranthene	0.27	J
L12-228	Benz(a)anthracene	4.9	=
L12-228	Benzo(a)pyrene	4.4	=
L12-228	Benzo(b)fluoranthene	6.4	=
L12-228	Dibenz(a,h)anthracene	0.67	J
L12-228	Indeno(1,2,3-cd)pyrene	3.9	=

Surface Water - mg/L			
Location	Constituent	Result	Qual
L12-213	2,4,6-Trinitrotoluene	0.011	=
L12-224	2,4-Dinitrotoluene	0.012	=
L12-224	2,6-Dinitrotoluene	0.0045	=
L12-225	Bis(2-ethylhexyl)phthalate	0.01	=

Figure B-2. Historical Sampling and Organics Exceedance Locations at Load Line 12

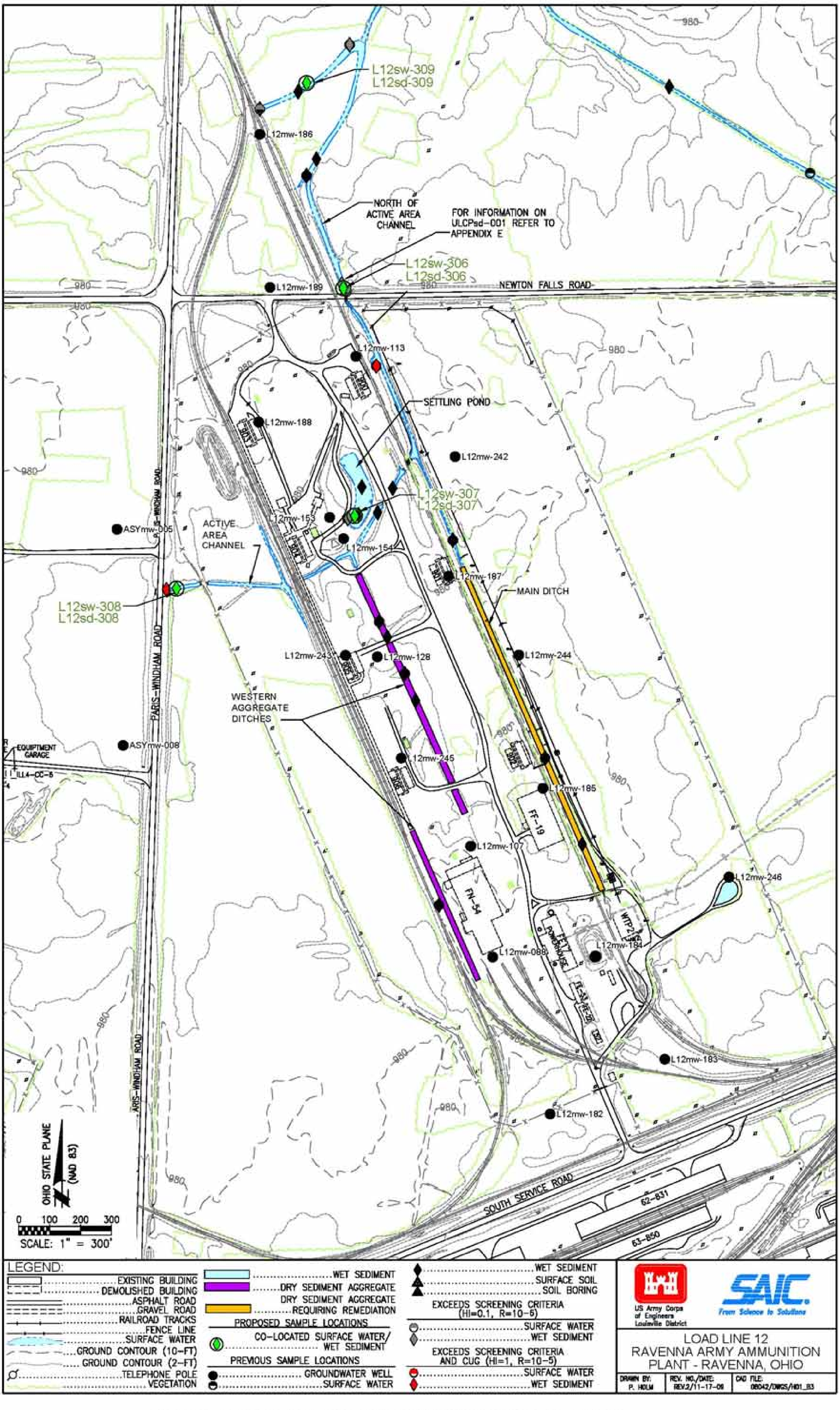


Figure B-3. Historical Exceedances and Proposed Sampling Locations at Load Line 12

APPENDIX C

Building 1200 (RVAAP-13)

C.0 BUILDING 1200 (RVAAP-13)

C.1 AOC DESCRIPTION

Building 1200 was the Ammunition Sectioning Area (Figure C-1). From 1941 to 1971, Building 1200 was used for ammunition demilitarization, which consisted of checking and steam cleaning munitions. The steam generated pink water which was discharged via a pipe, through a crushed slag gravel bed, and into a ditch connected to a 0.5 acre sedimentation pond (located approximated 415 ft northeast of the building). Overflow from the sedimentation pond discharges directly to ground surfaces southeast of the pond, as there is no established discharge drainage ditch. All structures have been demolished. Currently the AOC consists of the former building footprints, the surrounding land, a sedimentation pond, and ditches. The drainage ditch and the sedimentation pond were not backfilled or regraded during demolition activities and remain in their original form.

C.2 PREVIOUS INVESTIGATIONS

Since 1978, Building 1200 has been included in various assessments and investigations conducted at RVAAP. These investigations include:

- 1978 Installation Assessment (USATHAMA 1978);
- Preliminary Review and Visual Site Inspection conducted as a part of the Resource Conservation and Recovery Act (RCRA) Facility Assessment (M&E 1989);
- Preliminary Assessment for RVAAP (USACE 1996b);
- Phase I Remedial Investigation for High-Priority Areas of Concern (USACE 1998), and
- Final Characterization of 14 AOCs at Ravenna Army Ammunition Plant (MKM 2007a).

In the Preliminary Assessment, Building 1200 was considered among the higher priority AOCs based on a qualitative assessment of the potential hazards, release mechanisms, and environmental conditions (MKM 2007a).

From July through August of 1996, the USACE conducted a Phase I Remedial Investigation for High-Priority Areas of Concern at RVAAP. The findings of this investigation concluded that Building 1200 was a "Medium" priority AOC since no widespread contamination was detected in the soil, detected inorganics were below background values, explosives were not detected in the soil, and polycyclic aromatic hydrocarbons (PAHs) were detected in only one soil sample. The RI also concluded that there were no chemicals of potential concern (COPCs) identified in the sediments of the settling pond and drainage area leading from Building 1200. The results of this investigation were based on two surface soil samples collected near the building and seven wet and dry sediment samples collected along the drainage pathway away from the facility and the sedimentation pond. Five of the seven sediment samples were classified as surface soil (dry sediment) and the other two were classified as wet sediment.

From October 2004 through February 2005, the following field activities were conducted at Building 1200 as part of the Final Characterization of 14 AOCs at Ravenna Army Ammunition Plant (MKM 2007a):

- Collection of ten MI surface soil (0 to 1 ft) samples;
- Excavation of one test trench;
- Collection of two MI wet sediment (0 to 0.5 ft) samples from drainage pathways;
- Collection of two surface water samples from drainage pathways;
- Installation and sampling of three shallow groundwater monitoring wells;
- Collection of geotechnical samples from one soil borings;
- Well slug tests; and
- Survey of AOC identifying sampling and monitoring well locations.

This report concluded that contaminants were detected above screening criteria (i.e., USEPA Region 9 PRGs and RVAAP-specific background values) in all media sampled. Metals were the only chemicals that were detected above screening criteria in all media during this investigation.

For this SAP Addendum, all sample results were compared to the preliminary RVAAP facility-wide screening criteria (Section 3.2.2 of the FSP). Table C-1 lists the chemicals that exceeded preliminary RVAAP facility-wide screening criteria in each medium, as well as the maximum and minimum concentration detected.

Figures C-1 and C-2 illustrate the type and location of historical samples and identify samples that exceeded screening criteria for metals and organics, respectively.

Table C-1. Chemicals Exceeding Screening Criteria at Building 1200

Medium	Analyte	Units	Frequency of Detection	Minimum Detect	Maximum Detect	Average Result[a]	Screening Criteria[b]
Surface Soil	Aluminum	mg/kg	19/19	8020.00	30000.00	13500.00	17700
	Chromium	mg/kg	19/19	11.00	33.00	18.70	17.4
	Cobalt	mg/kg	13/13	1.30	15.00	8.30	10.4
	Manganese	mg/kg	19/19	112.00	4100.00	831.00	1450
	Thallium	mg/kg	2/13	0.93	1.50	0.43	0.61
	RDX	mg/kg	2/19	0.13	13.00	0.95	8
	Benzo(a)pyrene	mg/kg	2/3	0.01	0.16	0.13	0.022
	Dibenz(a,h)anthracene	mg/kg	1/3	0.05	0.05	0.10	0.022
Subsurface Soil	Not sampled	--	--	--	--	--	--
Wet Sediment	Aluminum	mg/kg	6/6	10000	15000	12000	13900
	Chromium	mg/kg	6/6	15.0	18.9	16.7	18.1
	Thallium	mg/kg	1/4	1.4	1.4	0.838	0.89
Surface Water	Manganese	mg/L	3/3	0.4800	4.5000	3.1600	0.63
	Thallium	mg/L	1/3	0.0015	0.0015	0.0018	0.0012
	RDX	mg/L	3/3	0.0028	0.0420	0.0266	0.015
	Bis(2-ethylhexyl)phthalate	mg/L	1/3	0.0045	0.0045	0.0065	0.0035

Table C-1. Chemicals Exceeding Cleanup Goals at Building 1200 (continued)

Medium	Analyte	Units	Frequency of Detection	Minimum Detect	Maximum Detect	Average Result[a]	Screening Criteria[b]
Groundwater	Aluminum	mg/L	2/9	0.24	2.6	0.34	1.0
	Arsenic	mg/L	1/9	0.0022	0.0022	0.0022	0.000056 (bedrock)
	Chromium	mg/L	1/9	0.005	0.0048	0.003	0.0027 (bedrock)
	Bis(2-ethylhexyl)phthalate	mg/L	1/9	0.00220	0.00220	0.00213	0.0009
	Indeno(1,2,3-cd) pyrene	mg/L	1/9	0.00072	0.00072	0.00021	0.0000023

-- Not applicable.
[a]Average result equals the sum of the concentrations divided by the number of samples; the average includes non-detects at half the reporting limit and field duplicate samples. This can result in an average less than the range of detected values.
[b]Screening criteria are based on HI=0.1 and Target Risk=10^{-6}.

Previous surface soil sampling has been accomplished at Building 1200 at depth intervals of 0-0.5 ft, 0-1ft, and 0-2 ft. Table C-2 summarizes the historical surface soil sampling conducted at Building 1200 and indicates whether a sample result exceeded screening criteria.

Table C-2. Building 1200 Historical Soil Sampling Data

Sample Location	Sample Number	Depth of Sample (ft bgs)	Analysis Performed				
			Metals	Explosives	VOCs	Pesticides/ PCBs	SVOCs
B12ss-001	B12ss-001-0378-SO	0.0- 2.0	**Y**	N	N	N	**Y**
B12ss-002	B12ss-002-0379-SO	0.0- 2.0	N	N	--	--	--
	B12ss-002-0380-FD	0.0- 2.0	N	N	--	--	--
B12ss-013M	B12ss-013M-DUP	0.0- 1.0	**Y**	N	--	--	--
	B12ss-013M-SO	0.0- 1.0	**Y**	N	--	--	--
B12ss-014M	B12ss-014M-SO	0.0- 1.0	Cr	N	--	--	--
B12ss-015D	B12ss-015D-SO	0.0- 1.0	--	--	N	--	--
B12ss-015M	B12ss-015M-SO	0.0- 1.0	**Y**	N	--	N	N
B12ss-016M	B12ss-016M-SO	0.0- 1.0	**Y**	N	--	--	--
B12ss-017M	B12ss-017M-SO	0.0- 0.5	**Y**	N	--	--	--
B12ss-018M	B12ss-018M-SO	0.0- 1.0	Cr	N	--	--	--
B12ss-019M	B12ss-019M-SO	0.0- 0.5	Cr	**Y**	--	--	--
B12ss-020M	B12ss-020M-SO	0.0- 0.5	Cr	N	--	--	--
B12ss-021M	B12ss-021M-SO	0.0- 0.5	Cr	N	--	--	--
B12ss-022M	B12ss-022M-SO	0.0- 1.0	**Y**	N	--	--	--
B12sd-003(d)	B12sd-003(D)-0382-SD	0.0- 0.5	N	N	--	--	--
B12sd-004(d)	B12sd-004(D)-0383-SD	0.0- 0.5	Cr	N	--	--	--

Table C-2. Building 1200 Historical Soil Sampling Data (continued)

Sample Location	Sample Number	Depth of Sample (ft bgs)	Analysis Performed				
			Metals	Explosives	VOCs	Pesticides/ PCBs	SVOCs
B12sd-005(d)	B12sd-005(D)-0384-SD	0.0- 0.5	**Y**	N	N	N	N
B12sd-006(d)	B12sd-006(D)-0385-SD	0.0- 0.5	N	N	--	--	--
B12sd-007(d)	B12sd-007(D)-0386-SD	0.0- 0.5	N	N	--	--	--

Y = Analyte(s) greater than screening criteria.
Cr = Only chromium greater than screening criterion.
N = Non-detect or less than screening criteria.
-- = Analysis not performed.
Only PAHs were detected above screening criteria in the SVOC analysis.

C.3 PROPOSED SAP ADDENDUM CHARACTERIZATION ACTIVITIES

The objective of this SAP Addendum for Building 1200 is to define the nature and extent of chemicals at concentrations greater than the screening criteria. To accomplish this further sampling and analysis of metals, explosives, and PAHs in surface and subsurface soil will be conducted and current chemical concentrations in groundwater will be evaluated. Existing sample coverage and operational data do not indicate there are substantial uncharacterized portions of the AOC; therefore, sampling will focus on defining extent of contamination greater than screening criteria with respect to previously sampled source areas.

Table C-3 summarizes the screening criteria and CUG exceedances for each medium, the types and quantities of samples to be collected during the implementation of this SAP Addendum, and the rationale behind the proposed samples. The general approach for investigation activities is presented in Section 3.2 of the FSP. Figure C-3 illustrates the locations of the samples to be collected as well as previous screening criteria and CUG exceedances.

Table C-4 presents the coordinates for the proposed sampling locations for this AOC. The locations may be altered during implementation of this SAP Addendum for a variety of reasons (e.g., soil boring refusal and MEC avoidance). The final coordinates of the sample locations (including elevations) will be presented in the RI Report.

Table C-3. Summary of Sampling at Building 1200

Medium	Historical Sample Type	Historical Screening Criteria Exceedances	Number of SAP Addendum Sample Locations	Rationale for SAP Addendum Field Activities
Surface soil	MI and discrete	Al B12ss-016M Co B12ss-013M, 015M, 022M Mn **B12ss-016M**, **017M**, & **022M** Tl B12sd-005(d), B12ss-001 Explosives B12ss-019M SVOCs B12ss-001	3	Three MI sample areas are planned to further define lateral extent of metals greater than screening criteria. One boundary MI area was placed around former MI area B12ss-022M; one to bound eight former MI samples (B12ss-013M, ss-014M, ss-015M, ss-016M, ss-017M, ss-018M, ss-019M, ss-020M, and ss-021M) with chemical concentrations greater than screening criteria (including three locations with chemical concentrations greater than the manganese CUG); and one upgradient of former wet sediment MI area B12sd-024M. All samples will be analyzed for TAL metals, explosives, and PAHs and 15% (one sample) will be analyzed for the full suite of RVAAP COPCs.
	Chromium speciation	Cr B12sd-004(d), B12ss-013M, 014M, 015M, 016M, 017M, 018M, 019M, 020M, 021M, 022M	3	One discrete surface soil will be collected at each of the former locations: B12ss-017M (maximum previous detection = 33 mg/kg), B12ss-022M (previous detection = 23 mg/kg), and B12ss-015M (lowest previous detection = 18 mg/kg). Refer to Section 4.1.3 of the FSP for a discussion about chromium speciation sampling.
Subsurface soil	None	N/A	5	Five boring locations are placed to further define the vertical extent of metals. These include: two in three former MI areas (B12ss-016M, ss-017M, and ss-022M) where chemicals exceeded CUGs (HI=1.0, Target Risk=10^{-5}), one within a previous MI area B12ss-013M where chemicals exceeded screening criteria, one in the former sedimentation pond, and one in a previously uninvestigated area to confirm the absence of contamination. Samples will be analyzed for TAL metals, explosives, and PAHs with 15% RVAAP full suite.
	Geotechnical	N/A	1	Two samples shall be collected from one location to provide soil data for modeling.

Table C-3. Summary of Sampling at Building 1200 (continued)

Medium	Historical Sample Type	Historical Screening Criteria Exceedances	Number of SAP Addendum Sample Locations	Rationale for SAP Addendum Field Activities
Surface water	Discrete	Mn B12sw-025 Sb B12sw-025 Explosives B12sw-025 SVOCs B12sw-026	0	No additional sampling because lateral extent is defined. Chemical concentrations were greater than the screening criteria in two previous samples; however, the area is an isolated pond and ditch (not directly connected to a stream) and only contains water seasonally. Further investigation is planned for the surface and subsurface soils downgradient of the discharge area of the pond as well as subsurface soil within the pond.
Wet sediment	MI and discrete	Al B12sd-024M Cr B12sd-008(p) Tl B12sd-009(p)	0	No additional sampling. One MI sample area contained aluminum concentrations greater than the screening criterion but below the surface soil screening criterion. The ditch area, as discussed in surface water, seasonally contains water. Wet sediment is confined within the ditch. Downgradient wet sediment samples show no chemical concentrations above the screening criteria and further investigation is planned for upgradient surface soil. Previous discrete sample exceedances are not recommended for further investigation since metals concentrations are sporadic and slightly above background values.
Groundwater	Discrete	Al B12mw-010 As **B12mw-010** Cr B12mw-010 SVOCs **B12mw-010**, 012	0	No additional sampling. Monitoring wells B12mw-010, B12-mw-011, and B12mw-012 are currently being sampled under FWGWMP. Four quarters of sampling were completed in October 2008. Four quarters of sampling were completed at monitoring well BKGmw-010 on Oct 07. No additional groundwater sampling is required for completion of the FS.

Bold indicates locations where concentration also exceeded the CUG (HI=1.0, Target Risk = 10^{-5}) for the identified chemical.

Table C-4. Coordinates for Proposed Sampling Locations at Building 1200

Sample Location ID	Coordinate Point	Sample Type	Easting	Northing
B12sb-027	N/A	Grab	2371325.1852	565687.1749
B12sb-028	N/A	Grab	2371364.9824	565752.9433
B12sb-029	N/A	Grab	2371395.2142	565745.5179
B12sb-030	N/A	Grab	2371452.5360	565774.1589
B12sb-031	N/A	Grab	2371965.2242	565895.6184
B12sb-032	N/A	Grab	2372028.8809	565829.9456
B12ss-033	N/A	Grab	2372079.5456	565725.7459
B12ss-034	N/A	Grab	2371358.0842	565761.4296
B12ss-035	N/A	Grab	2371346.4103	565798.0265
B12ss-036M	1	MI	2371275.2995	565849.2700
	2	MI	2371482.7166	565849.2700
	3	MI	2371290.2995	565834.2700
	4	MI	2371467.7166	565834.2700
	5	MI	2371290.2995	565636.3065
	6	MI	2371467.7166	565636.3065
	7	MI	2371275.2995	565621.3065
	8	MI	2371482.7166	565621.3065
B12ss-037M	9	MI	2371497.3702	565846.5381
	10	MI	2371504.2386	565833.2011
	11	MI	2371577.7618	565886.4251
	12	MI	2371584.4287	565872.9881
B12ss-038M	13	MI	2371976.7577	565826.4474
	14	MI	2371993.9834	565831.0311
	15	MI	2372029.5695	565858.8144
	16	MI	2372037.1494	565871.9901
	17	MI	2372032.0132	565775.9943
	18	MI	2372045.6740	565783.8331
	19	MI	2372085.7936	565808.0735
	20	MI	2372099.6516	565815.7723
	21	MI	2372046.6917	565707.4947
	22	MI	2372061.1761	565711.4900
	23	MI	2372101.6045	565719.9709
	24	MI	2372116.1398	565723.8956
	25	MI	2372085.7004	565638.3538
	26	MI	2372125.7113	565653.5315
	27	MI	2372076.2910	565619.2346
	28	MI	2372144.8548	565644.7503

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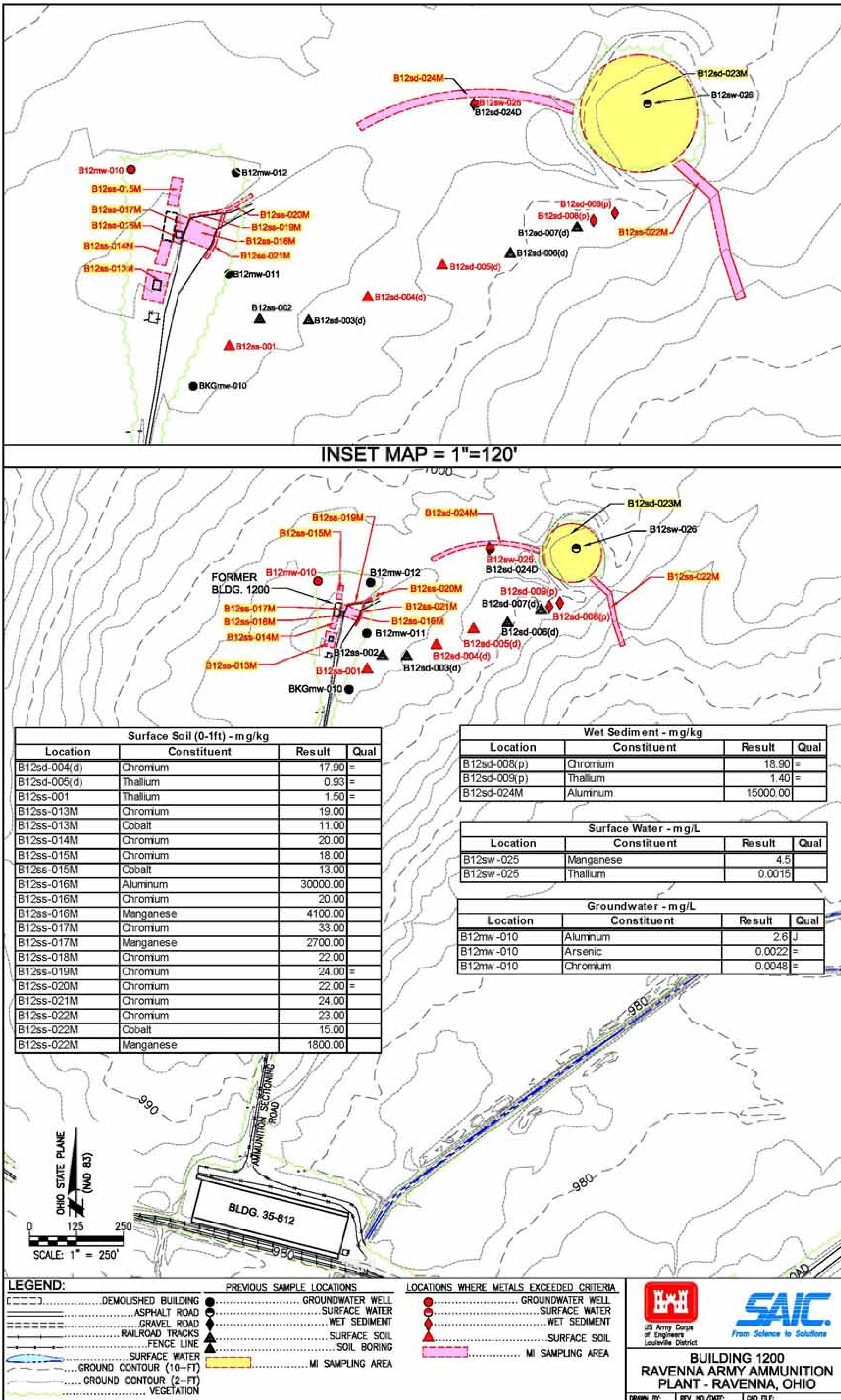


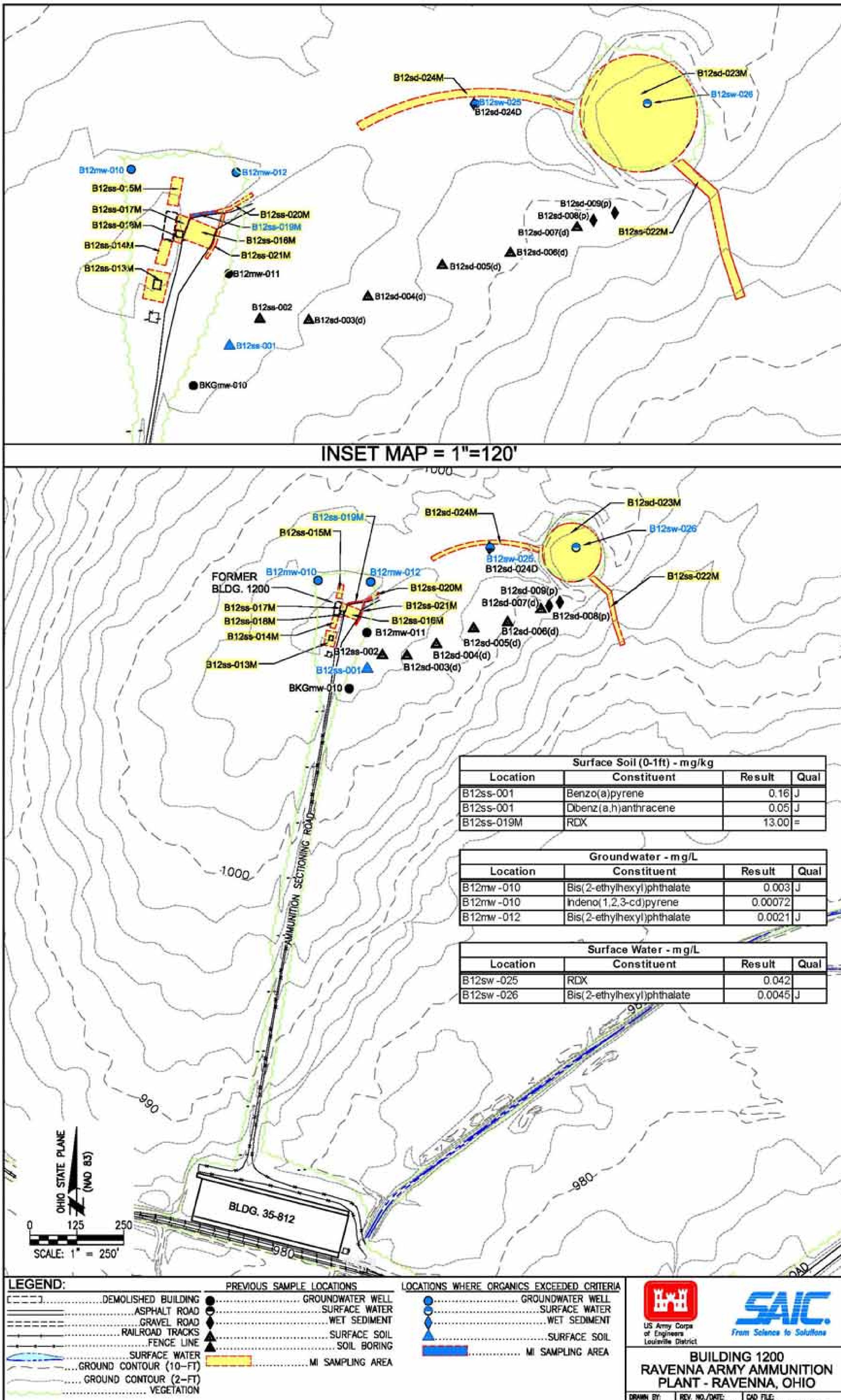
Surface Soil (0-1ft) - mg/kg			
Location	Constituent	Result	Qual
B12sd-004(d)	Chromium	17.90	=
B12sd-005(d)	Thallium	0.93	=
B12ss-001	Thallium	1.50	=
B12ss-013M	Chromium	19.00	
B12ss-013M	Cobalt	11.00	
B12ss-014M	Chromium	20.00	
B12ss-015M	Chromium	18.00	
B12ss-015M	Cobalt	13.00	
B12ss-016M	Aluminum	30000.00	
B12ss-016M	Chromium	20.00	
B12ss-016M	Manganese	4100.00	
B12ss-017M	Chromium	33.00	
B12ss-017M	Manganese	2700.00	
B12ss-018M	Chromium	22.00	
B12ss-019M	Chromium	24.00	=
B12ss-020M	Chromium	22.00	=
B12ss-021M	Chromium	24.00	
B12ss-022M	Chromium	23.00	
B12ss-022M	Cobalt	15.00	
B12ss-022M	Manganese	1800.00	

Wet Sediment - mg/kg			
Location	Constituent	Result	Qual
B12sd-008(p)	Chromium	18.90	=
B12sd-009(p)	Thallium	1.40	=
B12sd-024M	Aluminum	15000.00	

Surface Water - mg/L			
Location	Constituent	Result	Qual
B12sw-025	Manganese	4.5	
B12sw-025	Thallium	0.0015	

Groundwater - mg/L			
Location	Constituent	Result	Qual
B12mw-010	Aluminum	2.6	J
B12mw-010	Arsenic	0.0022	=
B12mw-010	Chromium	0.0048	=

Figure C-1. Historical Sampling and Metal Exceedance Locations at Building 1200



Surface Soil (0-1ft) - mg/kg			
Location	Constituent	Result	Qual
B12ss-001	Benzo(a)pyrene	0.16	J
B12ss-001	Dibenz(a,h)anthracene	0.05	J
B12ss-019M	RDX	13.00	=

Groundwater - mg/L			
Location	Constituent	Result	Qual
B12mw-010	Bis(2-ethylhexyl)phthalate	0.003	J
B12mw-010	Indeno(1,2,3-cd)pyrene	0.00072	
B12mw-012	Bis(2-ethylhexyl)phthalate	0.0021	J

Surface Water - mg/L			
Location	Constituent	Result	Qual
B12sw-025	RDX	0.042	
B12sw-026	Bis(2-ethylhexyl)phthalate	0.0045	J

Figure C-2. Historical Sampling and Organics Exceedance Locations at Building 1200

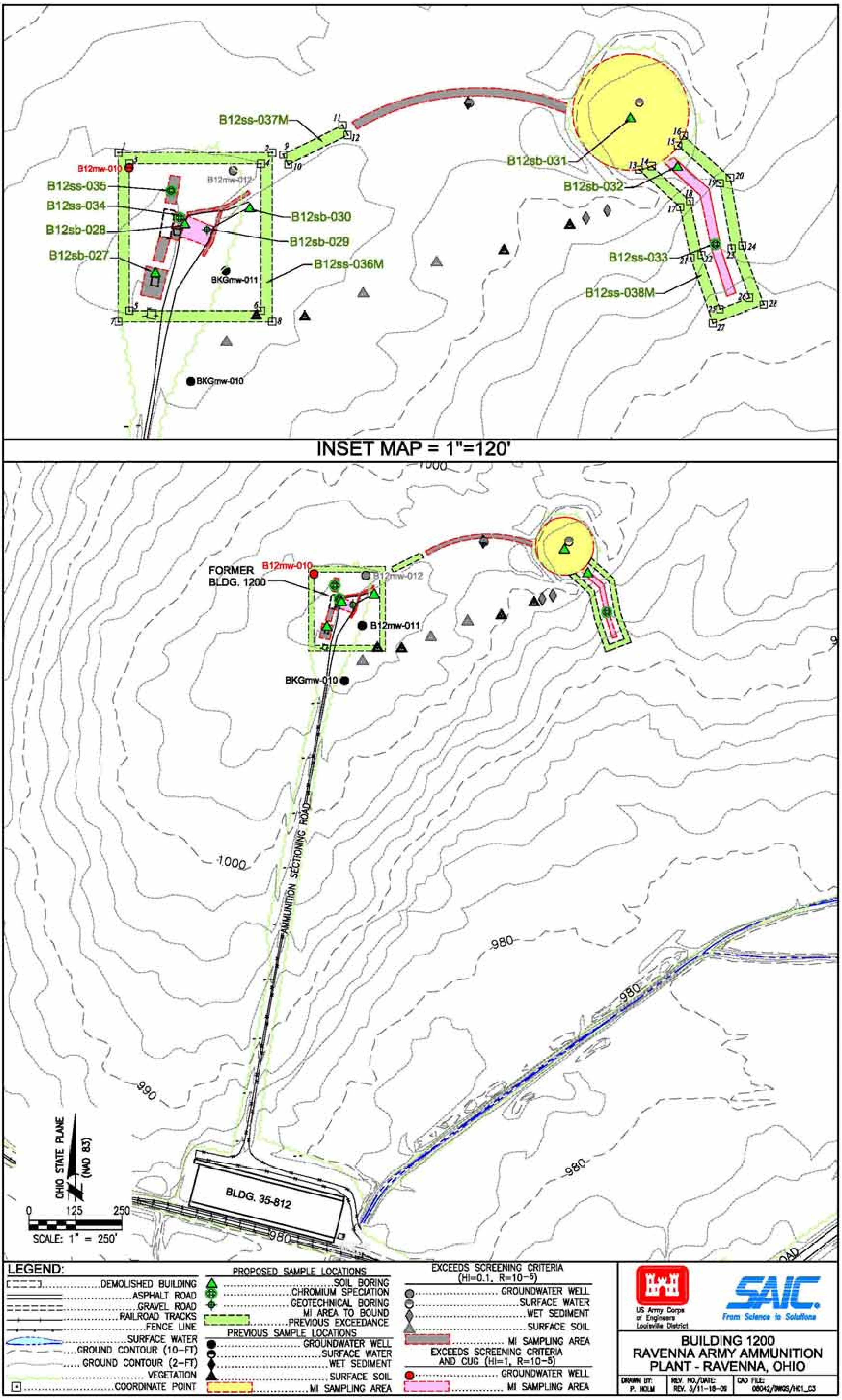


Figure C-3. Historical Exceedances and Proposed Sampling Locations at Building 1200

APPENDIX D

Landfill North of Winklepeck Burning Grounds (RVAAP-19)

D.0 LANDFILL NORTH OF WINKLEPECK BURNING GROUNDS (RVAAP-19)

D.1 AOC DESCRIPTION

The Landfill North of Winklepeck Burning Grounds (WBG) is an approximately 2.5-acre unlined landfill (Figure D-1). The AOC was operational between 1969 and 1976, during which time general refuse and wastes such as booster cups, aluminum liners, municipal waste, explosive and munitions waste and ash, and scrap metal from WBG were disposed. The landfill is not capped and debris is exposed along the northern toe slope. Wetlands are adjacent to the northeast and southeast of the landfill at elevations approximately 15 ft lower than the top of the landfill.

D.2 PREVIOUS INVESTIGATIONS

Since 1978 the Landfill North of WBG has been included in various investigations conducted at RVAAP. These include:

- U.S. Army Toxic and Hazardous Materials Agency (USATHAMA) 1978 Installation Assessment;
- 1989 Preliminary Review and Visual Site Inspection conducted as a part of RCRA Facility Assessment;
- Preliminary Assessment for RVAPP (USACE 1996b);
- Phase I Remedial Investigation for High-Priority Areas of Concern at the Ravenna Army Ammunition Plant (USACE 1998); and
- Final Characterization of 14 AOCs at Ravenna Army Ammunition Plant (MKM 2007a).

In the 1996 Preliminary Assessment for RVAAP, the Landfill North of WBG was considered among the higher priority AOCs based on a qualitative assessment of the potential hazards, release mechanisms, and environmental conditions (MKM 2007a).

From July through August of 1996, USACE conducted a Phase I RI for High-Priority Areas of Concern at RVAAP. The findings of this investigation were reported in 1998 and the Landfill North of WBG was re-categorized as a "Medium" priority AOC since no explosives were detected in soil, sediment, or groundwater samples; detected inorganic chemicals were generally at values below or just above the background criteria; scattered detections of organic compounds occurred in sediment and groundwater samples; and pesticides were limited to trench areas and one groundwater sample. The results of this investigation were based on nine surface soil samples collected at five trench locations, seven wet sediment samples collected in ditches and two ponds adjacent to the landfill boundary, and four groundwater samples (USACE 1998). Also conducted in the Phase I RI was a geophysical survey to locate buried conductive material and disposal trenches that might indicate the boundary of the landfill.

From October 2004 through May 2005, the following field activities were conducted at the Landfill North of WBG as part of the Final Characterization of 14 AOCs at RVAAP (MKM 2007a):

- Collection of 15 MI surface soil (0 to 1 ft) samples;
- Excavation of one test trench;
- Collection of 17 Geoprobe® subsurface soil (2 to 8 ft) samples;
- Collection of two MI sediment (0 to 0.5 ft) samples from drainage pathways;
- Collection of two surface water samples from drainage pathways;
- Installation and sampling of four shallow groundwater monitoring wells;
- Collection of geotechnical samples from one soil boring;
- Well slug tests; and
- Survey of the AOC identifying sampling and monitoring well locations.

Results of this investigation indicated that contaminants were detected above screening criteria (e.g., RVAAP-specific background values and USEPA Region 9 PRGs) in all media; however, very few chemicals other than inorganics were detected.

For this SAP Addendum, all sample results were compared to the preliminary RVAAP facility-wide screening criteria (Section 3.2.2 of the FSP). Table D-1 lists the chemicals that exceeded preliminary RVAAP facility-wide screening criteria in each medium, as well as the maximum and minimum concentration detected.

Figures D-1 and D-2 illustrate the type and location of historical samples and identify samples that exceeded screening criteria for metals and organics, respectively.

Table D-1. Chemicals Exceeding Screening Criteria at the Landfill North of WBG

Medium	Analyte	Units	Frequency of Detection	Minimum Detect	Maximum Detect	Average Result[a]	Screening Criteria[b]
Surface Soil	Chromium	mg/kg	23/23	9.50	26.00	17.70	17.4
	Copper	mg/kg	23/23	10.00	430.00	33.90	310
	Thallium	mg/kg	11/23	0.20	2.40	0.54	0.61
	Benzo(a)pyrene	mg/kg	10/23	0.01	0.14	0.06	0.022
Subsurface Soil	Thallium	mg/kg	10/25	0.21	1.70	0.55	0.91
	PCB-1254	mg/kg	2/6	0.09	0.18	0.07	0.12
Wet Sediment	Aluminum	mg/kg	13/13	3330	16500	9110	13900
	Chromium	mg/kg	13/13	6.2	20.6	12.3	18.1
	Thallium	mg/kg	1/6	3.2	3.2	0.979	0.89
	Benzo(a)pyrene	mg/kg	4/6	0.023	0.064	0.0905	0.022
Surface Water	Manganese	mg/L	7/7	0.3100	1.7000	0.7040	0.63
	Thallium	mg/L	1/7	0.0015	0.0015	0.0019	0.0012
	Benz(a)anthracene	mg/L	1/7	0.00017	0.00017	0.000109	0.000136
	Benzo(a)pyrene	mg/L	1/7	0.00012	0.00012	0.000184	0.00000797
	Benzo(b)fluoranthene	mg/L	1/7	0.00011	0.00011	0.000183	0.0000786
	Dibenz(a,h)anthracene	mg/L	1/7	0.00013	0.00013	0.000186	0.00000517
	Indeno(1,2,3-cd)pyrene	mg/L	1/7	0.00013	0.00013	0.000186	0.0000785

Table D-1. Chemicals Exceeding Screening Criteria at the Landfill North of WBG (continued)

Medium	Analyte	Units	Frequency of Detection	Minimum Detect	Maximum Detect	Average Result[a]	Screening Criteria[b]
Groundwater	Arsenic	mg/L	7/12	0.00089	0.0450	0.00635	0.0117 (unconsolidated)[c] 0.000056 (bedrock)[d]
	Thallium	mg/L	2/12	0.00020	0.0020	0.00098	0.000083
	Heptachlor epoxide	mg/L	1/13	0.000060	0.000060	0.000037	0.0000094
	Bis(2-ethylhexyl)phthalate	mg/L	7/13	0.00130	0.0150	0.00484	0.0009
	Methylene chloride	mg/L	1/ 16	0.011	0.011	0.00247	0.0053

[a]Average result equals the sum of the concentrations divided by the number of samples; the average includes non-detects at half the reporting limit and field duplicate samples. This can result in an average less than the range of detected values.
[b]Screening criteria are based on HI=0.1 and Target Risk=10^{-6}.
[c]Groundwater monitoring wells LNWmw-024, LNWmw-025, and LNWmw-026 screened within the unconsolidated zone.
[d]Groundwater monitoring well LNWmw-027 is screened within the bedrock.

Previous surface and subsurface soil sampling has been accomplished at the Landfill North of WBG at the 0 to 1 ft, 2 to 4 ft, 4 to 6 ft, and 6 to 8 ft depth intervals. Additionally, some samples were collected from the 0 to 1.5 ft and 1.5 to 3 ft intervals. Table D-2 summarizes the historical surface and subsurface soil sampling conducted at the Landfill North of WBG and indicates whether or not sample results exceeded screening criteria.

Table D-2. Landfill North of WBG Historical Soil Sampling Summary

Sample Location	Sample Number	Depth of Sample (ft bgs)	Analysis Performed				
			Metals	Explosives	VOCs	Pesticides/ PCBs	SVOCs
LNWss-028M	LNWss-028M-DUP	0.0-1.0	Cr	N	--	--	N
	LNWss-028M-SO	0.0 -1.0	--	N	--	--	**Y**
LNWss-029M	LNWss-029M-SO	0.0-1.0	Cr	N	--	--	N
LNWss-030M	LNWss-030M-SO	0.0-1.0	Cr	N	N	--	N
LNWss-031M	LNWss-031M-QA	0.0-1.0	Cr	N	--	--	N
	LNWss-031M-SO	0.0-1.0	Cr	N	--	--	N
LNWss-032M	LNWss-032M-SO	0.0-1.0	Cr	N	--	--	N
LNWss-033M	LNWss-033M-SO	0.0-1.0	Cr	N	--	--	N
LNWss-034M	LNWss-034D-SO	0.0-1.0	--	--	N	--	--
	LNWss-034M-SO	0.0-1.0	Cr	N	--	N	N
LNWss-035M	LNWss-035M-SO	0.0- 1.0	N	N	--	--	N
LNWss-036M	LNWss-036M-SO	0.0- 1.0	Cr	N	--	--	N
LNWss-037M	LNWss-037M-DUP	0.0- 1.0	Cr	N	--	--	N
	LNWss-037M-SO	0.0- 1.0	Cr	N	--	--	N
LNWss-038M	LNWss-038M-SO	0.0- 1.0	Cr	N	--	--	N
LNWss-039M	LNWss-039D-SO	0.0- 1.0	--	--	N	--	--
	LNWss-039M-SO	0.0- 1.0	N	N	--	N	N

Table D-2. Landfill North of WBG Historical Soil Sampling Summary (continued)

Sample Location	Sample Number	Depth of Sample (ft bgs)	Analysis Performed				
			Metals	Explosives	VOCs	Pesticides/ PCBs	SVOCs
LNWss-040M	LNWss-040M-SO	0.0- 1.0	**Y**	N	--	--	**Y**
LNWss-041M	LNWss-041M-SO	0.0- 1.0	N	N	--	--	**Y**
LNWss-042M	LNWss-042M-SO	0.0- 1.0	Cr	N	--	--	**Y**
LNWsb-053	LNWsb-053-SO	2.0- 4.0	N	N	--	--	N
LNWsb-054	LNWsb-054-SO	2.0- 4.0	N	N	--	--	N
LNWsb-055	LNWsb-055-SO	2.0- 4.0	N	N	--	--	N
LNWsb-056	LNWsb-056-DUP	4.0- 6.0	N	N	--	--	N
	LNWsb-056-SO	4.0- 6.0	N	N	--	--	N
LNWsb-057	LNWsb-057-SO	4.0- 6.0	N	N	--	--	N
LNWsb-058	LNWsb-058-SO	4.0- 6.0	N	N	--	--	N
LNWsb-059	LNWsb-059-SO	4.0- 6.0	N	N	--	--	N
LNWsb-060	LNWsb-060-SO	6.0- 8.0	N	N	--	--	N
LNWsb-061	LNWsb-061-SO	4.0- 6.0	N	N	--	--	N
LNWsb-062	LNWsb-062-SO	6.0- 8.0	N	N	--	--	N
LNWsb-063	LNWsb-063-SO	4.0- 6.0	N	N	--	--	N
LNWsb-064	LNWsb-064-DUP	2.0- 4.0	N	N	--	--	N
	LNWsb-064-SO	2.0- 4.0	N	N	--	--	N
LNWsb-065	LNWsb-065-SO	2.0- 4.0	N	N	--	--	N
LNWsb-066	LNWsb-066-SO	4.0- 6.0	N	N	--	--	N
LNWsb-067	LNWsb-067-SO	6.0- 8.0	N	N	--	--	N
LNWsb-068	LNWsb-068-SO	2.0- 4.0	N	N	--	--	N
LNWsb-069	LNWsb-069-SO	2.0- 4.0	N	N	--	--	N
LNWtr-001	LNWtr-001-0393-SO	0.0- 3.0	**Y**	N	N	N	N
LNWtr-002	LNWtr-002-0396-SO	0.0- 1.5	**Y**	N	N	N	N
	LNWtr-002-0397-SO	1.5- 3.0	**Y**	N	N	N	N
LNWtr-003	LNWtr-003-0399-SO	0.0- 1.0	**Y**	N	N	N	N
	LNWtr-003-0400-SO	1.0- 3.0	**Y**	N	N	**Y**	N
	LNWtr-003-0402-FD	1.0- 3.0	**Y**	N	N	N	N
LNWtr-004	LNWtr-004-0404-SO	0.0- 1.5	**Y**	N	N	N	N
	LNWtr-004-0405-SO	1.5- 3.0	**Y**	N	N	N	N
	LNWtr-004-0407-FD	1.5- 3.0	**Y**	N	N	N	N
LNWtr-005	LNWtr-005-0408-SO	0.0- 1.5	**Y**	N	N	N	N
	LNWtr-005-0409-SO	1.5- 3.0	**Y**	N	N	N	N

Y = Analyte(s) greater than screening criteria.
Cr = Only chromium greater than screening criterion.
N = Non-detect or less than screening criteria.
-- = Analysis not performed.
Only PAHs were detected above screening criteria in the SVOC analysis.

D.3 PROPOSED SAP ADDENDUM CHARACTERIZATION ACTIVITIES

The objective of this SAP Addendum for the Landfill North of WBG to is to define the nature and extent of chemical at concentrations greater than the screening criteria. To accomplish this further sampling and analysis of metals and PAHs in surface soil will be conducted, co-located surface water and wet sediment samples will be collected, and current chemical concentrations in groundwater will be evaluated.

Table D-3 summarizes the chemicals that exceeded screening criteria and CUGs for each medium, the types and quantities of samples to be collected during the implementation of this SAP Addendum, and the rationale behind the proposed samples. The general approach for investigation activities is presented in Section 3.2 of the FSP. Figure D-3 illustrates the locations of the samples to be collected as well as previous screening criteria and CUG exceedances.

Table D-4 presents the coordinates for the proposed sampling locations for this AOC. The locations may be altered during implementation of this SAP Addendum for a variety of reasons (e.g., soil boring refusal and MEC avoidance). The final coordinates of the sample locations (including elevations) will be presented in the RI Report.

Table D-3. Summary of Sampling at the Landfill North of WBG

Medium	Historical Sample Type	Historical Screening Criteria Exceedances	Number of SAP Addendum Sample Locations	Rationale for SAP Addendum Field Activities
Surface soil	Discrete and MI	Co LNWss-040M Tl LNWtr-001, 002, 003, 004, 005 SVOCs LNWss-028M, 040M, 041M, 042M	10	A total of ten MI areas are planned to define the nature and extent of metals and SVOCs in surface soil. Nine approximately 0.5-acre MI areas are planned within the known boundary of the landfill in areas not previously sampled, and one bounding MI area around previous MI sample LNWss-042M. These samples will be analyzed for explosives, TAL metals, and PAHs, with 10% RVAAP full suite. MI sample areas LNWss-040M and ss-041M are not considered part of this AOC. The sample locations are geographically separated from the landfill and located over 1,200 feet from the toe of the landfill boundary.
	Cr speciation (none previously collected)	Cr LNWss-028M, 029M, 030M, 031M, 032M, 033M, 034M, 036M, 037M, 038M, 042M	3	One discrete surface soil sample will be collected for total and hexavalent chromium within each of three previous MI areas: LNWss-032M (26 mg/kg – maximum previous concentration of total chromium), LNWss-029M (21 mg/kg), and LNWss-035M (17 mg/kg). Refer to Section 4.1.3 of the FSP for a discussion about chromium speciation sampling.
Subsurface soil	Discrete	Tl LNWtr-002, 003, 004, 005 Pesticide/PCB LNWtr-003	0	No additional vertical nature and extent delineation is planned. Previous investigations have defined the vertical extent of chemical concentration greater than screening criteria. Seventeen locations were previously sampled around the estimated landfill boundary. Each location had one 2-ft interval sample, with depths varying from 2-4 ft to 6-8 ft bgs. Many of the subsurface soil samples are within MI areas with surface soil results that were less than the screening criteria; therefore, the absence of subsurface contamination in those areas has been confirmed. Trench samples were collected within the estimated boundary of the landfill. Thallium concentrations greater than the screening criterion were near background values.
	Geotechnical	N/A	1	Two samples shall be collected from one location to provide soil data for modeling.

Table D-3. Summary of Sampling at the Landfill North of WBG (continued)

Medium	Historical Sample Type	Historical Screening Criteria Exceedances	Number of SAP Addendum Sample Locations	Rationale for SAP Addendum Field Activities
Surface water	Discrete	Mn LNWsw-051, 052 Tl LNWsw-049 SVOCs **LNWsw-047**	4	Four surface water and co-located composite wet sediment samples will be collected to characterize current conditions and provide data for the ecological WOE evaluation and confirm the extent and magnitude of historical sample concentrations: 1. Upstream of the AOC. 2. Down gradient of former sample location LNWsw-049 (within MI area LNWsd-043M). 3. Downstream of the AOC, but upstream of the confluence point located east of the AOC. 4. South of landfill in former MI area LNWsd-045M. Surface water samples will be analyzed for the RVAAP full suite. Composite wet sediment samples will be analyzed for explosives, TAL metals, and SVOCs, with 10% (1 sample) RVAAP full suite. Chemical concentrations were less than the screening criteria for metals and explosives in two rounds of surface water sampling at the facility-wide sample location S6, located downstream of the confluence point east of the AOC. SVOCs were generally not detected; however, the detection limit was greater than the screening criteria but less than the CUG. No further sampling downstream is proposed. The previous and isolated sampling location LNWsw-047 where SVOC concentrations were greater than screening criteria and CUGs will not be re-investigated during this SAP Addendum. The sample location is not connected to other water onsite and was believed to be associated with temporary standing water from a rain event.

Table D-3. Summary of Sampling at the Landfill North of WBG (continued)

Medium	Historical Sample Type	Historical Screening Criteria Exceedances	Number of SAP Addendum Sample Locations	Rationale for SAP Addendum Field Activities
Wet sediment	MI and discrete	Al LNWsd-016(d) Cr LNWsd-013(d) Tl LNWsd-015(d) SVOCs LNWsd-043M, 44M, 45M	4	Refer to surface water rationale for discussion of locations of four co-located composite samples. Chemical concentrations were less than the screening criteria for metals and explosives, at the facility-wide sample location S6, located downstream of the confluence point. SVOCs were generally non-detect; however, detection limits were greater than screening criteria but less than CUGs. No samples are planned. Metal and SVOC concentrations were slightly above screening criteria but lower than CUGs. Samples are planned in two MI areas where SVOCs concentrations slightly exceeded screening criteria to confirm that attenuation has occurred .
Groundwater	Discrete	Al LNWmw-026 As **LNWmw-025**, **027** Tl **LNWmw-024** Pesticide/PCB LNWwp-019 SVOCs LNWmw-024, **025**, 026, 027 VOCs LNWwp-022	0	No additional groundwater monitoring is planned. Monitoring wells LNWmw-024, LNWmw-025, LNWmw-026 and LNWmw-027 are currently being sampled under the FWGWMP. Four quarters of sampling were completed in October 2008. No additional groundwater sampling is required for completion of the FS.

Bold indicates locations where concentration also exceeded the CUG (HI=1.0, Target Risk = 10^{-5}) for the identified chemical.

Table D-4. Coordinates for Proposed Sampling Locations at Landfill North of WBG

Sample Location ID	Coordinate Point	Sample Type	Easting	Northing
LNWsb-087	N/A	Grab	2358401.7309	564537.3294
LNWsd-083	N/A	Composite	2358341.2305	565739.3820
LNWsd-084	N/A	Composite	2358753.5594	565006.9605
LNWsd-085	N/A	Composite	2359388.1590	564702.0668
LNWsd-086	N/A	Composite	2358845.8401	564148.6776
LNWss-070M	58	MI	2358078.1318	565027.7861
	59	MI	2358194.3796	564985.3468
	60	MI	2358087.0781	565008.5516
	61	MI	2358175.1452	564976.4005
	62	MI	2358048.1495	564901.9197
	63	MI	2358136.2165	564869.7686
	64	MI	2358028.9150	564892.9734
	65	MI	2358145.1629	564850.5342
LNWss-071M	9	MI	2358507.5338	565200.7387
	10	MI	2358624.2633	565234.4938
	11	MI	2358626.3210	565190.6190
	12	MI	2358630.0070	565161.4420
	13	MI	2358636.1870	565139.1039
	14	MI	2358622.2760	565133.1421
	15	MI	2358602.4031	565143.0785
	16	MI	2358600.8835	565129.1007
	17	MI	2358622.2760	565107.3073
	18	MI	2358602.4031	565095.3835
	19	MI	2358626.2506	565079.4852
	20	MI	2358648.1108	565083.4598
	21	MI	2358666.9696	565054.0406
	22	MI	2358636.1870	565005.9554
	23	MI	2358675.9226	565021.9152
	24	MI	2358690.9257	565020.6588
	25	MI	2358735.9972	564991.3362
	26	MI	2358757.8445	564971.3930
	27	MI	2358775.7382	564945.1170
	42	MI	2358740.8299	564917.2199
LNWss-072M	27	MI	2358775.7382	564945.1170
	28	MI	2358791.4214	564956.6685
	29	MI	2358817.7227	564965.8278
	30	MI	2358837.7072	564968.6680
	31	MI	2358853.2748	564966.7820
	32	MI	2358865.8038	564955.3997
	33	MI	2358861.2793	564933.1340
	34	MI	2358862.2883	564914.2820
	35	MI	2358854.0509	564905.9115

Table D-4. Coordinates for Proposed Sampling Locations at Landfill North of WBG (continued)

Sample Location ID	Coordinate Point	Sample Type	Easting	Northing
LNWss-072M (continued)	36	MI	2358841.1708	564902.5225
	37	MI	2358868.5647	564846.8099
	38	MI	2358847.2033	564783.2159
	39	MI	2358697.7930	564782.3505
	40	MI	2358700.8299	564907.2199
	41	MI	2358710.8299	564917.2199
	42	MI	2358740.8299	564917.2199
	8	MI	2358697.7930	564866.8451
LNWss-073M	1	MI	2358306.2968	565262.3159
	2	MI	2358369.8901	565290.1380
	3	MI	2358409.6359	565137.1166
	4	MI	2358437.4580	565015.8919
	5	MI	2358519.8263	565064.5196
LNWss-074M	4	MI	2358437.4580	565015.8919
	5	MI	2358519.8263	565064.5196
	6	MI	2358578.5556	564976.1461
	7	MI	2358530.8606	564866.8451
	8	MI	2358697.7930	564866.8451
LNWss-075M	43	MI	2358847.0728	564725.4843
	46	MI	2358846.8398	564622.4084
	45	MI	2358697.7930	564622.4084
	39	MI	2358697.7930	564782.3505
	38	MI	2358847.2033	564783.2159
LNWss-076M	43	MI	2358847.0728	564725.4843
	44	MI	2359008.8844	564725.4843
	46	MI	2358846.8398	564622.4084
	47	MI	2358846.8398	564575.0444
	48	MI	2359008.8844	564572.7708
LNWss-077M	47	MI	2358846.8398	564575.0444
	48	MI	2359008.8844	564572.7708
	49	MI	2359074.3658	564574.9369
	52	MI	2358846.8398	564477.3362
	53	MI	2358921.0884	564477.3362
	54	MI	2359074.3658	564477.3362
LNWss-078M	50	MI	2358590.4793	564477.3362
	51	MI	2358751.9997	564477.3362
	55	MI	2358590.4793	564330.2767
	56	MI	2358751.9997	564330.2767
LNWss-079M	51	MI	2358751.9997	564477.3362
	52	MI	2358846.8398	564477.3362
	53	MI	2358921.0884	564477.3362
	56	MI	2358751.9997	564330.2767
	57	MI	2358921.0884	564330.2767

Table D-4. Coordinates for Proposed Sampling Locations at Landfill North of WBG (continued)

Sample Location ID	Coordinate Point	Sample Type	Easting	Northing
LNWss-080	N/A	Grab	2358546.8637	564408.0406
LNWss-081	N/A	Grab	2358606.5958	564669.5822
LNWss-082	N/A	Grab	2358358.3310	565052.5539
LNWsw-083	N/A	Grab	2358341.2305	565739.3820
LNWsw-084	N/A	Grab	2358753.5594	565006.9605
LNWsw-085	N/A	Grab	2359388.1590	564702.0668
LNWsw-086	N/A	Grab	2358845.8401	564148.6776

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Subsurface Soil (1-13ft) - mg/kg			
Location	Constituent	Result	Qual
LNWtr-002	Thallium	1.70	=
LNWtr-003	Thallium	1.40	=
LNWtr-004	Thallium	1.30	=
LNWtr-005	Thallium	0.98	=

Surface Water - mg/L			
Location	Constituent	Result	Qual
LNWsw-049	Thallium	0.0015	
LNWsw-051	Manganese	1.7	J
LNWsw-052	Manganese	0.83	=

Groundwater - mg/L			
Location	Constituent	Result	Qual
LNWmw-024	Thallium	0.002	=
LNWmw-025	Arsenic	0.045	
LNWmw-026	Aluminum	2.2	=
LNWmw-027	Arsenic	0.0059	J

Wet Sediment - mg/kg			
Location	Constituent	Result	Qual
LNWsd-013(d)	Chromium	20.60	J
LNWsd-015(d)	Thallium	3.20	=
LNWsd-016(d)	Aluminum	16500.00	=

Surface Soil (0-1ft) - mg/kg			
Location	Constituent	Result	Qual
LNWss-028M	Chromium	19.00	
LNWss-029M	Chromium	21.00	
LNWss-030M	Chromium	23.00	
LNWss-031M	Chromium	21.00	
LNWss-032M	Chromium	26.00	
LNWss-033M	Chromium	25.00	
LNWss-034M	Chromium	18.00	
LNWss-036M	Chromium	21.00	
LNWss-037M	Chromium	18.00	
LNWss-038M	Chromium	18.00	
LNWss-040M	Copper	430.00	
LNWss-042M	Chromium	22.00	
LNWtr-001	Thallium	2.40	=
LNWtr-002	Thallium	1.70	=
LNWtr-003	Thallium	1.10	=
LNWtr-004	Thallium	1.10	=
LNWtr-005	Thallium	1.00	=

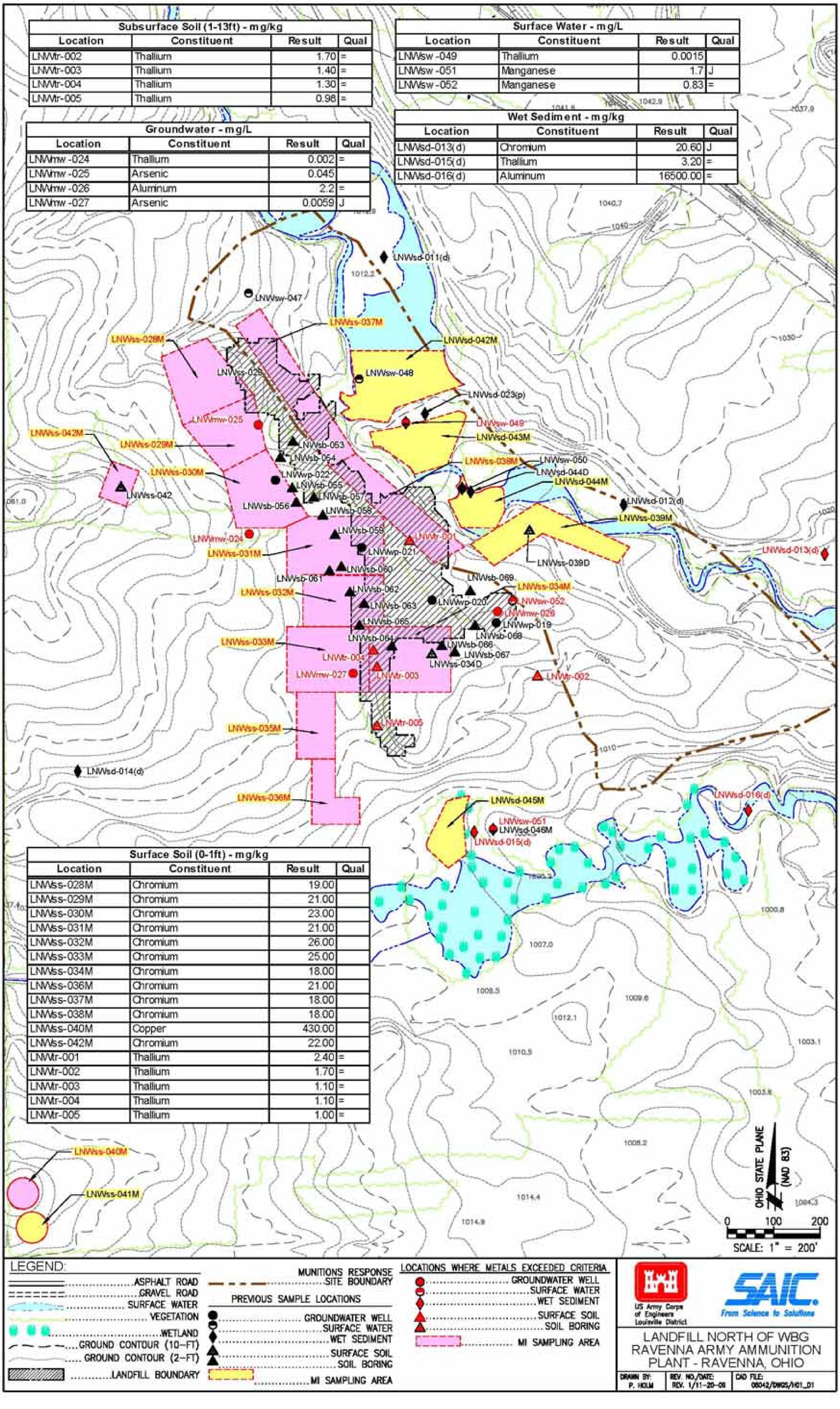
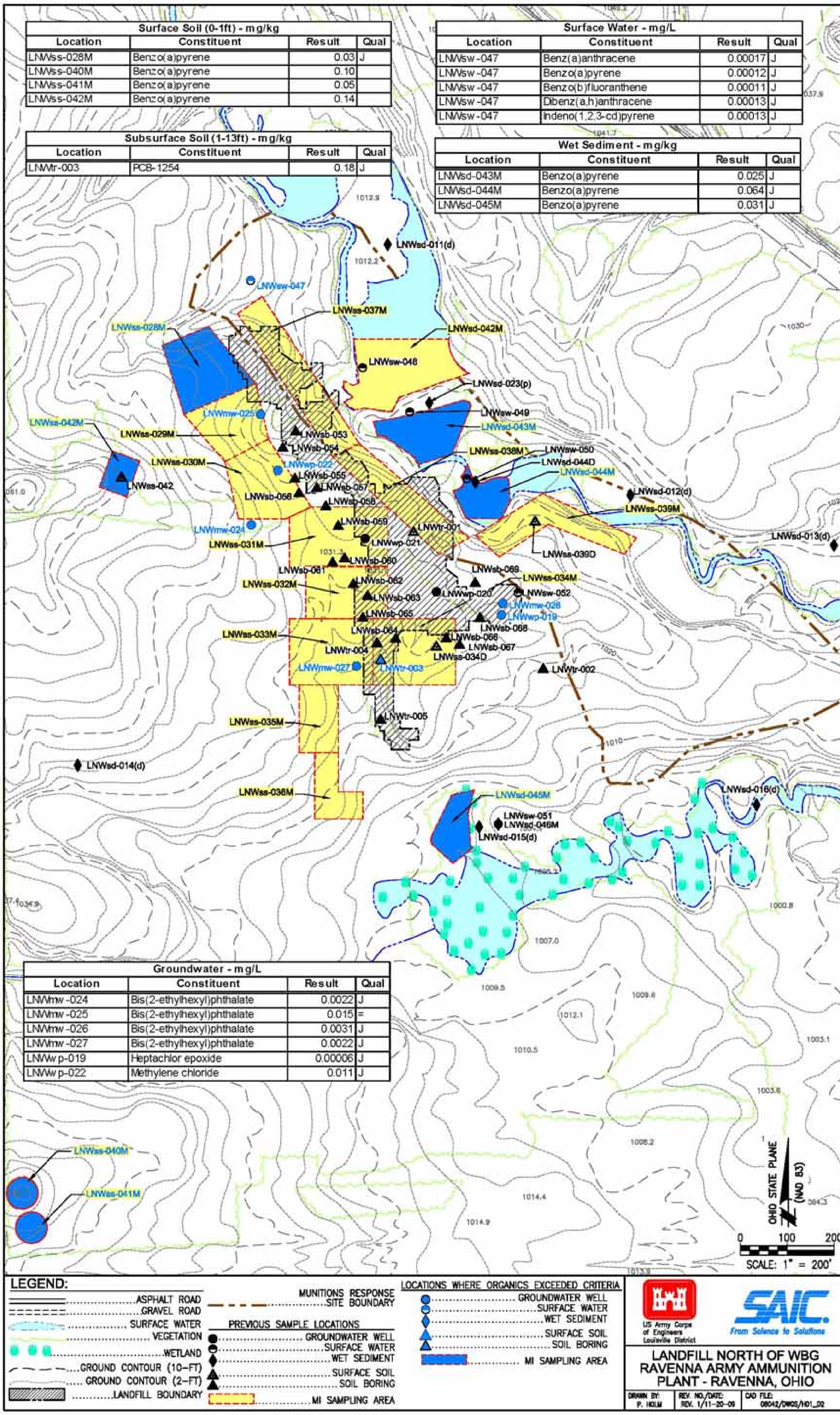


Figure D-1. Historical Sampling and Metal Exceedance Locations at Landfill North of Winklepeck Burning Grounds



Surface Soil (0-1ft) - mg/kg

Location	Constituent	Result	Qual
LNWss-028M	Benzo(a)pyrene	0.03	J
LNWss-040M	Benzo(a)pyrene	0.10	
LNWss-041M	Benzo(a)pyrene	0.05	
LNWss-042M	Benzo(a)pyrene	0.14	

Subsurface Soil (1-13ft) - mg/kg

Location	Constituent	Result	Qual
LNWtr-003	PCB-1254	0.18	J

Surface Water - mg/L

Location	Constituent	Result	Qual
LNWsw-047	Benz(a)anthracene	0.00017	J
LNWsw-047	Benzo(a)pyrene	0.00012	J
LNWsw-047	Benzo(b)fluoranthene	0.00011	J
LNWsw-047	Dibenz(a,h)anthracene	0.00013	J
LNWsw-047	Indeno(1,2,3-cd)pyrene	0.00013	J

Wet Sediment - mg/kg

Location	Constituent	Result	Qual
LNWsd-043M	Benzo(a)pyrene	0.025	J
LNWsd-044M	Benzo(a)pyrene	0.064	J
LNWsd-045M	Benzo(a)pyrene	0.031	J

Groundwater - mg/L

Location	Constituent	Result	Qual
LNWmw-024	Bis(2-ethylhexyl)phthalate	0.0022	J
LNWmw-025	Bis(2-ethylhexyl)phthalate	0.015	=
LNWmw-026	Bis(2-ethylhexyl)phthalate	0.0031	J
LNWmw-027	Bis(2-ethylhexyl)phthalate	0.0022	J
LNWwp-019	Heptachlor epoxide	0.00006	J
LNWwp-022	Methylene chloride	0.011	J

Figure D-2. Historical Sampling and Organic Exceedance Locations at Landfill North of Winklepeck Burning Grounds

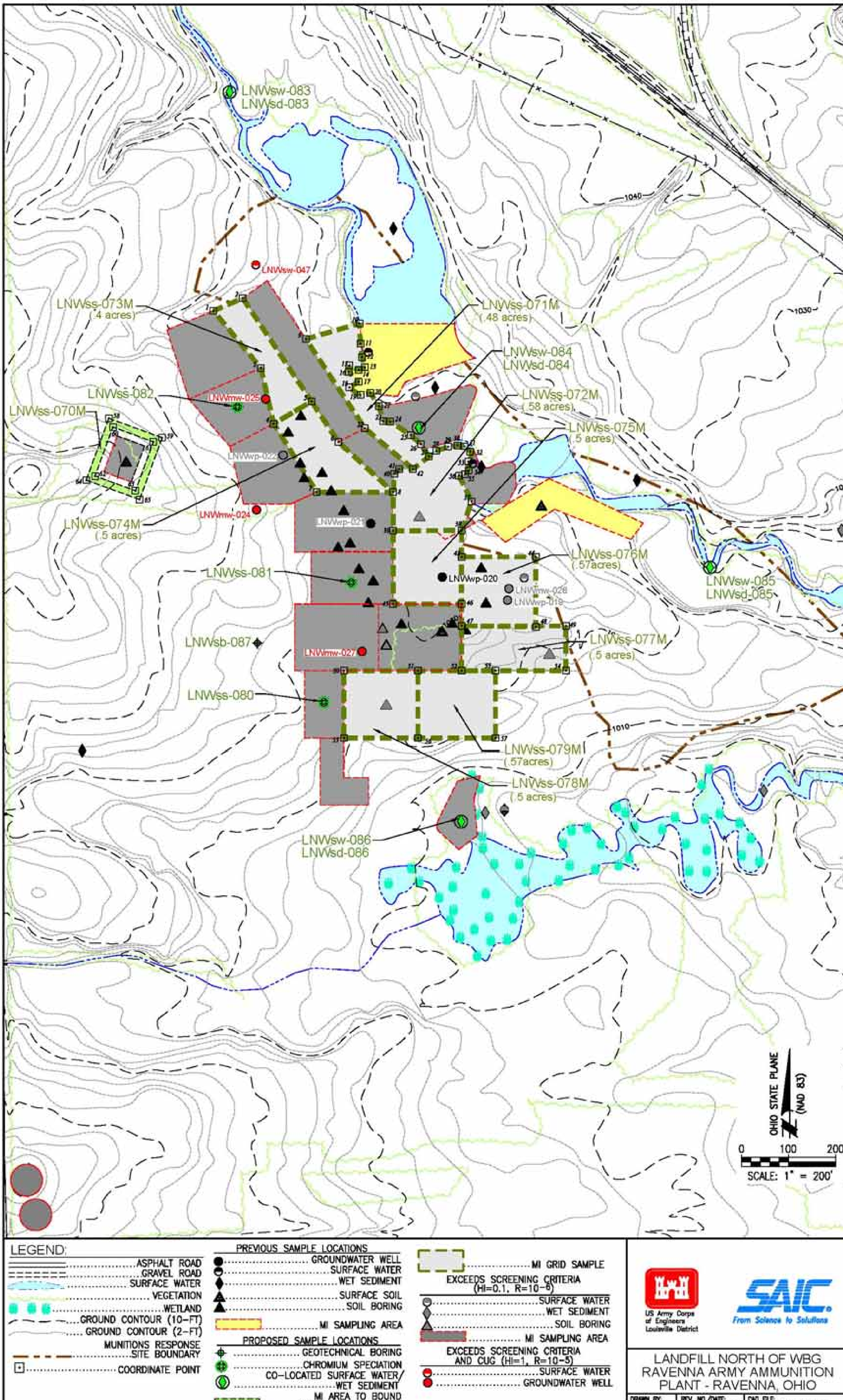


Figure D-3. Historical Exceedances and Proposed Sampling Locations at Landfill North of Winklepeck Burning Grounds

APPENDIX E

Upper and Lower Cobbs Ponds (RVAAP-29)

E.0 UPPER AND LOWER COBBS PONDS (RVAAP-29)

E.1 AOC DESCRIPTION

Upper Cobbs Pond is approximately 5-acres in size and ranges from 3 to 8 ft in depth (Figure E-1). Lower Cobbs Pond is approximately 3.5-acres and ranges 2 to 7 ft in depth. From 1941 to 1971, the ponds were utilized as sedimentation basins for discharges from Load Lines 3 and 12 which included effluents from sawdust filtration units and building wash down activities transported via storm and surface water runoffs. These discharges may have contained explosives, propellants, metals, SVOCs, and VOCs.

E.2 PREVIOUS INVESTIGATIONS

Since 1978, Upper and Lower Cobbs Ponds have been a part or the subject in various investigations conducted at RVAAP. These include:

- USATHAMA 1978 Installation Assessment;
- A graduate research hydrogeologic study in 1982;
- USAEHA 1988 groundwater contamination survey and evaluation of Solid Waste Management Units;
- 1989 Preliminary Review and Visual Site Inspection conducted as a part of RCRA Facility Assessment, Preliminary Assessment for RVAPP (USACE 1996b);
- Phase I Remedial Investigation for High-Priority Areas of Concern at the Ravenna Army Ammunition Plant (USACE 1998); and
- Phase II Remedial Investigation in 2001 (MKM 2005).

In the 1996 Preliminary Assessment, Upper and Lower Cobbs Ponds were considered among the higher priority AOCs based on a qualitative assessment of the potential hazards, release mechanisms and environmental conditions (USACE 1996b).

From July through August of 1996, USACE conducted a Phase I RI for High-Priority Areas of Concern at RVAAP. This investigation included ten wet sediment samples (eight 0 to 1 ft samples and two 0 to 0.5 ft samples) collected in the ponds and downstream drainage area and three groundwater samples (USACE 1998). The finding of this investigation were reported in 1998 and the Upper and Lower Cobbs Ponds were re-categorized as a “Medium” priority AOC since there was only one detect of nitrobenzene, most of the detected metals were only slightly above the background criteria or within USGS Ohio reference levels, and concentrations of inorganic chemicals in the drainage downstream of the AOC were generally below the background criteria indicating that contaminants are not migrating from the ponds.

The following field activities were conducted at the Upper and Lower Cobbs Ponds, from July through September 2001 as part of the Upper and Lower Cobbs Ponds Phase II Remedial Investigation (MKM 2005):

- Collection of ten surface soil (0 to 1 ft) samples around the pond boundaries and drainage area;
- Collection of 29 wet sediment samples (ten at depths 0 to 0.5 ft; seven at depths 0 to 0.75 ft; nine at depths 0 to 1 ft; one at depths 0 to 1.5 ft, and two at depths 0 to 1.75 ft) from throughout the ponds and drainage area;
- Collection of seven surface water samples from the ponds and drainage pathway;
- Installation and sampling of six shallow groundwater monitoring wells;
- Collection of geotechnical samples from three soil borings; and
- Well slug tests.

During the 2001 Phase II RI, the physical appearance, color, texture, and other characteristics of each wet sediment core were recorded. The cores showed several inches of black silt with organic matter overlaying gray silt with little organic matter. The upper black sediment layer is presumed to represent depositional material since the ponds were constructed. Samples were collected from both the dark humus-rich sediment and the gray silt layer.

Sampling was also performed by Ohio EPA and USACE in 2003. Samples taken from throughout the ponds during the RVAAP Facility-wide Surface Water Study (Ohio EPA and USACE 2003) were MI samples comprised of 30 to 50 subsamples in each pond of wet sediment from 0 to 0.5 ft depth that was mixed thoroughly and yielded one sample; thus, there was one sample from each pond.

The Phase II RI human health risk assessment concluded that arsenic was the primary risk driver for the AOC.

For this SAP Addendum, all sample results were compared to the preliminary RVAAP facility-wide screening criteria (Section 3.2.2 of the FSP). Table E-1 lists the chemicals that exceeded preliminary RVAAP facility-wide screening criteria in each medium, as well as the maximum and minimum concentration detected.

Figures E-1 and E-2 illustrate the type and location of historical samples and identify samples that exceeded screening criteria for metals and organics, respectively.

Table E-1. Chemicals Exceeding Screening Criteria at the Upper and Lower Cobbs Ponds

Medium	Analyte	Units	Frequency of Detection	Minimum Detect	Maximum Detect	Average Result[a]	Screening Criteria[b]
Surface Soil	Aluminum	mg/kg	12/12	6450	19200	12700	17700
	Arsenic	mg/kg	12/12	4.20	28.40	12.40	15.4
	Chromium	mg/kg	12/12	9.60	24.80	16.00	17.4
	Cobalt	mg/kg	12/12	5.60	12.00	8.28	10.4
	Thallium	mg/kg	11/12	0.19	1.10	0.41	0.61
	Benzo(a)pyrene	mg/kg	2/2	0.08	0.08	0.08	0.022
	Dibenz(a,h)anthracene	mg/kg	2/2	0.14	0.15	0.15	0.022
	N-Nitroso-di-n-propylamine	mg/kg	2/2	0.13	0.13	0.13	0.12
Subsurface Soil	Not sampled	--	--	--	--	--	--
Wet Sediment	Aluminum	mg/kg	40/40	4310	21400	12200	13900
	Arsenic	mg/kg	40/40	3.5	34.3	11.4	19.5
	Cadmium	mg/kg	33/40	0.11	7.3	0.945	6.4
	Chromium	mg/kg	40/40	7.9	329	45.8	18.1
	Chromium, hexavalent	mg/kg	4/29	1.0	10.6	1.2	1.6
	Copper	mg/kg	31/31	10.9	316	49.8	310
	Silver	mg/kg	30/40	0.23	130	6.52	39
	Thallium	mg/kg	3/31	0.24	2.4	0.307	0.89
	Benz(a)anthracene	mg/kg	3/8	0.21	0.83	0.19	0.22
	Benzo(a)pyrene	mg/kg	4/8	0.23	0.89	0.232	0.022
	Benzo(b)fluoranthene	mg/kg	3/8	0.37	0.86	0.29	0.22
	Indeno(1,2,3-cd)pyrene	mg/kg	3/8	0.19	0.48	0.179	0.22
Surface Water	Arsenic	mg/L	5/ 7	0.0020	0.0043	0.0024	0.0032
	Manganese	mg/L	7/7	0.124	15.8	3.54	6.33
Groundwater	Arsenic	mg/L	9/18	0.00410	0.0303	0.00756	0.0117 (unconsolidated)
	Manganese	mg/L	18/18	0.00051	3.7800	0.56900	1.02 (unconsolidated)
	4,4'-DDD	mg/L	1/21	0.00035	0.00035	0.000034	0.000047
	Bis(2-ethylhexyl) phthalate	mg/L	6/21	0.00160	0.0160	0.00409	0.0009

-- Not applicable.

[a]Average result equals the sum of the concentrations divided by the number of samples; the average includes non-detects at half the reporting limit and field duplicate samples. This can result in an average less than the range of detected values.

[b]Screening criteria are based on HI=0.1 and Target Risk=10^{-6}.

Previous surface soil sampling has been accomplished at the Upper and Lower Cobbs Ponds at 0 to 1ft and 0.5 to 1 ft intervals. Table E-2 summarizes the historical surface soil (including dry sediment) sampling conducted at the Upper and Lower Cobbs Ponds and indicates whether or not sample results exceeded screening criteria.

Table E-2. The Upper and Lower Cobbs Ponds Historical Soil Sampling Summary

Sample Location	Sample Number	Depth of Sample (ft bgs)	Analysis Performed					
			Metals	Explosives	VOCs	Pesticides/ PCBs	SVOCs	Anions
ULCPss-001	ULCPss-001-0001-SO	0.0- 1.0	**Y**	N	--	--	--	N
ULCPss-002	ULCPss-002-0001-SO	0.0- 1.0	**Y**	N	--	--	--	N
ULCPss-003	ULCPss-003-0001-SO	0.0- 1.0	N	N	--	--	--	N
ULCPss-004	ULCPss-004-0001-SO	0.0- 1.0	**Y**	N	--	--	--	N
ULCPss-005	ULCPss-005-0001-SO	0.0- 1.0	**Y**	N	--	--	--	N
ULCPss-006	ULCPss-006-0001-SO	0.0- 1.0	N	N	--	--	--	N
ULCPss-007	ULCPss-007-0001-FD	0.0- 1.0	**Y**	N	N	N	**Y**	N
	ULCPss-007-0001-SO	0.0- 1.0	N	N	N	N	**Y**	N
ULCPss-008	ULCPss-008-0001-SO	0.0- 1.0	**Y**	N	--	--	--	N
ULCPss-009	ULCPss-009-0001-SO	0.0- 1.0	N	N	--	--	--	N
ULCPss-010	ULCPss-010-0001-SO	0.0- 1.0	Cr	N	--	--	--	N
ULCPsd-010	ULCPsd-010-0001-SD	0.5- 1.0	**Y**	N	--	--	--	N

Y = Analyte(s) greater than screening criteria.
Cr= Only chromium greater than screening criterion.
N = Non-detect or less than screening criteria.
-- = Analysis not performed.

E.3 PROPOSED SAP ADDENDUM CHARACTERIZATION ACTIVITIES

The objective of this SAP Addendum for Upper and Lower Cobbs Ponds is to define the nature and extent of chemicals at concentrations greater than the screening criteria. To accomplish this further sampling and analysis of metals and SVOCs in surface and subsurface soil, manganese and arsenic in surface water, and metals and SVOCs in wet sediment will be conducted. In addition, current concentrations of chemicals in groundwater will be evaluated.

Table E-3 summarizes the chemicals that exceeded screening criteria and CUGs for each medium, the types and quantities of samples to be collected during the implementation of this SAP Addendum, and the rationale behind the proposed samples. Almost all historical soil and wet sediment sampling at this AOC has been conducted using discrete sample methods; therefore, this addendum proposes discrete samples so that consistent sample types can be used in nature and extent evaluation and future risk management decisions. The general approach for investigation activities is presented in Section 3.2 of the FSP. Figure E-3 illustrates the locations of the samples to be collected as well as previous screening criteria and CUG exceedances.

Table E-4 presents the coordinates for the proposed sampling locations for this AOC. The locations may be altered during implementation of this SAP Addendum for a variety of reasons (e.g., soil boring refusal and MEC avoidance). The final coordinates of the sample locations (including elevations) will be presented in the RI Report.

Table E-3. Summary of Sampling at Upper and Lower Cobbs Ponds

<table>
<tr><th>Medium</th><th>Historical Sample Type</th><th>Historical Screening Criteria Exceedances</th><th>Number of SAP Addendum Sample Locations</th><th>Rationale for SAP Addendum Field Activities</th></tr>
<tr><td rowspan="2">Surface soil</td><td>Discrete</td><td><u>Al</u>
ULCPss-004, 005
<u>As</u>
ULCPss-002, 005, & 007
ULCPsd-010
<u>Co</u>
ULCPss-001, 002, 005, 008
<u>Tl</u>
ULCPss-007, 008
<u>SVOCs</u>
ULCPss-007</td><td>8</td><td>A total of eight discrete surface soil samples will be collected along the banks of the ponds to define the lateral extent of metals and SVOCs. Five locations are near five previous sampling locations with chemicals greater than screening criteria (ULCPss-002, 005, 007, 008, and ULCPsd-010) along the shoreline, and three locations are in areas not previously investigated around Upper Cobbs Pond.
There is no historical documentation indicating the land directly adjacent to the ponds was used for operational purposes; therefore, surface soil characterization beyond the pond banks will not be conducted.
Samples will be analyzed for TAL metals, explosives, and SVOCs; 10% RVAAP full suite.</td></tr>
<tr><td>Chromium speciation</td><td><u>Cr</u>
ULCPss-005, 008, 010</td><td>1</td><td>25 soil and wet sediment locations have been analyzed for total chromium and hexavalent chromium. Of the 25 samples analyzed, hexavalent chromium was detected in four samples and total chromium was detected in all samples. At 3 of the 4 locations where hexavalent chromium was detected, the percent ratio of hexavalent to total chromium was less than 7.9%; the other one was 53.26% (wet sediment location ULCPsd-018).
One composite wet sediment sample will be re-collected at ULCPsd-018 for total chromium and hexavalent chromium to confirm concentrations.
Refer to Section 4.1.3 of the FSP for a discussion about chromium speciation sampling.</td></tr>
<tr><td rowspan="2">Subsurface soil</td><td>None</td><td>N/A</td><td>5</td><td>Five boring locations are planned to along the pond banks to further define the vertical extent of metals and SVOCs. Four locations are near the five previous surface soil locations with chemicals greater than the screening criteria and CUGs (ULCPss-002, 005, 007, 008, and ULCPsd-010), and one at Lower Cobbs Pond in an uninvestigated area to verify the absence of subsurface soil contamination.
Given the boring locations are near surface water, boring depths may be limited to the depth to groundwater (in place of 13 feet).
Samples will be analyzed for TAL metals, explosives, and SVOCs with 10% RVAAP full suite.</td></tr>
<tr><td>Geotechnical</td><td>N/A</td><td>1</td><td>Two samples shall be collected at one location to provide soil data for modeling.</td></tr>
</table>

Table E-3. Summary of Sampling at Upper and Lower Cobbs Ponds (continued)

Medium	Historical Sample Type	Historical Screening Criteria Exceedances	Number of SAP Addendum Sample Locations	Rationale for SAP Addendum Field Activities
Surface water	Discrete	<u>As</u> UCLPsw-002 <u>Mn</u> **ULCPsw-002**, 007	5	Existing samples were taken 5 to 12 years ago. In order to confirm that wet sediment concentrations have not changed and also to obtain current surface water data, five more samples will be collected. Five surface water and co-located composite wet sediment samples will be collected to confirm previous exceedances (4 of the 5), characterize deep wet sediment (4 of the 5), characterize current conditions (all 5), and provide data for the ecological WOE evaluation (all 5). Unless otherwise noted, all samples will be collected for the RVAAP full suite of parameters. 1. Inlet of Upper Cobbs Pond (previous location ULCPsd-006, where SVOC concentration previously exceeded the CUG). Shallow (0-0.5 ft) and deep (0.5-2 ft) composite wet sediment will be collected. 2. Upper Cobbs Pond (at previous location ULCPsd-015, where SVOC concentrations exceeded CUGs). Shallow (0-0.5 ft) and deep (0.5-2 ft) composite wet sediment will be collected. 3. Upper Cobbs Pond central portion. Shallow (0-0.5 ft) and deep (0.5-2 ft) composite wet sediment will be collected. Facility-wide sample collected in 2003 manganese and chromium above CUGs in sediment and no exceedances for surface water during two rounds of data. 4. Lower Cobbs Pond (previous location ULCPsd-007, where SVOC concentrations exceeded CUGs). Shallow (0-0.5 ft) and deep (0.5-2 ft) composite wet sediment will be collected. Facility-wide sample collected in 2003 indicated manganese above the CUG in wet sediment and no exceedances for surface water during two rounds of data. 5. Outlet of Lower Cobbs Pond (north of previous location ULCPsd-025, which exceeded CUGs for metals). This location is of ecological interest for characterization, surface water will be analyzed for the RVAAP full suite of parameters. The composite wet sediment sample will be analyzed for only metals and SVOCs. Facility-wide sample collected in 2003 indicated that downstream of Cobbs Ponds (sample S8), arsenic was detected below background values, but above the CUG for Resident Farmer. No further sampling downstream is proposed.

Table E-3. Summary of Sampling at Upper and Lower Cobbs Ponds (continued)

Medium	Historical Sample Type	Historical Screening Criteria Exceedances	Number of SAP Addendum Sample Locations	Rationale for SAP Addendum Field Activities
Wet sediment	Discrete	<u>Al</u> ULCPsd-001, 002, 003, 004, 009, 013, 017, 018, 019, 022, 026 <u>As</u> **ULCPsd-021**, **026** **CPCsd-002(p)** <u>Cd</u> ULCPsd-003 <u>Cr</u> CPCsd-002(p), 003(p), 004(p), 005(p), 006(p), **007(p)**, 008(p) ULCPsd-001, 002, 003, 004, 006, 007, 009, 011, 013, 017, 019, 020, 021022, 023 <u>Cr^{6+}</u> ULCPsd-018, 021, 022 <u>Cu</u> CPCsd-007(p) <u>Ag</u> ULCPsd-001 <u>Tl</u> CPCsd-007(p) <u>SVOCs</u> **ULCPsd-006**, **015** **CPCsd-007**	5	Refer to surface water above.

Table E-3. Summary of Sampling at Upper and Lower Cobbs Ponds (continued)

Medium	Historical Sample Type	Historical Screening Criteria Exceedances	Number of SAP Addendum Sample Locations	Rationale for SAP Addendum Field Activities
Groundwater	Discrete	As **ULCPmw-005** Mn **ULCPmw-006**, **CPCwp-013** Pesticide/PCB UCLPmw-003 SVOCS ULCPmw-001, **002**, 003, 004, 005, **006**	0	No additional groundwater monitoring is planned. Monitoring wells ULCPmw-001, ULCPmw-002, ULCPmw-003, ULCPmw-004, ULCPmw-005 and ULCPmw-006 are currently being sampled under the FWGWMP. Four quarters of sampling were completed in October 2008. No additional groundwater sampling is required for completion of the FS.

Bold indicates locations where concentration also exceeded the CUG (HI=1.0, Target Risk=10^{-5}) for the identified chemical.

Table E-4. Coordinates for Proposed Sampling Locations at Upper and Lower Cobbs Ponds

Sample Location ID	Sample Type	Easting	Northing
CPCsb-030	Grab	2368598.473	562401.0469
CPCsb-031	Grab	2368547.434	561867.0187
CPCsb-032	Grab	2368564.455	561234.2531
CPCsb-033	Grab	2368592.52	561235.9474
CPCsb-034	Grab	2368716.037	560724.3937
CPCsb-035	Grab	2368021.414	561865.4088
CPCsd-044	Composite	2367793.652	562664.8405
CPCsd-045	Composite	2368169.4	562624.3958
CPCsd-046	Composite	2368158.431	561559.2039
CPCsd-047	Composite	2368432.898	561016.702
CPCsd-048	Composite	2368664.741	560082.8955
CPCsd-049	Grab	2368109.201	561323.6386
CPCss-036	Grab	2368277.743	562648.7029
CPCss-037	Grab	2368568.249	562114.9615
CPCss-038	Grab	2368436.847	561401.858
CPCss-039	Grab	2368617.299	561201.5139
CPCss-040	Grab	2368741.829	560532.8724
CPCss-041	Grab	2367987.958	561785.3777
CPCss-042	Grab	2368102.585	561939.8943
CPCss-043	Grab	2368115.401	562469.3658
CPCsw-044	Grab	2367793.652	562664.8405
CPCsw-045	Grab	2368169.4	562624.3958
CPCsw-046	Grab	2368158.431	561559.2039
CPCsw-047	Grab	2368432.898	561016.702
CPCsw-048	Grab	2368664.741	560082.8955

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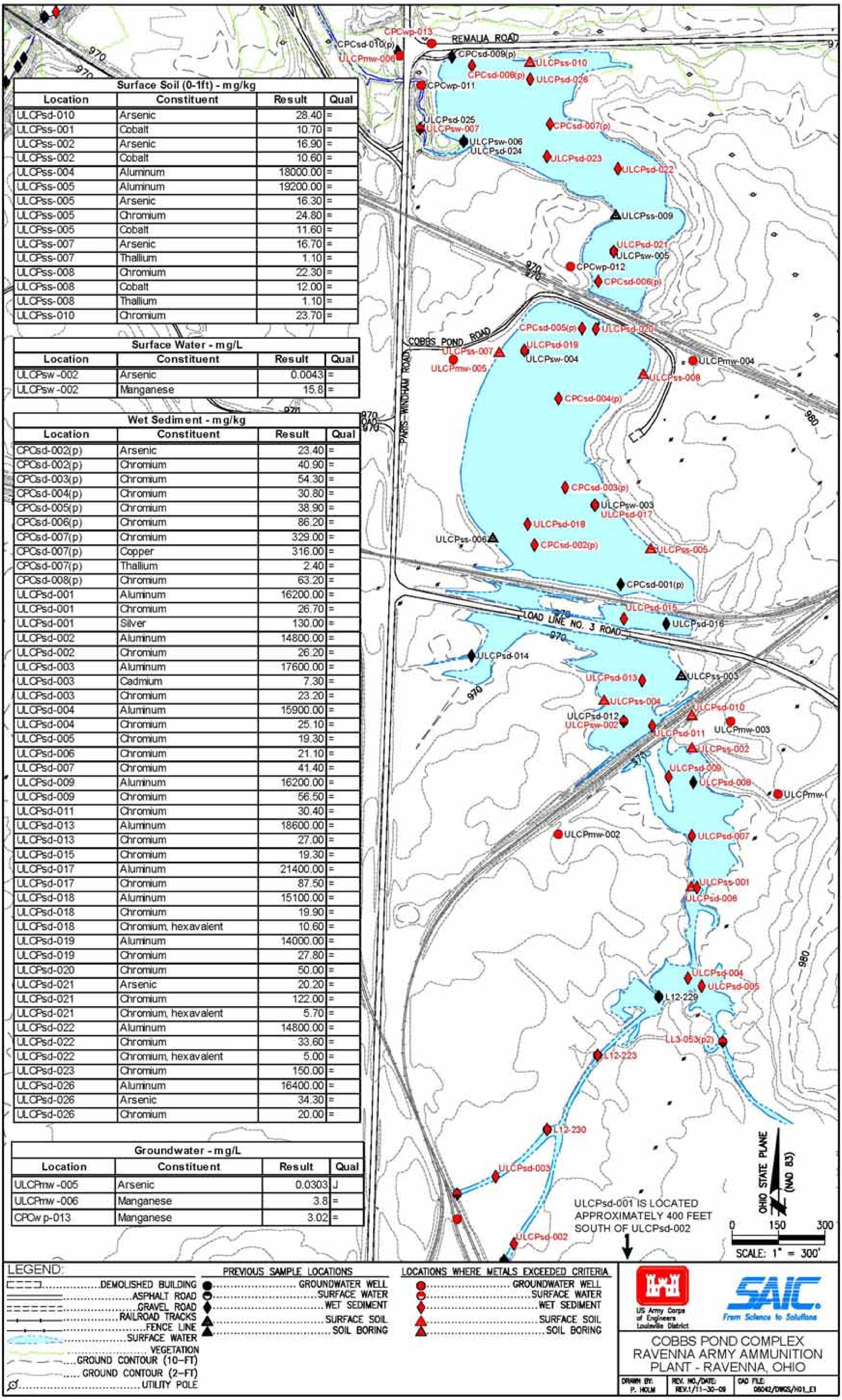


Surface Soil (0-1ft) - mg/kg

Location	Constituent	Result	Qual
ULCPsd-010	Arsenic	28.40	=
ULCPss-001	Cobalt	10.70	=
ULCPss-002	Arsenic	16.90	=
ULCPss-002	Cobalt	10.60	=
ULCPss-004	Aluminum	18000.00	=
ULCPss-005	Aluminum	19200.00	=
ULCPss-005	Arsenic	16.30	=
ULCPss-005	Chromium	24.80	=
ULCPss-005	Cobalt	11.60	=
ULCPss-007	Arsenic	16.70	=
ULCPss-007	Thallium	1.10	=
ULCPss-008	Chromium	22.30	=
ULCPss-008	Cobalt	12.00	=
ULCPss-008	Thallium	1.10	=
ULCPss-010	Chromium	23.70	=

Surface Water - mg/L

Location	Constituent	Result	Qual
ULCPsw-002	Arsenic	0.0043	=
ULCPsw-002	Manganese	15.8	=

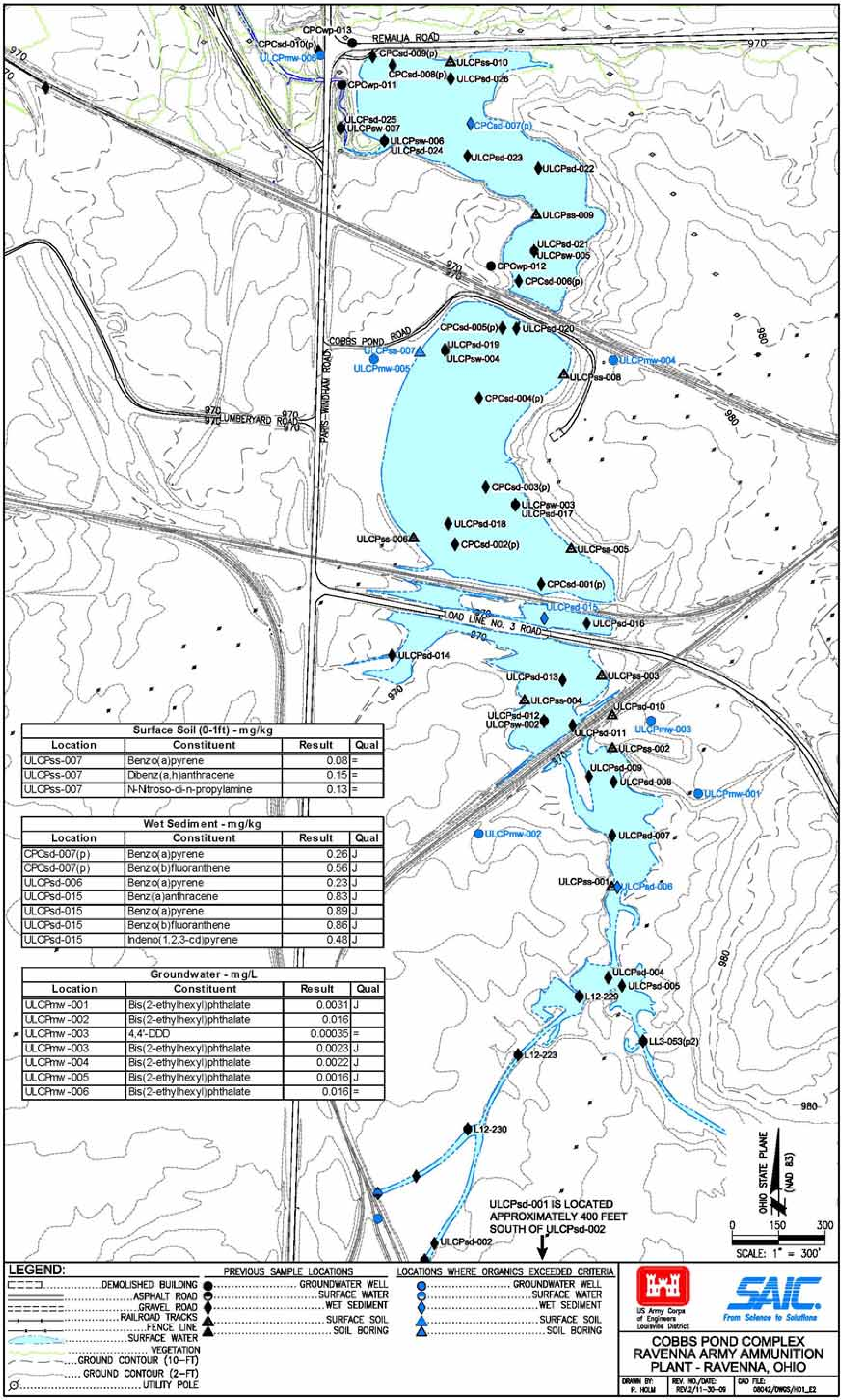
Wet Sediment - mg/kg

Location	Constituent	Result	Qual
CPCsd-002(p)	Arsenic	23.40	=
CPCsd-002(p)	Chromium	40.90	=
CPCsd-003(p)	Chromium	54.30	=
CPCsd-004(p)	Chromium	30.80	=
CPCsd-005(p)	Chromium	38.90	=
CPCsd-006(p)	Chromium	86.20	=
CPCsd-007(p)	Chromium	329.00	=
CPCsd-007(p)	Copper	316.00	=
CPCsd-007(p)	Thallium	2.40	=
CPCsd-008(p)	Chromium	63.20	=
ULCPsd-001	Aluminum	16200.00	=
ULCPsd-001	Chromium	26.70	=
ULCPsd-001	Silver	130.00	=
ULCPsd-002	Aluminum	14800.00	=
ULCPsd-002	Chromium	26.20	=
ULCPsd-003	Aluminum	17600.00	=
ULCPsd-003	Cadmium	7.30	=
ULCPsd-003	Chromium	23.20	=
ULCPsd-004	Aluminum	15900.00	=
ULCPsd-004	Chromium	25.10	=
ULCPsd-005	Chromium	19.30	=
ULCPsd-006	Chromium	21.10	=
ULCPsd-007	Chromium	41.40	=
ULCPsd-009	Aluminum	16200.00	=
ULCPsd-009	Chromium	56.50	=
ULCPsd-011	Chromium	30.40	=
ULCPsd-013	Aluminum	18600.00	=
ULCPsd-013	Chromium	27.00	=
ULCPsd-015	Chromium	19.30	=
ULCPsd-017	Aluminum	21400.00	=
ULCPsd-017	Chromium	87.50	=
ULCPsd-018	Aluminum	15100.00	=
ULCPsd-018	Chromium	19.90	=
ULCPsd-018	Chromium, hexavalent	10.60	=
ULCPsd-019	Aluminum	14000.00	=
ULCPsd-019	Chromium	27.80	=
ULCPsd-020	Chromium	50.00	=
ULCPsd-021	Arsenic	20.20	=
ULCPsd-021	Chromium	122.00	=
ULCPsd-021	Chromium, hexavalent	5.70	=
ULCPsd-022	Aluminum	14800.00	=
ULCPsd-022	Chromium	33.60	=
ULCPsd-022	Chromium, hexavalent	5.00	=
ULCPsd-023	Chromium	150.00	=
ULCPsd-026	Aluminum	16400.00	=
ULCPsd-026	Arsenic	34.30	=
ULCPsd-026	Chromium	20.00	=

Groundwater - mg/L

Location	Constituent	Result	Qual
ULCPmw-005	Arsenic	0.0303	J
ULCPmw-006	Manganese	3.8	=
CPCwp-013	Manganese	3.02	=

Figure E-1. Historical Sampling and Metal Exceedance Locations at Upper and Lower Cobbs Ponds



Surface Soil (0-1ft) - mg/kg			
Location	Constituent	Result	Qual
ULCPss-007	Benzo(a)pyrene	0.08	=
ULCPss-007	Dibenz(a,h)anthracene	0.15	=
ULCPss-007	N-Nitroso-di-n-propylamine	0.13	=

Wet Sediment - mg/kg			
Location	Constituent	Result	Qual
CPCsd-007(p)	Benzo(a)pyrene	0.26	J
CPCsd-007(p)	Benzo(b)fluoranthene	0.56	J
ULCPsd-006	Benzo(a)pyrene	0.23	J
ULCPsd-015	Benz(a)anthracene	0.83	J
ULCPsd-015	Benzo(a)pyrene	0.89	J
ULCPsd-015	Benzo(b)fluoranthene	0.86	J
ULCPsd-015	Indeno(1,2,3-cd)pyrene	0.48	J

Groundwater - mg/L			
Location	Constituent	Result	Qual
ULCPmw-001	Bis(2-ethylhexyl)phthalate	0.0031	J
ULCPmw-002	Bis(2-ethylhexyl)phthalate	0.016	
ULCPmw-003	4,4'-DDD	0.00035	=
ULCPmw-003	Bis(2-ethylhexyl)phthalate	0.0023	J
ULCPmw-004	Bis(2-ethylhexyl)phthalate	0.0022	J
ULCPmw-005	Bis(2-ethylhexyl)phthalate	0.0016	J
ULCPmw-006	Bis(2-ethylhexyl)phthalate	0.016	=

Figure E-2. Historical Sampling and Organic Exceedance Locations at Upper and Lower Cobbs Ponds

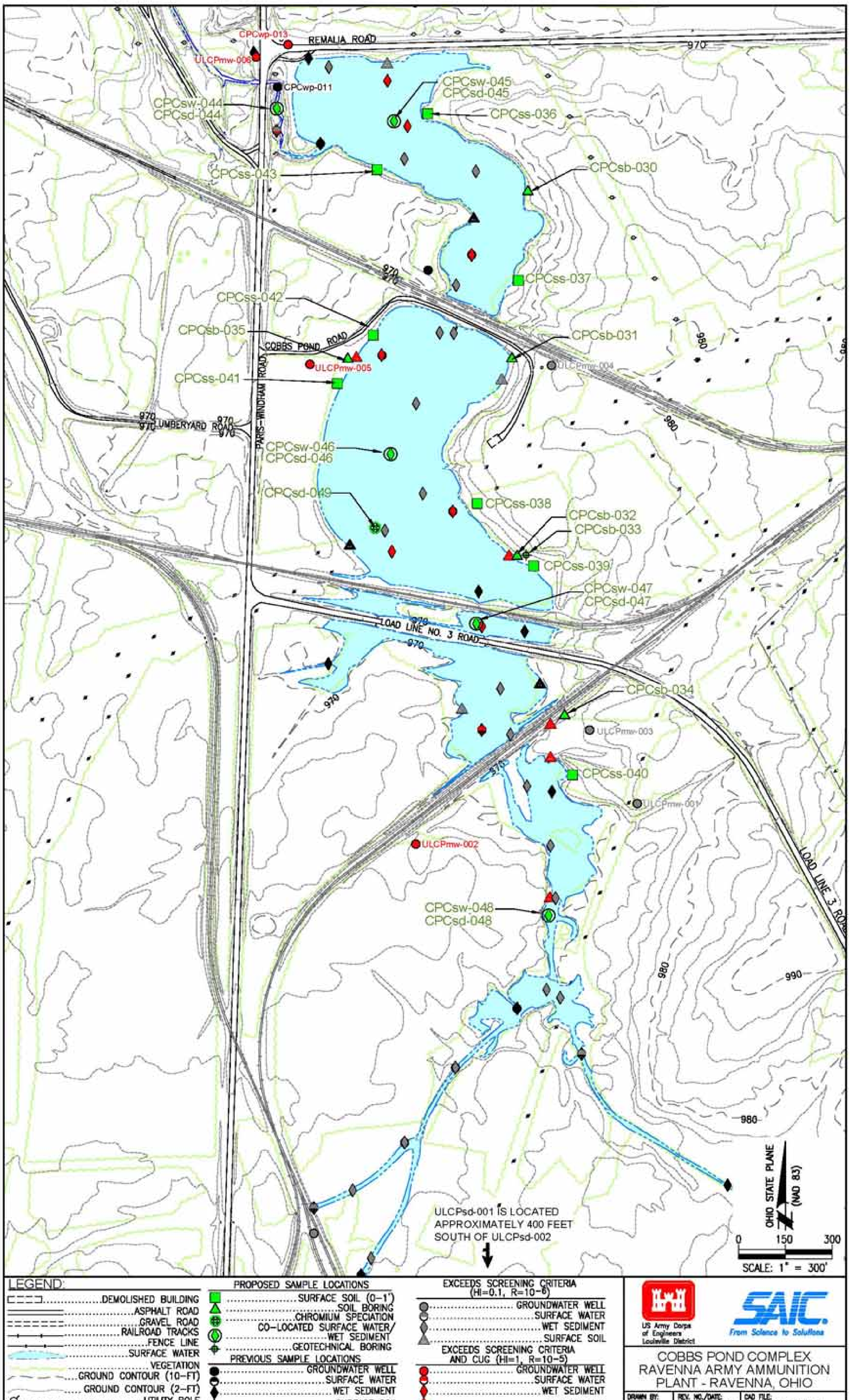


Figure E-3. Historical Exceedances and Proposed Sampling Locations at Upper and Lower Cobbs Ponds

APPENDIX F

Load Line 6 (RVAAP-33)

F.0 LOAD LINE 6 (RVAAP-33)

F.1 AOC DESCRIPTION

Load Line 6 is approximately 51-acres in size (Figure F-1). From 1941 to 1945, Load Line 6 operated primarily as a fuze assembly line. Building 2F-4 was used as a fulminate mixing building. The Load Line was deactivated in 1945 and all equipment was removed. In the 1950s and 1970s, a portion of Load Line 6 was utilized by Firestone Defense Research for the research and development of shaped charges for the U.S. Department of Defense (DoD). All buildings at the AOC have since been demolished, with the exception of a former Firestone test chamber building foundation and concrete blocks around a testing pond adjacent to the building.

F.2 PREVIOUS INVESTIGATIONS

In 1996 the USACHPPM conducted a RRSE at Load Line 6. The report indicated that surface soil was a potential medium for contaminant migration and hunters and recyclers (personnel hired by the facility to collect/scavenge recyclable materials) were identified as potential receptors. As a result of the investigation, the AOC was scored as “High” priority (MKM 2007b).

An azide screening operation was conducted for the purposes of health and safety in March 2002 by the U.S. Army Operations Support Command (OSC) and USACE. Results of sampling indicated that there was no safety concern related to azide contamination at the AOC, but metals were detected in excess of the RVAAP installation background criteria in some soil, surface water, and wet sediment samples (MKM 2007b).

The following activities were conducted from October through December 2003 as part of a Phase I Remedial Investigation at Load Line 6 (MKM 2007b):

- Collection of 37 surface soil (0 to 1 ft) samples;
- Collection of 49 subsurface soil (1 to 3 ft) samples;
- Collection of eight wet sediment (0 to 0.5 ft) samples from throughout the pond and drainage area;
- Collection of six surface water samples from the pond and drainage pathway;
- Installation and sampling of seven shallow groundwater monitoring wells;
- Collection of geotechnical samples from three soil borings; and
- Well slug tests.

Results of the investigation indicated that contaminants were detected in all media sampled. However, most of the contaminants, with the exception of metals, were detected in very few samples.

For this SAP Addendum, all sample results were compared to the preliminary RVAAP facility-wide screening criteria (Section 3.2.2 of the FSP). Table F-1 lists the chemicals that exceeded screening criteria in each medium, as well as the maximum and minimum concentration detected.

Figures F-1 and F-2 illustrate the type and location of historical samples and identify samples that exceeded screening criteria for metals and organics, respectively.

Table F-1. Chemicals Exceeding Screening Criteria at Load Line 6

Media	Analyte	Units	Frequency of Detection	Minimum Detect	Maximum Detect	Average Result[a]	Screening Criteria[b]
Surface Soil	Aluminum	mg/kg	55/55	1990	18000	11600	17700
	Arsenic	mg/kg	55/55	2.20	41.00	11.50	15.4
	Cadmium	mg/kg	16/55	0.11	6.80	0.40	6.4
	Chromium	mg/kg	55/55	5.70	25.00	15.30	17.4
	Cobalt	mg/kg	55/55	3.60	13.00	8.16	10.4
	Copper	mg/kg	55/55	6.00	627.00	33.00	310
	Manganese	mg/kg	55/55	120	1800	469	1450
	Benzo(a)pyrene	mg/kg	6/8	0.00	0.04	0.02	0.022
	Dibenz(a,h)anthracene	mg/kg	4/8	0.01	0.03	0.01	0.022
Subsurface Soil	Aluminum	mg/kg	46/46	590	21000	1290	19500
	Arsenic	mg/kg	46/46	2.60	26.00	13.20	19.8
	Chromium	mg/kg	46/46	8.20	29.00	17.80	27.2
	Cobalt	mg/kg	46/46	2.30	33.00	10.00	23.2
	Benz(a)anthracene	mg/kg	110	0.29	0.29	0.03	0.22
	Benzo(a)pyrene	mg/kg	1/10	0.20	0.20	0.02	0.022
	Benzo(b)fluoranthene	mg/kg	1/10	0.23	0.23	0.02	0.22
	Dibenz(a,h)anthracene	mg/kg	1/10	0.05	0.05	0.01	0.022
Wet Sediment	Aluminum	mg/kg	4/4	4500	16200	10800	13900
	Arsenic	mg/kg	4/4	8.7	37	16.6	19.5
	Chromium	mg/kg	4/4	9.1	23.2	16.8	18.1
Surface Water	Aluminum	mg/L	7/7	0.0972	16.0000	3.7200	15
	Arsenic	mg/L	4/7	0.0016	0.0260	0.0063	0.0032
	Lead	mg/L	4/7	0.0010	0.0830	0.0172	0.015
	Manganese	mg/L	7/7	0.0620	11.0000	2.3100	0.63
Groundwater	Antimony	mg/L	3/14	0.00270	0.0042	0.00159	0.000389
	Arsenic	mg/L	2/14	0.00076	0.0130	0.00236	0.0117 (unconsolidated)
	4-Nitrobenzenamine	mg/L	1/14	0.0041	0.0041	0.00128	0.0031
	Bis(2-ethylhexyl) phthalate	mg/L	6/14	0.00130	0.0140	0.00412	0.0009

-- Not applicable

[a]Average result equals the sum of the concentrations divided by the number of samples; the average includes non-detects at half the reporting limit and field duplicate samples. This can result in an average less than the range of detected values.

[b]Screening criteria are based on HI=0.1 and Target Risk=10^{-6}

Previous surface and subsurface soil sampling has been primarily accomplished at Load Line 6 at the 0 to 1 ft and 1 to 3 ft depth intervals. However, there are several instances in which samples were collected at deeper depth intervals (e.g., 3 to 5 ft, 4 to 6 ft, 7 ft, 8 to 10 ft, 12 to 14 ft, and 11 to 13 ft).

Table F-2 summarizes the historical surface soil (including dry sediment) and subsurface soil sampling conducted at Load Line 6 and indicates whether sample results exceeded screening criteria.

Table F-2. Load Line 6 Historical Soil Sampling Summary

Sample Location	Sample Number	Depth of Sample (ft bgs)	Analysis Performed					
			Metals	**Explosives**	**VOCs**	**Pesticides/ PCBs**	**SVOCs**	**TPH**
LL6ss/sb-001	LL6ss-001-0001-SO	0.0-1.0	N	N	--	--	--	--
	LL6ss-001-D12S-FD	0.0- 1.0	--	N	--	--	--	--
	LL6ss-001-W12S-FD	0.0- 1.0	--	N	--	--	--	--
	LL6sb-001-0001-SO	1.0- 3.0	N	--	--	--	--	--
LL6ss/sb-002	LL6ss-002-0001-SO	0.0- 1.0	**Y**	N	--	--	--	--
	LL6ss-002-D13S-FD	0.0- 1.0	--	N	--	--	--	--
	LL6ss-002-W13S-FD	0.0- 1.0	N	N	--	--	--	--
	LL6sb-002-0001-SO	1.0- 3.0	N	--	--	--	--	--
LL6ss/sb-003	LL6ss-003-0001-SO	0.0- 1.0	N	N	--	--	--	--
	LL6ss-003-D14S-FD	0.0- 1.0	--	N	--	--	--	--
	LL6ss-003-W14S-FD	0.0- 1.0	--	N	--	--	--	--
	LL6sb-003-0001-SO	1.0- 3.0	N	N	N	N	N	--
LL6ss/sb-004	LL6ss-004-0001-SO	0.0- 1.0	Cr	--	--	--	--	--
	LL6sb-004-0001-SO	1.0- 3.0	N	--	--	--	--	--
LL6ss/sb-005	LL6ss-005-0001-SO	0.0- 1.0	N	--	--	--	--	--
	LL6sb-005-0001-SO	1.0- 3.0	N	--	--	--	--	--
LL6ss/sb-006	LL6ss-006-0001-SO	0.0- 1.0	N	--	--	--	--	--
	LL6sb-006-0001-FD	1.0- 3.0	--	--	N	--	--	--
	LL6sb-006-0001-SO	1.0- 3.0	N	N	N	N	N	--
LL6ss/sb-007	LL6ss-007-0001-SO	0.0- 1.0	**Y**	--	--	--	--	--
	LL6sb-007-0001-SO	1.0- 3.0	N	--	--	--	--	--
LL6ss/sb-008	LL6ss-008-0001-SO	0.0- 1.0	N	--	--	--	--	--
	LL6sb-008-0001-SO	1.0- 3.0	N	--	--	--	--	--
LL6ss/sb-009	LL6ss-009-0001-SO	0.0- 1.0	N	--	--	--	--	--
	LL6sb-009-0001-SO	1.0- 3.0	N	--	--	--	--	--
LL6ss/sb-010	LL6ss-010-0001-SO	0.0- 1.0	**Y**	N	N	N	N	--
	LL6ss-010-0002-SO	0.0- 1.0	--	N	--	--	--	--
	LL6sb-010-0001-SO	1.0- 3.0	N	--	--	--	--	--
LL6ss/sb-011	LL6ss-011-0001-SO	0.0- 1.0	N	--	--	--	--	--
	LL6sb-011-0001-SO	1.0- 3.0	N	--	--	--	--	--
LL6ss/sb-012	LL6ss-012-0001-SO	0.0- 1.0	Cr	--	--	--	--	--
	LL6sb-012-0001-FD	1.0- 3.0	**Y**	--	--	--	--	--
	LL6sb-012-0001-SO	1.0- 3.0	N	--	--	--	--	--
LL6ss/sb-013	LL6ss-013-0001-SO	0.0- 1.0	N	--	--	--	--	--
	LL6sb-013-0001-SO	1.0- 3.0	**Y**	--	--	--	--	--
LL6ss/sb-014	LL6ss-014-0001-SO	0.0- 1.0	N	--	--	--	--	--
	LL6sb-014-0001-SO	1.0- 3.0	N	N	N	N	N	--
LL6ss/sb-015	LL6ss-015-0001-SO	0.0- 1.0	Cr	--	--	--	--	--
	LL6sb-015-0001-FD	1.0- 3.0	Cr	N	--	--	--	--
	LL6sb-015-0001-SO	1.0- 3.0	Cr	N	--	--	--	--

Table F-2. Load Line 6 Historical Soil Sampling Summary (continued)

Sample Location	Sample Number	Depth of Sample (ft bgs)	Analysis Performed					
			Metals	Explosives	VOCs	Pesticides/ PCBs	SVOCs	TPH
LL6ss/sb-016	LL6ss-016-0001-SO	0.0- 1.0	Cr	--	--	--	--	--
	LL6sb-016-0001-SO	1.0- 3.0	**Y**	--	--	--	--	--
LL6ss/sb-017	LL6ss-017-0001-SO	0.0- 1.0	N	--	--	--	--	--
	LL6sb-017-0001-SO	1.0- 3.0	N	--	--	--	--	--
LL6ss/sb-018	LL6ss-018-0001-SO	0.0- 1.0	N	--	--	--	--	--
	LL6sb-018-0001-FD	1.0- 3.0	**Y**	N	--	--	--	--
	LL6sb-018-0001-SO	1.0- 3.0	N	N	--	--	--	--
LL6ss/sb-019	LL6ss-019-0001-SO	0.0- 1.0	**Y**	--	--	--	--	--
	LL6sb-019-0001-SO	1.0- 3.0	N	--	--	--	--	--
LL6ss/sb-020	LL6ss-020-0001-FD	0.0- 1.0	N	N	N	N	**Y**	--
	LL6ss-020-0001-SO	0.0- 1.0	N	N	N	N	**Y**	--
	LL6sb-020-0001-SO	1.0- 3.0	N	--	--	--	--	--
LL6ss/sb-021	LL6ss-021-0001-SO	0.0- 1.0	N	--	--	--	--	--
	LL6sb-021-0001-SO	1.0- 3.0	N	--	--	--	--	--
LL6ss-022	LL6ss-022-0001-SO	0.0- 1.0	N	--	--	--	--	--
LL6ss/sb-023	LL6ss-023-0001-SO	0.0- 1.0	N	N	N	N	**Y**	--
	LL6sb-023-0001-SO	1.0- 3.0	N	--	--	--	--	--
LL6ss/sb-024	LL6ss-024-0001-SO	0.0- 1.0	N	--	--	--	--	--
	LL6sb-024-0001-SO	1.0- 3.0	N	N	N	N	**Y**	--
LL6ss/sb-025	LL6ss-025-0001-SO	0.0- 1.0	N	--	--	--	--	--
	LL6sb-025-0001-SO	1.0- 3.0	N	--	--	--	--	--
LL6ss/sb-026	LL6ss-026-0001-SO	0.0- 1.0	N	--	--	--	--	--
	LL6sb-026-0001-SO	1.0- 3.0	N	--	--	--	--	--
LL6ss/sb-027	LL6ss-027-0001-SO	0.0- 1.0	**Y**	--	--	--	--	--
	LL6sb-027-0001-SO	1.0- 3.0	N	--	--	--	--	--
LL6ss/sb-028	LL6ss-028-0001-SO	0.0- 1.0	N	--	--	--	--	--
	LL6sb-028-0001-SO	1.0- 3.0	N	--	--	--	--	--
LL6ss-029	LL6ss-029-0001-FD	0.0- 1.0	**Y**	--	--	--	--	--
	LL6ss-029-0001-SO	0.0- 1.0	Cr	--	--	--	--	--
LL6ss/sb-030	LL6ss-030-0001-SO	0.0- 1.0	Cr	--	--	--	--	--
	LL6sb-030-0001-SO	1.0- 3.0	N	--	--	--	--	--
LL6ss/sb-031	LL6ss-031-0001-SO	0.0- 1.0	N	--	--	--	--	--
	LL6sb-031-0001-SO	6.0- 8.0	N	--	--	--	--	--
LL6ss-032	LL6ss-032-0001-FD	0.0- 1.0	N	N	--	--	--	--
	LL6ss-032-0001-SO	0.0- 1.0	**Y**	N	--	--	--	--
LL6ss/sb-033	LL6ss-033-0001-SO	0.0- 1.0	**Y**	--	--	--	--	--
	LL6sb-033-0001-FD	6.0- 8.0	**Y**	N	--	--	--	--
	LL6sb-033-0001-SO	6.0- 8.0	**Y**	N	--	--	--	--
LL6ss-034	LL6ss-034-0001-SO	0.0- 1.0	N	N	N	N	N	--
LL6ss/sb-035	LL6ss-035-0001-SO	0.0- 1.0	N	N	N	N	N	--
	LL6sb-035-0001-SO	11.0-13.0	N	--	--	--	--	--

Table F-2. Load Line 6 Historical Soil Sampling Summary (continued)

Sample Location	Sample Number	Depth of Sample (ft bgs)	Analysis Performed					
			Metals	Explosives	VOCs	Pesticides/ PCBs	SVOCs	TPH
LL6ss/sb-036	LL6ss-036-0001-SO	0.0- 1.0	Cr	--	--	--	--	--
	LL6sb-036-0001-SO	6.0- 8.0	N	--	--	--	--	--
LL6ss/sb-037	LL6ss-037-0001-SO	0.0- 1.0	N	--	--	--	--	--
	LL6sb-037-0001-SO	12.0-14.0	N	--	--	--	--	--
LL6ss/sb-038	LL6ss-038-0001-SO	0.0- 1.0	N	--	--	--	--	--
	LL6sb-038-0001-SO	8.0-10.0	N	--	--	--	--	--
LL6ss/sb-039	LL6ss-039-0001-SO	0.0- 1.0	Cr	--	--	--	--	--
	LL6sb-039-0001-SO	8.0-10.0	N	N	--	--	--	--
LL6ss/sb-040	LL6ss-040-0001-FD	0.0- 1.0	N	N	--	--	--	--
	LL6ss-040-0001-SO	0.0- 1.0	N	N	--	--	--	--
	LL6sb-040-0001-SO	4.0- 6.0	N	--	--	--	--	--
LL6sb-041	LL6sb-041-0001-SO	7.0- 7.0	N	--	--	--	--	--
LL6sb-042	LL6sb-042-0001-SO	1.0- 3.0	N	--	--	--	--	--
LL6sb-044	LL6sb-044-0001-FD	1.0- 3.0	N	N	N	N	N	--
LL6sb-044	LL6sb-044-0001-SO	1.0- 3.0	N	N	N	N	N	--
LL6sb-045	LL6sb-045-0001-SO	1.0- 3.0	N	--	--	--	--	--
LL6sb-049	LL6sb-049-0001-SO	4.0- 6.0	--	--	N	--	N	N
LL6sb-050	LL6sb-050-0001-SO	6.0- 8.0	--	--	N	--	N	N
LL6sb-051	LL6sb-051-0001-SO	6.0- 8.0	--	--	N	--	N	N
LL6sb-055	LL6sb-055-0001-SO	3.0- 5.0	--	--	N	--	N	N
LL6ss-056	LL6ss-056-0001-SO	0.0- 1.0	N	--	--	--	--	--
LL6sb-056	LL6sb-056-0001-SO	1.0- 3.0	N	--	--	--	--	--
LL6sd-005	LL6sd-005-0001-FD	0.0- 0.5	N	--	--	--	--	--
LL6sd-005	LL6sd-005-0001-SD	0.0- 0.5	N	--	--	--	--	--
LL6sd-010	LL6sd-010-0001-FD	0.0- 0.5	**Y**	N	N	N	**Y**	--
	LL6sd-010-0001-SD	0.0- 0.5	Cr	N	N	N	**Y**	--
LL6sd-011	LL6sd-011-0001-SD	0.0- 1.0	Cr	--	--	--	--	--
LL6sd-012	LL6sd-012-0001-SD	0.0- 1.0	**Y**	--	--	--	--	--
LL6sd-013	LL6sd-013-0001-SD	0.0- 1.5	N	--	--	--	--	--
LL6sd-014	LL6sd-014-0001-SD	0.0- 0.5	Cr	--	--	--	--	--
LL6sd-015	LL6sd-015-0001-SD	0.0- 0.5	N	--	--	--	--	--

Y = Analytes exceeded screening criteria.
Cr = Only chromium exceeded screening criterion.
N = Non-detect or below screening criteria.
-- = Analysis was not performed.
TPH = total petroleum hydrocarbons.
Only PAHs were detected above screening criteria in the SVOC analysis.

F.3 PROPOSED SAP ADDENDUM CHARACTERIZATION ACTIVITIES

The objective of this SAP Addendum for Load Line 6 is to define the nature and extent of chemicals at concentrations greater than the screening criteria. To accomplish this, further sampling and analysis of metals and PAHs in surface and subsurface soil, and metals in surface water and wet sediment will be conducted. In addition, current concentrations of chemicals in groundwater will be evaluated.

Table F-3 summarizes the chemicals that exceeded the screening criteria and CUGs for each medium, the types and quantities of samples to be collected during the implementation of this SAP Addendum, and the rationale behind the proposed samples. All historical soil and wet sediment sampling at this AOC has been conducted using discrete sample methods. Therefore, this addendum proposes discrete samples so that consistent sample types can be used in nature and extent evaluation and future risk management decisions. The general approach for investigation activities is presented in Section 3.2 of the FSP. Figure F-3 illustrates the locations of the samples to be collected as well as previous screening criteria and CUG exceedances.

Table F-4 presents the coordinates for the proposed sampling locations for this AOC. The locations may be altered during implementation of this SAP Addendum for a variety of reasons (e.g., soil boring refusal and MEC avoidance). The final coordinates of the sample locations (including elevations) will be presented in the RI Report.

Table F-3. Summary of Sampling at Load Line 6

Medium	Historical Sample Type	Historical Screening Criteria Exceedances	Number of SAP Addendum Sample Locations	Rationale for SAP Addendum Field Activities
Surface soil	Discrete	Al LL6ss-029, 032 As **LL6ss-007**, **010**, **029**, **LL6sd-010**, **012** Cd LL6ss-002 Co LL6ss-010, 016, 019, 027, 033 LL6sd-010 Cu LL6ss-002 Mn **LL6ss-032** SVOCs LL6ss-020, 023 LL6sd-010	5	Five surface soil samples are planned in areas not previously investigated, including two near former buildings, two within the outer roadway ditch, and one upgradient of LL6ss-007. Discrete locations with surface soil chemical concentrations greater than CUGs or multiple screening criteria (which may indicate a source area) will be laterally bound by surface soil samples collected in conjunction with boring locations. At all surface soil locations with metal concentrations greater than screening criteria, metals were detected near background concentrations, with two exceptions. The concentration of arsenic at LL6ss-007 was greater than twice the surface soil background concentration, and the concentration of copper at LL6ss-002 was twice the screening criteria but below the CUG for the Resident Farmer Child. Samples will be analyzed for TAL metals, explosives and PAHs; 10% RVAAP full suite.
	Chromium speciation	Cr LL6sd-011, 014 LL6ss-004, 012, 015, 016, 019, 027, 029, 030, 033, 036, 039	3	Discrete surface soil samples will be collected at existing locations: LL6ss-029 (25 mg/kg – max), LL6ss-004 (21 mg/kg) and LL6ss-012 (18 mg/kg). One third of the exceedances (ss-012, ss-030, ss-036, sd-011, sd-014) were detected at 18 mg/kg only slightly above the background concentration of 17.4 mg/kg. Refer to Section 4.1.3 of the FSP for a discussion about chromium speciation sampling.

Table F-3. Summary of Sampling at Load Line 6 (continued)

Medium	Historical Sample Type	Historical Screening Criteria Exceedances	Number of SAP Addendum Sample Locations	Rationale for SAP Addendum Field Activities
Subsurface soil	Discrete	<u>Al</u> LL6sb-012 <u>As</u> **LL6sb-013**, **033** <u>Co</u> LL6sb-016, 018 <u>Cr</u> LL6sb-015 <u>SVOCs</u> LL6sb-024	5	Previous investigations have vertically bound most surface soil locations where concentrations exceeded screening criteria and have characterized the subsurface soil generally to three feet below grade. Five boring locations are planned to further define the vertical extent of surface and subsurface soil with chemicals greater than screening criteria and CUGs. These include one between LL6sb-033 and ss-010; two downgradient of LL6sb-013 and ss-029; one upgradient of LL6ss-032; and one in a ditch downgradient of LL6sd-012, LL6ss/sb-015, and LL6ss/sb-024. Samples will be analyzed for TAL metals, explosives and PAHs; 10% RVAAP full suite.
	Geotechnical (none collected)	NA	1	Two samples shall be collected from one location to provide soil data for modeling.
Surface water	Discrete	<u>Al</u> LL6sw-004 <u>As</u> **LL6sw-004**, 005 <u>Pb</u> LL6sw-004, 005 <u>Mn</u> LL6sw-002, **004**	2	Two surface water and co-located composite wet sediment samples will be collected to characterize current conditions and assess potential exit pathways from the AOC. The samples will be collected at previous sample locations sw-003 and sw-004. Potential transport beyond the AOC boundary will be further assessed under the Fuze and Booster Hill sample locations (Section 3.2.5.3 of the FSP). Surface water samples will be analyzed for the RVAAP full suite. Composite wet sediment samples will be analyzed for TAL metals and explosives; 10% RVAAP full suite.
Wet sediment	Discrete	<u>Al</u> LL6sd-001 <u>As</u> **LL6sd-004** <u>Cr</u> LL6sd-001, 004	2	Refer to surface water above.

Table F-3. Summary of Sampling at Load Line 6 (continued)

Medium	Historical Sample Type	Historical Screening Criteria Exceedances	Number of SAP Addendum Sample Locations	Rationale for SAP Addendum Field Activities
Groundwater	Grab	As **LL6mw-005** Sb **LL6mw-003**, 004, **007** SVOCs **LL6mw-001**, 002, 003, 004, **005**, **006**	0	No additional groundwater sampling is planned. All monitoring wells were recently or are currently being sampled under the FWGWMP. Four quarters of sampling were completed in October 2008 at monitoring wells LL6mw-001, -002, -003, and -004. Monitoring wells LL6mw-005, -006, and -007 were included in the FWGWMP in January 2009 and four quarters of sampling were completed in October 2009.

Bold indicates locations where concentration also exceeded the CUG (HI=1.0, Target Risk=10^{-5}) for the identified chemical.

Table F-4. Coordinates for Proposed Sampling Locations at Load Line 6

Sample Location ID	Sample Type	Easting	Northing
LL6sb-068	Grab	2353794.3176	553619.6520
LL6sb-069	Grab	2353472.2318	553244.7435
LL6sb-070	Grab	2353153.1686	553368.7487
LL6sb-071	Grab	2353086.3371	553510.8815
LL6sb-072	Grab	2353136.0117	553496.1432
LL6sb-083	Grab	2353057.3031	552598.7757
LL6sd-081	Composite	2353062.0191	554377.0718
LL6sd-082	Composite	2353403.8830	552563.6896
LL6ss-073	Grab	2353059.1691	553917.6172
LL6ss-074	Grab	2353199.6319	553741.1226
LL6ss-075	Grab	2353519.1582	553457.6742
LL6ss-076	Grab	2353384.7593	553102.4939
LL6ss-077	Grab	2353057.3031	552638.2241
LL6ss-078	Grab	2352825.8138	553022.0906
LL6ss-079	Grab	2352776.4197	553419.2960
LL6ss-080	Grab	2352978.2690	553497.1658
LL6sw-081	Grab	2353062.0191	554377.0718
LL6sw-082	Grab	2353403.8830	552563.6896

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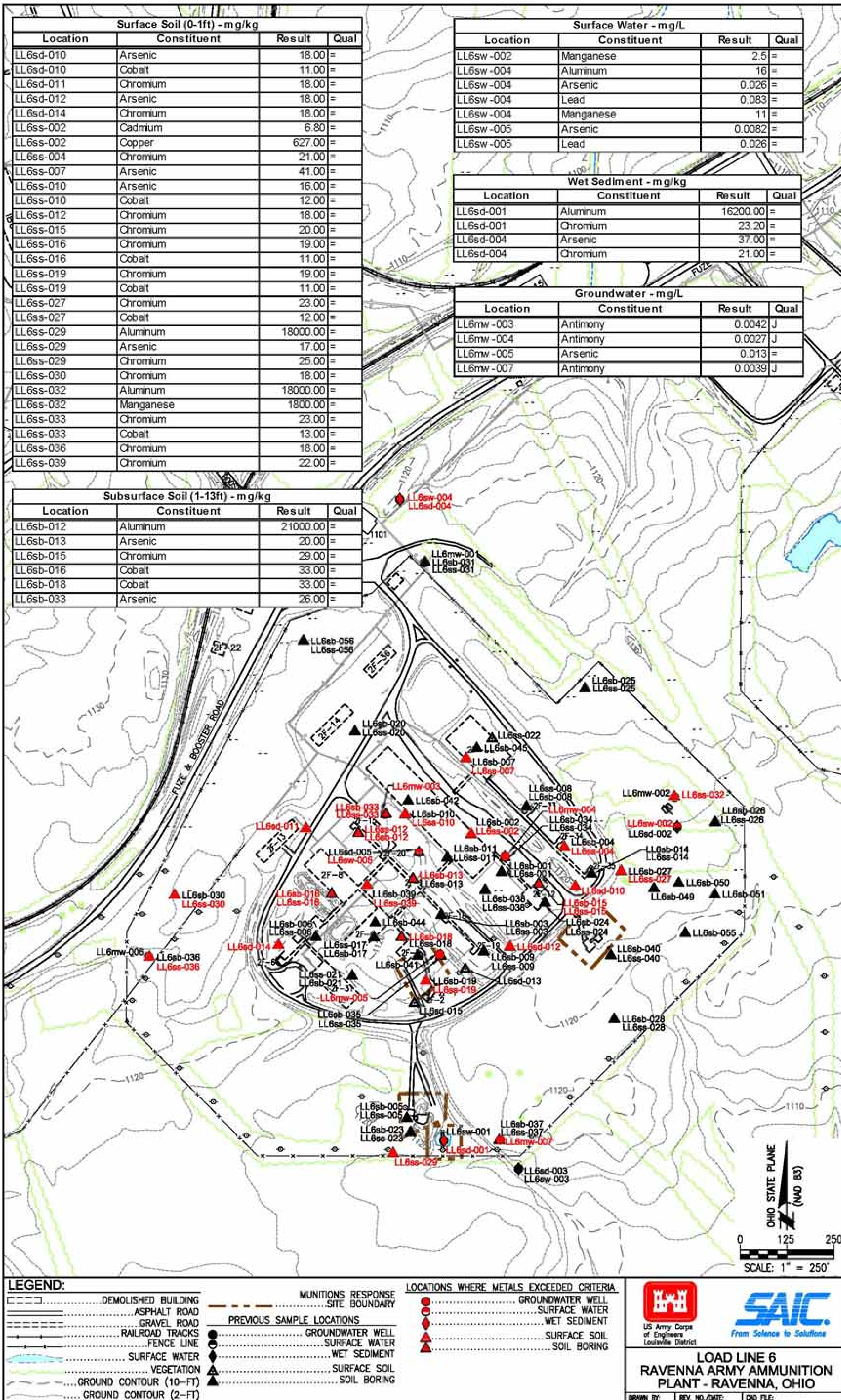


Surface Soil (0-1ft) - mg/kg

Location	Constituent	Result	Qual
LL6sd-010	Arsenic	18.00	=
LL6sd-010	Cobalt	11.00	=
LL6sd-011	Chromium	18.00	=
LL6sd-012	Arsenic	18.00	=
LL6sd-014	Chromium	18.00	=
LL6ss-002	Cadmium	6.80	=
LL6ss-002	Copper	627.00	=
LL6ss-004	Chromium	21.00	=
LL6ss-007	Arsenic	41.00	=
LL6ss-010	Arsenic	16.00	=
LL6ss-010	Cobalt	12.00	=
LL6ss-012	Chromium	18.00	=
LL6ss-015	Chromium	20.00	=
LL6ss-016	Chromium	19.00	=
LL6ss-016	Cobalt	11.00	=
LL6ss-019	Chromium	19.00	=
LL6ss-019	Cobalt	11.00	=
LL6ss-027	Chromium	23.00	=
LL6ss-027	Cobalt	12.00	=
LL6ss-029	Aluminum	18000.00	=
LL6ss-029	Arsenic	17.00	=
LL6ss-029	Chromium	25.00	=
LL6ss-030	Chromium	18.00	=
LL6ss-032	Aluminum	18000.00	=
LL6ss-032	Manganese	1800.00	=
LL6ss-033	Chromium	23.00	=
LL6ss-033	Cobalt	13.00	=
LL6ss-036	Chromium	18.00	=
LL6ss-039	Chromium	22.00	=

Subsurface Soil (1-13ft) - mg/kg

Location	Constituent	Result	Qual
LL6sb-012	Aluminum	21000.00	=
LL6sb-013	Arsenic	20.00	=
LL6sb-015	Chromium	29.00	=
LL6sb-016	Cobalt	33.00	=
LL6sb-018	Cobalt	33.00	=
LL6sb-033	Arsenic	26.00	=

Surface Water - mg/L

Location	Constituent	Result	Qual
LL6sw-002	Manganese	2.5	=
LL6sw-004	Aluminum	16	=
LL6sw-004	Arsenic	0.026	=
LL6sw-004	Lead	0.083	=
LL6sw-004	Manganese	11	=
LL6sw-005	Arsenic	0.0082	=
LL6sw-005	Lead	0.026	=

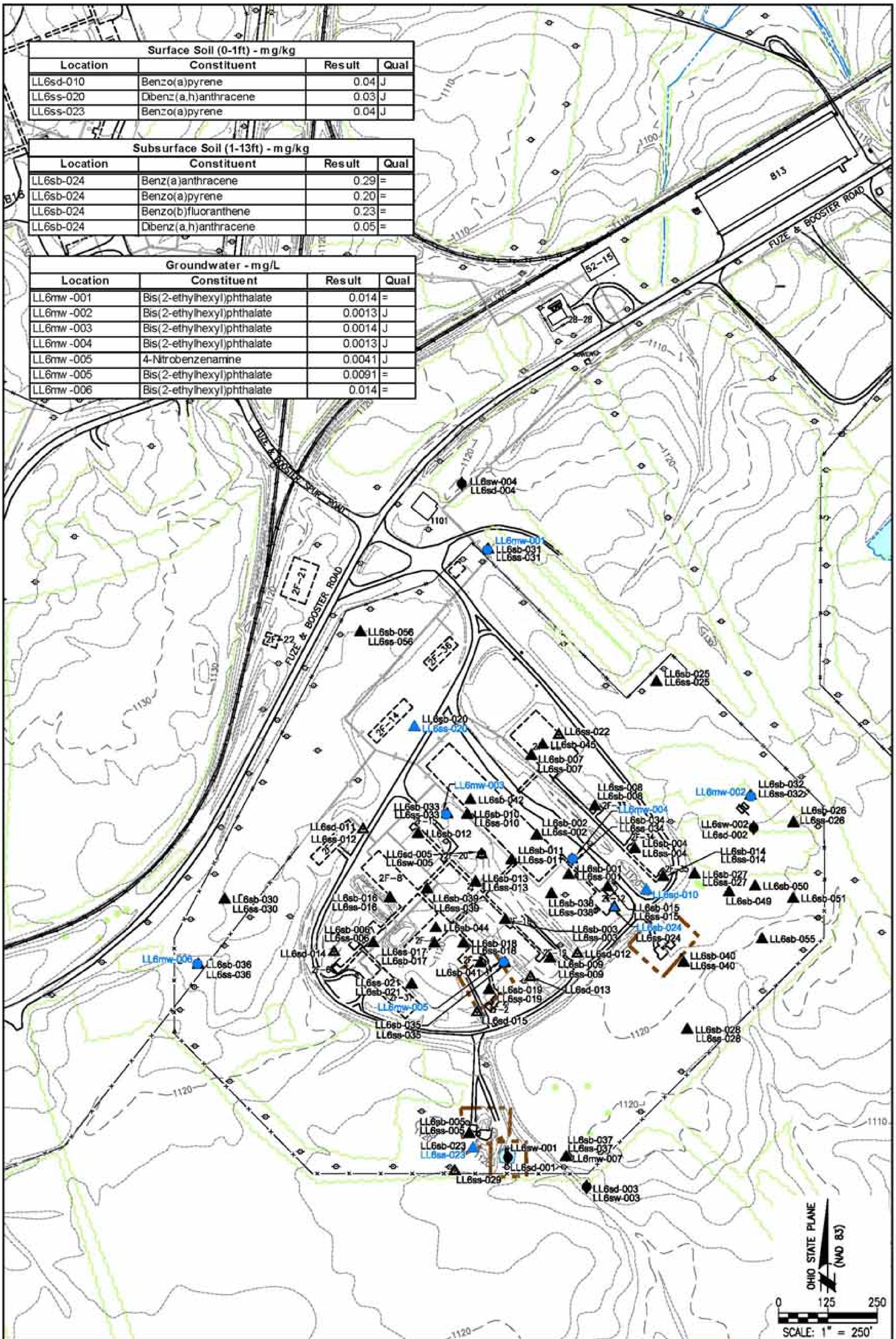
Wet Sediment - mg/kg

Location	Constituent	Result	Qual
LL6sd-001	Aluminum	16200.00	=
LL6sd-001	Chromium	23.20	=
LL6sd-004	Arsenic	37.00	=
LL6sd-004	Chromium	21.00	=

Groundwater - mg/L

Location	Constituent	Result	Qual
LL6mw-003	Antimony	0.0042	J
LL6mw-004	Antimony	0.0027	J
LL6mw-005	Arsenic	0.013	=
LL6mw-007	Antimony	0.0039	J

Figure F-1. Historical Sampling and Metal Exceedance Locations at Load Line 6



Surface Soil (0-1ft) - mg/kg			
Location	Constituent	Result	Qual
LL6sd-010	Benzo(a)pyrene	0.04	J
LL6ss-020	Dibenz(a,h)anthracene	0.03	J
LL6ss-023	Benzo(a)pyrene	0.04	J

Subsurface Soil (1-13ft) - mg/kg			
Location	Constituent	Result	Qual
LL6sb-024	Benz(a)anthracene	0.29	=
LL6sb-024	Benzo(a)pyrene	0.20	=
LL6sb-024	Benzo(b)fluoranthene	0.23	=
LL6sb-024	Dibenz(a,h)anthracene	0.05	=

Groundwater - mg/L			
Location	Constituent	Result	Qual
LL6mw-001	Bis(2-ethylhexyl)phthalate	0.014	=
LL6mw-002	Bis(2-ethylhexyl)phthalate	0.0013	J
LL6mw-003	Bis(2-ethylhexyl)phthalate	0.0014	J
LL6mw-004	Bis(2-ethylhexyl)phthalate	0.0013	J
LL6mw-005	4-Nitrobenzenamine	0.0041	J
LL6mw-005	Bis(2-ethylhexyl)phthalate	0.0091	=
LL6mw-006	Bis(2-ethylhexyl)phthalate	0.014	=

Figure F-2. Historical Sampling and Organic Exceedance Locations at Load Line 6

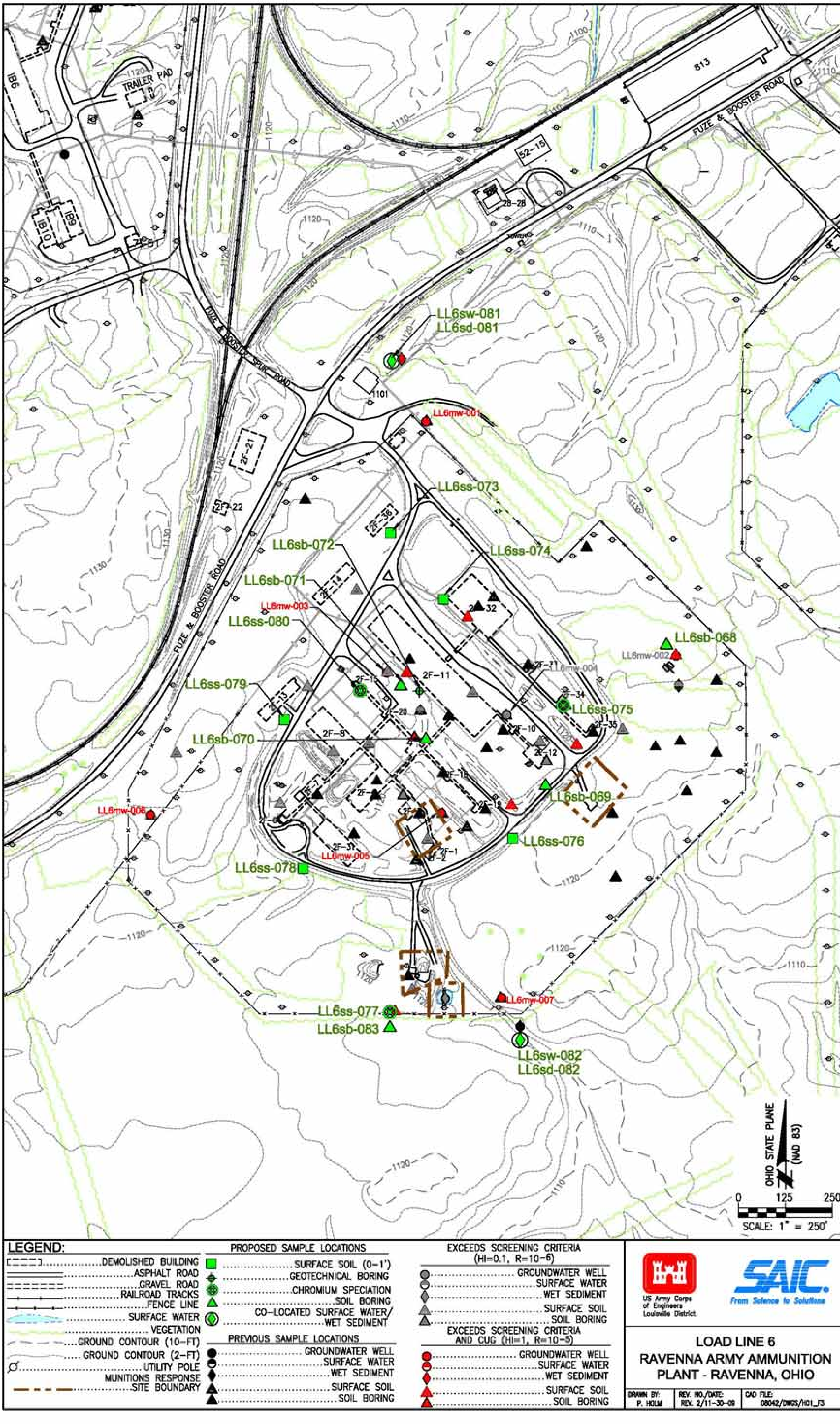


Figure F-3. Historical Exceedances and Proposed Sampling Locations at Load Line 6

APPENDIX G

NACA Test Area (RVAAP-38)

G.0 NACA TEST AREA (RVAAP-38)

G.1 AOC DESCRIPTION

National Advisory Committee on Aeronautics (NACA) Test Area is an approximately 12-acre site formerly used as an aircraft test area to develop crash-worthy fuel tanks and/or high flashpoint aviation fuel (Figure G-1). Some aircraft debris was buried at the AOC after the testing. The AOC currently consists of the former concrete crash strip, the remains of operational building footings, a small concrete-walled well pit, and a former fire suppression water well. Hinkley Creek runs adjacent to the AOC along the west and south boundaries.

G.2 PREVIOUS INVESTIGATIONS

NACA Test Area has been the subject of various investigations performed at RVAAP. Between 1980 and 1992 surface water runoff from NACA Test Area discharging into Hinkley Creek was evaluated as part of the RVAAP Water Quality Surveillance Program (USACE 2001b).

In 1996, the USACHPPM conducted a RRSE. Most constituent detections in soil were below the RRSE risk-based criteria. However, the report concluded that the site was a "Medium" risk because there are no site controls to restrict access to potential receptors (USACE 2001b).

A Phase I Remedial Investigation was conducted at NACA Test Area in 1999. During this investigation 99 discrete surface soil samples, 19 subsurface soil samples, six sediment and surface water samples, and one groundwater sample were collected. An elevated concentration of lead was detected in dry sediment (surface soil) at NTA-101, a former water supply well pit. This location will not be further investigated in this SAP Addendum because it is contained within a concrete-lined pit. The report concluded that the principal concern for human health was inorganics in the surface soil and additional characterization of the site was recommended (USACE 2001b).

Groundwater characterization was conducted at the AOC from October 2004 through May 2005 as part of the Final Characterization of 14 AOCs at RVAAP. During this investigation, 14 groundwater monitoring wells were installed. The results of this investigation concluded that contaminants were detected above background or USEPA Region 9 PRGs in all the groundwater samples. Contaminants detected above screening levels were mostly metals and SVOCs, which were detected in two wells (MKM 2007a).

For this SAP Addendum, historical sample results were compared to the preliminary RVAAP facility-wide screening criteria (Section 3.2.2 of the FSP). Table G-1 lists the chemicals that exceeded screening criteria in each medium, as well as the maximum and minimum concentration detected.

Figures G-1 and G-2 illustrate the type and location of historical samples and identify samples that exceeded screening criteria for metals and organics, respectively.

Table G-1. Chemicals Exceeding Screening Criteria at NACA Test Area

Media	Analyte	Units	Frequency of Detection	Minimum Detect	Maximum Detect	Average Result[a]	Screening Criteria[b]
Surface Soil	Aluminum	mg/kg	108/108	5090	33900	11400	17700
	Antimony	mg/kg	16/97	0.53	2.90	0.67	2.8
	Arsenic	mg/kg	108/108	2.20	23	8.31	15.4
	Barium	mg/kg	108/108	18.00	436	79.10	350
	Cadmium	mg/kg	13/108	0.28	14.50	0.59	6.4
	Chromium	mg/kg	108/108	6.30	54.20	13.00	17.4
	Cobalt	mg/kg	108/108	1.50	38.20	6.94	10.4
	Copper	mg/kg	108/108	2.60	1760	29.30	310
	Lead	mg/kg	108/108	6.90	13200	140	400
	Manganese	mg/kg	108/108	49.00	6240	709	1450
	Benz(a)anthracene	mg/kg	12/108	0.05	36	0.68	0.22
	Benzo(a)pyrene	mg/kg	15/108	0.05	41	0.76	0.022
	Benzo(b)fluoranthene	mg/kg	19/108	0.05	54	0.94	0.22
	Benzo(k)fluoranthene	mg/kg	12/108	0.05	19	0.47	2.2
	Chrysene	mg/kg	18/108	0.04	46.00	0.82	22
	Dibenz(a,h)anthracene	mg/kg	7/108	0.08	5.70	0.29	0.022
	Indeno(1,2,3-cd)pyrene	mg/kg	12/ 108	0.07	24.00	0.54	0.22
Subsurface Soil	Aluminum	mg/kg	25/25	5340	24400	11200	19500
	Cadmium	mg/kg	5/25	0.44	30.00	2.68	6.4
	Copper	mg/kg	25/25	6.90	733.00	63.00	310
	Benz(a)anthracene	mg/kg	1/25	0.46	0.46	0.20	0.22
	Benzo(a)pyrene	mg/kg	1/25	0.70	0.70	0.21	0.022
	Benzo(b)fluoranthene	mg/kg	1/25	1.00	1.00	0.22	0.22
	Dibenz(a,h)anthracene	mg/kg	1/25	0.11	0.11	0.19	0.022
	Indeno(1,2,3-cd)pyrene	mg/kg	1/25	0.52	0.52	0.20	0.22
Wet Sediment	Barium	mg/kg	5/5	59.1	398	145	350
	Chromium	mg/kg	5/5	8.8	18.5	13.7	18.1
	Manganese	mg/kg	5/5	235	9440	2420	1950
Surface Water	Manganese	mg/L	6/6	0.08	12.8	2.45	0.63
Groundwater	Aluminum	mg/L	8/37	0.022	6.8	0.258	1.0
	Antimony	mg/L	8/37	0.00014	0.0076	0.00270	0.000389
	Arsenic	mg/L	18/37	0.00082	0.0180	0.00595	0.0117 (unconsolidated)
	Chromium	mg/L	3/37	0.00360	0.0830	0.00571	0.0073 (unconsolidated)

Table G-1. Chemicals Exceeding Screening Criteria at NACA Test Area (continued)

Media	Analyte	Units	Frequency of Detection	Minimum Detect	Maximum Detect	Average Result[a]	Screening Criteria[b]
Groundwater	Nickel	mg/L	6/37	0.0023	0.062	0.00698	0.021 (unconsolidated)
	Vanadium	mg/L	3/37	0.0013	0.012	0.00557	0.0064
	Benz(a)anthracene	mg/L	1/37	0.00014	0.00014	0.00031	0.0000039
	Benzo(a)pyrene	mg/L	1/37	0.00012	0.00012	0.00034	0.00000023
	Benzo(b)fluoranthene	mg/L	1/37	0.00010	0.00010	0.00034	0.0000023
	Bis(2-ethylhexyl)phthalate	mg/L	17/37	0.0011	0.0061	0.00453	0.0009
	Dibenz(a,h)anthracene	mg/L	1/37	0.00024	0.0002	0.00035	0.00000015
	Indeno(1,2,3-cd) pyrene	mg/L	2/37	0.00009	0.0002	0.00034	0.0000023

-- Not applicable.
[a]Average result equals the sum of the concentrations divided by the number of samples; the average includes non-detects at half the reporting limit and field duplicate samples. This can result in an average less than the range of detected values.
[b]Screening criteria are based on HI=0.1 and Target Risk=10^{-6}.

During previous investigations, surface soil (0 to 1 ft) and subsurface soil (1 to 3 ft and 3 to 5 ft depth intervals) samples have been collected at the AOC. Table G-2 summarizes the historical surface soil (including dry sediment) and subsurface soil sampling conducted at NACA Test Area and indicates whether sample results exceeded screening criteria.

Table G-2. NACA Test Area Historical Soil Sampling Summary

Sample Location	Sample Number	Depth of Sample (ft bgs)	Analysis Performed				
			Metals	Explosives	VOCs	Pesticides/ PCBs	SVOCs
NTA-001	NTAss-001-0001-SO	0.0- 1.0	Cr	--	N	--	N
NTA-002	NTAss-002-0002-SO	0.0- 1.0	N	--	N	--	N
NTA-003	NTAss-003-0003-SO	0.0- 1.0	N	--	N	--	N
NTA-004	NTAss-004-0004-SO	0.0- 1.0	N	N	N	N	N
NTA-005	NTAss-005-0005-SO	0.0- 1.0	**Y**	--	N	--	N
NTA-006	NTAss-006-0006-SO	0.0- 1.0	N	--	N	--	N
NTA-007	NTAss-007-0007-SO	0.0- 1.0	N	--	N	--	N
NTA-008	NTAss-008-0008-SO	0.0- 1.0	N	--	N	--	N
NTA-009	NTAss-009-0009-SO	0.0- 1.0	Cr	--	N	--	N
NTA-010	NTAss-010-0010-SO	0.0- 1.0	N	--	N	--	N
NTA-011	NTAss-011-0011-SO	0.0- 1.0	**Y**	--	N	--	N
NTA-012	NTAss-012-0012-SO	0.0- 1.0	N	--	N	--	N
NTA-013	NTAss-013-0013-SO	0.0- 1.0	N	--	N	--	N
NTA-014	NTAss-014-0014-SO	0.0- 1.0	N	--	N	--	N
NTA-015	NTAss-015-0015-SO	0.0- 1.0	N	--	N	--	N
NTA-016	NTAss-016-0016-SO	0.0- 1.0	**Y**	--	N	--	N
NTA-017	NTAss-017-0017-SO	0.0- 1.0	Cr	--	N	--	N
NTA-018	NTAss-018-0018-SO	0.0- 1.0	Cr	--	N	--	N
NTA-019	NTAss-019-0019-SO	0.0- 1.0	N	--	N	--	N
NTA-020	NTAss-020-0020-SO	0.0- 1.0	N	--	N	--	N
NTA-021	NTAss-021-0021-SO	0.0- 1.0	N	--	N	--	**Y**
NTA-022	NTAss-022-0022-SO	0.0- 1.0	N	--	N	--	N
NTA-023	NTAss-023-0023-SO	0.0- 1.0	N	N	N	N	N
NTA-024	NTAss-024-0024-SO	0.0- 1.0	N	--	N	--	N
NTA-025	NTAss-025-0025-SO	0.0- 1.0	**Y**	--	N	--	**Y**
NTA-026	NTAss-026-0026-SO	0.0- 1.0	N	--	N	--	**Y**
NTA-027	NTAss-027-0027-SO	0.0- 1.0	Cr	--	N	--	N
NTA-028	NTAss-028-0028-SO	0.0- 1.0	**Y**	--	N	--	N
NTA-029	NTAss-029-0029-SO	0.0- 1.0	N	--	N	--	**Y**
NTA-030	NTAss-030-0030-SO	0.0- 1.0	N	N	N	N	N
NTA-031	NTAss-031-0031-SO	0.0- 1.0	N	--	N	--	N
NTA-032	NTAss-032-0032-SO	0.0- 1.0	N	--	N	--	**Y**
	NTAss-032-0139-SO	0.0- 1.0	N	--	N	--	**Y**
NTA-033	NTAss-033-0033-SO	0.0- 1.0	N	--	N	--	N
NTA-034	NTAss-034-0034-SO	0.0- 1.0	**Y**	--	N	--	N
NTA-035	NTAss-035-0035-SO	0.0- 1.0	N	--	N	--	N
NTA-036	NTAss-036-0036-SO	0.0- 1.0	N	--	N	--	N
NTA-037	NTAss-037-0037-SO	0.0- 1.0	N	N	N	N	N
NTA-038	NTAss-038-0038-SO	0.0- 1.0	N	--	N	--	N
NTA-039	NTAss-039-0040-SO	0.0- 1.0	N	--	N	--	N
NTA-040	NTAss-040-0041-SO	0.0- 1.0	N	--	N	--	N

Table G-2. NACA Test Area Historical Soil Sampling Summary (continued)

Sample Location	Sample Number	Depth of Sample (ft bgs)	Analysis Performed				
			Metals	Explosives	VOCs	Pesticides/ PCBs	SVOCs
NTA-041	NTAss-041-0042-SO	0.0- 1.0	N	--	N	--	N
NTA-042	NTAss-042-0043-SO	0.0- 1.0	N	--	N	--	N
NTA-043	NTAss-043-0044-SO	0.0- 1.0	N	--	N	--	N
	NTAss-043-0140-SO	0.0- 1.0	N	--	N	--	N
NTA-044	NTAss-044-0045-SO	0.0- 1.0	N	--	N	--	N
NTA-045	NTAss-045-0046-SO	0.0- 1.0	N	--	N	--	N
NTA-046	NTAss-046-0047-SO	0.0- 1.0	N	--	N	--	N
NTA-047	NTAss-047-0048-SO	0.0- 1.0	N	--	N	--	N
NTA-048	NTAss-048-0049-SO	0.0- 1.0	N	--	N	--	N
NTA-049	NTAss-049-0050-SO	0.0- 1.0	N	--	N	--	N
NTA-050	NTAss-050-0051-SO	0.0- 1.0	N	--	N	--	N
NTA-051	NTAss-051-0052-SO	0.0- 1.0	N	N	N	N	N
NTA-052	NTAss-052-0053-SO	0.0- 1.0	N	--	N	--	N
NTA-053	NTAss-053-0054-SO	0.0- 1.0	**Y**	--	N	--	N
NTA-054	NTAss-054-0055-SO	0.0- 1.0	**Y**	--	N	--	N
NTA-055	NTAss-055-0056-SO	0.0- 1.0	N	--	N	--	N
	NTAss-055-0141-SO	0.0- 1.0	N	--	N	--	N
NTA-056	NTAss-056-0057-SO	0.0- 1.0	Cr	--	N	--	N
NTA-057	NTAss-057-0058-SO	0.0- 1.0	N	N	N	N	N
NTA-058	NTAss-058-0060-SO	0.0- 1.0	N	--	N	--	N
	NTAss-058-0137-SO	0.0- 1.0	N	N	N	N	N
NTA-059	NTAss-059-0061-SO	0.0- 1.0	N	--	N	--	N
NTA-060	NTAss-060-0062-SO	0.0- 1.0	N	--	N	--	N
NTA-061	NTAss-061-0063-SO	0.0- 1.0	N	--	N	--	N
NTA-062	NTAss-062-0064-SO	0.0- 1.0	N	N	N	N	N
NTA-063	NTAss-063-0065-SO	0.0- 1.0	N	--	N	--	N
NTA-064	NTAss-064-0066-SO	0.0- 1.0	**Y**	--	N	--	N
NTA-065	NTAss-065-0067-SO	0.0- 1.0	N	--	N	--	N
	NTAso-065-0068-SO	1.0- 3.0	N	--	N	--	N
NTA-066	NTAss-066-0069-SO	0.0- 1.0	Cr	--	N	--	N
	NTAso-066-0070-SO	1.0- 3.0	N	--	N	--	N
NTA-067	NTAss-067-0071-SO	0.0- 1.0	**Y**	N	N	N	N
	NTAso-067-0072-SO	1.0- 3.0	N	N	N	N	N
NTA-068	NTAss-068-0073-SO	0.0- 1.0	N	--	N	--	N
	NTAso-068-0074-SO	1.0- 3.0	N	--	N	--	N
NTA-069	NTAss-069-0075-SO	0.0- 1.0	**Y**	--	N	--	N
	NTAss-069-0142-SO	0.0- 1.0	N	--	N	--	N
	NTAso-069-0076-SO	1.0- 3.0	N	--	N	--	N
	NTAss-069-0143-SO	1.0- 3.0	N	--	N	--	N

Table G-2. NACA Test Area Historical Soil Sampling Summary (continued)

Sample Location	Sample Number	Depth of Sample (ft bgs)	Analysis Performed				
			Metals	Explosives	VOCs	Pesticides/ PCBs	SVOCs
NTA-070	NTAss-070-0078-SO	0.0- 1.0	**Y**	--	N	--	N
	NTAso-070-0079-SO	1.0- 3.0	N	--	N	--	N
	NTAss-070-0120-SO	3.0- 5.0	N	--	N	--	N
	NTAss-070-0147-SO	3.0- 5.0	N	--	N	--	N
NTA-071	NTAss-071-0080-SO	0.0- 1.0	N	--	N	--	**Y**
	NTAso-071-0081-SO	1.0- 3.0	N	--	N	--	N
NTA-072	NTAss-072-0082-SO	0.0- 1.0	N	--	N	--	N
	NTAso-072-0083-SO	1.0- 3.0	N	--	N	--	N
NTA-073	NTAss-073-0084-SO	0.0- 1.0	N	N	N	N	N
	NTAso-073-0085-SO	1.0- 3.0	**Y**	N	N	N	N
	NTAss-073-0138-SO	1.0- 3.0	**Y**	N	N	N	N
	NTAso-073-0121-SO	3.0- 5.0	N	--	N	--	N
	NTAss-073-0146-SO	3.0- 5.0	N	--	N	--	N
NTA-074	NTAss-074-0086-SO	0.0- 1.0	N	--	N	--	N
	NTAso-074-0087-SO	1.0- 3.0	N	--	N	--	N
NTA-075	NTAss-075-0088-SO	0.0- 1.0	N	--	N	--	N
	NTAso-075-0089-SO	1.0- 3.0	N	--	N	--	N
NTA-076	NTAss-076-0090-SO	0.0- 1.0	N	--	N	--	N
	NTAso-076-0091-SO	1.0- 3.0	N	--	N	--	N
NTA-077	NTAss-077-0092-SO	0.0- 1.0	N	--	N	--	N
	NTAso-077-0093-SO	1.0- 3.0	N	--	N	--	N
NTA-078	NTAss-078-0094-SO	0.0- 1.0	**Y**	--	N	--	N
NTA-079	NTAss-079-0095-SO	0.0- 1.0	N	--	N	--	N
	NTAso-079-0096-SO	1.0- 3.0	N	--	N	--	N
NTA-080	NTAss-080-0097-SO	0.0- 1.0	N	--	N	--	N
NTA-081	NTAss-081-0098-SO	0.0- 1.0	N	--	N	--	N
NTA-082	NTAss-082-0099-SO	0.0- 1.0	N	--	N	--	N
NTA-083	NTAss-083-0100-SO	0.0- 1.0	N	--	N	--	**Y**
	NTAso-083-0101-SO	1.0- 3.0	N	--	N	--	**Y**
NTA-084	NTAss-084-0102-SO	0.0- 1.0	**Y**	--	N	--	**Y**
	NTAso-084-0103-SO	1.0- 3.0	N	--	N	--	N
NTA-085	NTAss-085-0104-SO	0.0- 1.0	N	--	N	--	N
	NTAso-085-0105-SO	1.0- 3.0	N	--	N	--	N
NTA-086	NTAss-086-0106-SO	0.0- 1.0	Cr	--	N	--	N
NTA-087	NTAss-087-0107-SO	0.0- 1.0	N	--	N	--	N
NTA-088	NTAss-088-0108-SO	0.0- 1.0	**Y**	--	N	N	**Y**
NTA-089	NTAss-089-0109-SO	0.0- 1.0	N	--	N	--	**Y**
NTA-090	NTAss-090-0110-SO	0.0- 1.0	**Y**	N	N	--	**Y**
NTA-091	NTAss-091-0111-SO	0.0- 1.0	**Y**	--	N	--	**Y**
	NTAss-091-0144-SO	0.0- 1.0	**Y**	--	N	--	**Y**
NTA-092	NTAss-092-0112-SO	0.0- 1.0	**Y**	--	N	--	**Y**

Table G-2. NACA Test Area Historical Soil Sampling Summary (continued)

Sample Location	Sample Number	Depth of Sample (ft bgs)	Analysis Performed				
			Metals	Explosives	VOCs	Pesticides/ PCBs	SVOCs
NTA-093	NTAss-093-0113-SO	0.0- 1.0	N	--	N	--	N
NTA-094	NTAss-094-0114-SO	0.0- 1.0	**Y**	--	N	--	N
NTA-095	NTAss-095-0115-SO	0.0- 1.0	N	--	N	--	**Y**
	NTAso-095-0116-SO	1.0- 3.0	N	--	N	--	N
NTA-096	NTAss-096-0117-SO	0.0- 1.0	**Y**	--	N	N	N
NTA-097	NTAss-097-0118-SO	0.0- 1.0	**Y**	N	N	--	N
NTA-098	NTAss-098-0119-SO	0.0- 1.0	**Y**	--	N	--	N
	NTAss-098-0145-SO	0.0- 1.0	N	--	N	--	N
NTA-100	NTAss-100-0122-SO	0.0- 1.0	N	--	N	--	N
	NTAso-100-0123-SO	1.0- 3.0	N	--	N	--	N
NTA-101[a]	NTAsd-101-0124-SD	0.0- 0.5	**Y**	N	N	N	N
NTA-102	NTAsd-102-0125-SD	0.0- 0.5	N	N	N	N	N

NTA = NACA Test Area
Y = Analyte(s) greater than screening criteria.
Cr = Only chromium greater than screening criterion.
N = Non-detect or less than screening criteria.
-- = Analysis not performed.
[a]The sample for location NTA-101 was collected at the bottom of the concrete pit of the former water supply well.
Only PAHs were detected above screening criteria in the SVOC analysis.

G.3 PROPOSED SAP ADDENDUM CHARACTERIZATION ACTIVITIES

The objective of this SAP Addendum for NACA Test Area is to define the nature and extent of chemicals at concentrations greater than the screening criteria. To accomplish this further sampling and analysis of metals and PAHs in soil, and metals in wet sediment and surface water will be conducted. In addition, current concentrations of chemicals in groundwater will be evaluated.

Table G-3 summarizes the chemicals that exceeded screening criteria and CUGs for each medium, the types and quantities of samples to be collected during the implementation of this SAP Addendum, and the rationale behind the proposed samples. All historical soil and wet sediment sampling at this AOC has been conducted using discrete sample methods; therefore, this addendum proposes discrete samples so that consistent sample types can be used in nature and extent evaluation and future risk management decisions. The general approach for investigation activities is presented in Section 3.2 of the FSP. Figure G-3 illustrates the locations of the samples to be collected as well as previous screening criteria and CUG exceedances.

Table G-4 presents the coordinates for the proposed sampling locations for this AOC. The locations may be altered during implementation of this SAP Addendum for a variety of reasons (e.g., soil boring refusal and MEC avoidance). The final coordinates of the sample locations (including elevations) will be presented in the RI Report.

Table G-3. Summary of Sampling at NACA Test Area

Medium	Historical Sample Type	Historical Screening Criteria Exceedances	Number of SAP Addendum Sample Locations	Rationale for SAP Addendum Field Activities
Surface soil	Discrete	Al NTA-011, 016, 025, 070, 090, 091, 092, 096 Sb NTA-070 As **NTA-034**, **064**, **067**, **098**, Ba NTA-092,101 Cd NTA-070 Co NTA-005, 028, 034, 053, 054, 067, 078, 084, 094, 097 Cu NTA-070 Pb **NTA-101** Mn **NTA-011**, **016**, **025**, **034**, **067**, **069**, **084**, **088**, **090**, **091**, **092** SVOCs NTA-021, 025**, 026**, 029, **032**, 071, **083**, 084, **088**, **089**, **090**, 091, 092, 095	12	Most sample locations with chemicals greater than screening criteria are already laterally bound by other samples. In general, additional surface soil samples are planned to bound CUG exceedances and/or exceedances of multiple screening criteria where large gaps exist between prior sampling locations and points where chemicals were less than screening criteria. Samples will be analyzed for TAL metals, explosives, and PAHs; 10% RVAAP full suite.
	Chromium speciation	Cr NTA-001, 009, 017, 018, 027, 056, 066, 067, 070, 086, 094, 096, 097, 101	3	Discrete surface soil samples will be collected to perform chromium speciation analysis at existing locations: NTA-070 (54.2 mg/kg – maximum previous concentration of total chromium), NTA-086 (21.9 mg/kg) and NTA-090 (13.5 mg/kg). Refer to Section 4.1.3 of the FSP for a discussion about chromium speciation sampling.

Table G-3. Summary of Sampling at NACA Test Area (continued)

Medium	Historical Sample Type	Historical Screening Criteria Exceedances	Number of SAP Addendum Sample Locations	Rationale for SAP Addendum Field Activities
Subsurface soil	Discrete	<u>Al</u> NTA-073 <u>Cd</u> NTA-073 <u>Cu</u> NTA-073 <u>SVOCs</u> **NTA-083**	8	Eight boring locations are placed to further define the vertical extent of contamination. If a previous surface soil result exceeded a CUG and/or exceeded multiple screening criteria, and either no subsurface data was collected or the deepest interval exceeded a CUG (e.g., NTA-011, NTA-016, NTA-064, NTA-083 and NTA-098), a boring was placed at or near the sample location to define the vertical extent. In the grass boulevard (a former trolley track area) between the two paved runway strips areas, multiple surface soil sample locations in close proximity exceeded screening criteria and CUGs. These sample locations were evaluated as a group (NTA-088, NTA-089, NTA- 090, NTA-091, NTA-092, NTA-025, NTA-026, NTA-034 and NTA-096). The vertical extent is being defined by the placement of three borings within the boulevard. NTA-034 is also considered characteristic of the grass boulevard area since it is nearby and down gradient. Surface soil samples were also placed along the southern side of the crash strip in an adjacent ditch to assess any run off from the vicinity of the crash strip. Three exceedances locations NTA-101, NTA-032, and NTA-083 have been adequately characterized during previous investigations. NTA-101 is a well pit and contaminants are confined within the concrete pit; and adjacent soil sample NTA-035 had no exceedances. NTA-038, a former well point, had no results greater than screening criteria in soils in the 0-1 ft interval. Sample results from NTA-032 exceeded a CUG at the 0-1 ft interval; downgradient surface soil exceeded one screening criterion and associated subsurface soils indicated no screening criteria exceedances. Further evaluation of NTA-073 is not planned, surface soils at the

Table G-3. Summary of Sampling at NACA Test Area (continued)

Medium	Historical Sample Type	Historical Screening Criteria Exceedances	Number of SAP Addendum Sample Locations	Rationale for SAP Addendum Field Activities
				location did not exceed screening criteria and adjacent surface and subsurface samples do not exceed screening criteria. Three former surface soil sample locations (NTA-084, NTA-067, NTA-069, and NTA-070) with results greater than CUGs are bound by 1-3 ft interval results that did not exceed the CUGs. Because the exceedances are vertically bound, no further subsurface investigation is required at these locations (additional surface soil samples were placed to define the lateral extent). Samples will be analyzed for TAL metals, explosives, and PAHs, with 10% RVAAP full suite.
	Geotechnical	N/A	0	Previous geotechnical samples collected are adequate for nature and extent assessment. No additional samples planned.
Surface water	Discrete	Mn NTA-104, **105**	3	Three surface water and co-located composite wet sediment samples will be collected to characterize current conditions and provide data for the ecological WOE evaluation. 1. Lower end of wetland near sample location NTA-011. 2. At culvert outfall near previous location NTA-103. 3. Downstream of AOC at point prior to confluence with Hinkley Creek (depicted on Figure 3-1). Facility-wide sample collected in 2003 upstream of this confluence point (sample H3) indicated no CUG exceedances in one wet sediment sample and two rounds of surface water sampling. No further sampling downstream is necessary at this time. Another facility-wide sample collected past this confluence and immediately adjacent to the facility southern boundary indicated no exceedances of CUGs in surface water or wet sediment. All samples will be analyzed for the RVAAP full suite of parameters.

Table G-3. Summary of Sampling at NACA Test Area (continued)

Medium	Historical Sample Type	Historical Screening Criteria Exceedances	Number of SAP Addendum Sample Locations	Rationale for SAP Addendum Field Activities
Wet sediment	Discrete	Ba NTA-104 Cr NTA-104 Mn **NTA-104**	3	Refer to surface water above.
Groundwater	Discrete	Al NTAmw-110, 113 Sb NTAmw-107, 108, 111, **112**, 113, 117 As **NTA-038 (piezometer)**, **NTAmw-107**, **110**, **112**, **113** Cr NTAmw-113, 118 Ni NTAmw-118 V NTAmw-113 SVOCs NTAmw-107, 108, 109, 110, 111, 112, **113**, 115, 116, **117**, **118**	0	No additional groundwater sampling is proposed. All 12 groundwater wells at NTA (NTAmw-107 through -118) are currently being sampled under the FWGWMP. Four quarters of sampling were completed October 2008. No additional groundwater sampling is required for completion of the FS.

Bold indicates locations where concentration also exceeded the CUG (HI=1.0, Target Risk= 10^{-5}) for the identified chemical.

Table G-4. Coordinates for Proposed Sampling Locations at NACA Test Area

Sample Location ID	Sample Type	Easting	Northing
NTAsb-120	Grab	2345594.0016	551802.7678
NTAsb-121	Grab	2345603.1133	551600.0416
NTAsb-122	Grab	2346393.5601	551604.5973
NTAsb-123	Grab	2347190.8409	551609.1529
NTAsb-124	Grab	2347291.1475	551781.2462
NTAsb-125	Grab	2347764.8829	551807.3234
NTAsb-126	Grab	2347785.3844	551226.4787
NTAsb-127	Grab	2347108.8348	551073.8647
NTAsd-143	Composite	2347002.8765	551500.5461
NTAsd-144	Composite	2347306.7511	551830.4800
NTAss-128	Grab	2345552.9987	551898.4363
NTAss-129	Grab	2345721.5666	551873.3802
NTAss-130	Grab	2345946.1118	551860.9293
NTAss-131	Grab	2345896.9682	551711.6548
NTAss-132	Grab	2345587.1678	551563.5964
NTAss-133	Grab	2345963.1504	551570.3990
NTAss-134	Grab	2346204.4909	551602.3194
NTAss-135	Grab	2346489.2340	551807.3234
NTAss-136	Grab	2346621.9071	551575.7782
NTAss-137	Grab	2347024.8733	551052.4883
NTAss-138	Grab	2347138.4482	550970.9247
NTAss-139	Grab	2347297.1937	551072.0999
NTAss-140	Grab	2348229.5839	551841.4908
NTAss-141	Grab	2348456.4775	551919.2973
NTAss-142	Grab	2348305.7456	552098.8067
NTAsw-143	Grab	2347002.8765	551500.5461
NTAsw-144	Grab	2347306.7511	551830.4800

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Surface Soil (0-1ft) - mg/kg			
Location	Constituent	Result	Qual
NTA-001	Chromium	17.60	=
NTA-005	Cobalt	16.70	=
NTA-009	Chromium	18.30	=
NTA-011	Aluminum	20900.00	=
NTA-011	Manganese	2280.00	=
NTA-016	Aluminum	19200.00	=
NTA-016	Manganese	2480.00	=
NTA-017	Chromium	17.50	=
NTA-018	Chromium	20.70	=
NTA-025	Aluminum	25400.00	=
NTA-025	Manganese	2850.00	=
NTA-027	Chromium	17.80	=
NTA-028	Cobalt	14.30	J
NTA-034	Arsenic	17.40	=
NTA-034	Cobalt	38.20	=
NTA-034	Manganese	4500.00	=
NTA-053	Cobalt	12.70	=
NTA-054	Cobalt	10.50	=
NTA-056	Chromium	17.70	=
NTA-064	Arsenic	19.00	=
NTA-066	Chromium	22.30	J
NTA-067	Arsenic	23.00	=
NTA-067	Chromium	23.50	J
NTA-067	Cobalt	10.60	=
NTA-067	Manganese	2190.00	=
NTA-069	Manganese	1500.00	J
NTA-070	Aluminum	31200.00	=
NTA-070	Antimony	2.90	=
NTA-070	Cadmium	14.50	=
NTA-070	Chromium	54.20	J
NTA-070	Copper	1760.00	J
NTA-078	Cobalt	12.00	=
NTA-084	Cobalt	27.50	=
NTA-084	Manganese	6240.00	J
NTA-086	Chromium	21.90	=
NTA-088	Manganese	1570.00	J
NTA-090	Aluminum	22800.00	J
NTA-090	Manganese	3410.00	J
NTA-091	Aluminum	26800.00	J
NTA-091	Manganese	3930.00	J
NTA-092	Aluminum	33900.00	J
NTA-092	Barium	359.00	J
NTA-092	Manganese	6080.00	J
NTA-094	Chromium	17.90	=
NTA-094	Cobalt	10.80	=
NTA-096	Aluminum	22500.00	=
NTA-096	Chromium	25.20	J
NTA-097	Chromium	22.40	=
NTA-097	Cobalt	11.60	=
NTA-098	Arsenic	18.30	=
NTA-101	Barium	436.00	=
NTA-101	Chromium	24.60	=
NTA-101	Lead	13200.00	=

Subsurface Soil (1-13ft) - mg/kg			
Location	Constituent	Result	Qual
NTA-073	Aluminum	24400.00	=
NTA-073	Cadmium	30.00	=
NTA-073	Copper	733.00	J

Wet Sediment - mg/kg			
Location	Constituent	Result	Qual
NTA-104	Barium	398.00	J
NTA-104	Chromium	18.50	J
NTA-104	Manganese	9440.00	=

Surface Water - mg/L			
Location	Constituent	Result	Qual
NTA-104	Manganese	0.79	=
NTA-105	Manganese	12.8	=

Groundwater - mg/L			
Location	Constituent	Result	Qual
NTA-038	Arsenic	0.017	=
NTAmw-107	Antimony	0.0025	=
NTAmw-107	Arsenic	0.0132	
NTAmw-108	Antimony	0.0032	=
NTAmw-110	Aluminum	1.1	
NTAmw-110	Arsenic	0.0139	
NTAmw-111	Antimony	0.0031	=
NTAmw-112	Antimony	0.0076	=
NTAmw-112	Arsenic	0.0163	J
NTAmw-113	Aluminum	6.8	=
NTAmw-113	Antimony	0.0036	=
NTAmw-113	Arsenic	0.018	=
NTAmw-113	Chromium	0.012	=
NTAmw-113	Vanadium	0.012	=
NTAmw-117	Antimony	0.0049	=
NTAmw-118	Chromium	0.083	=
NTAmw-118	Nickel	0.062	=

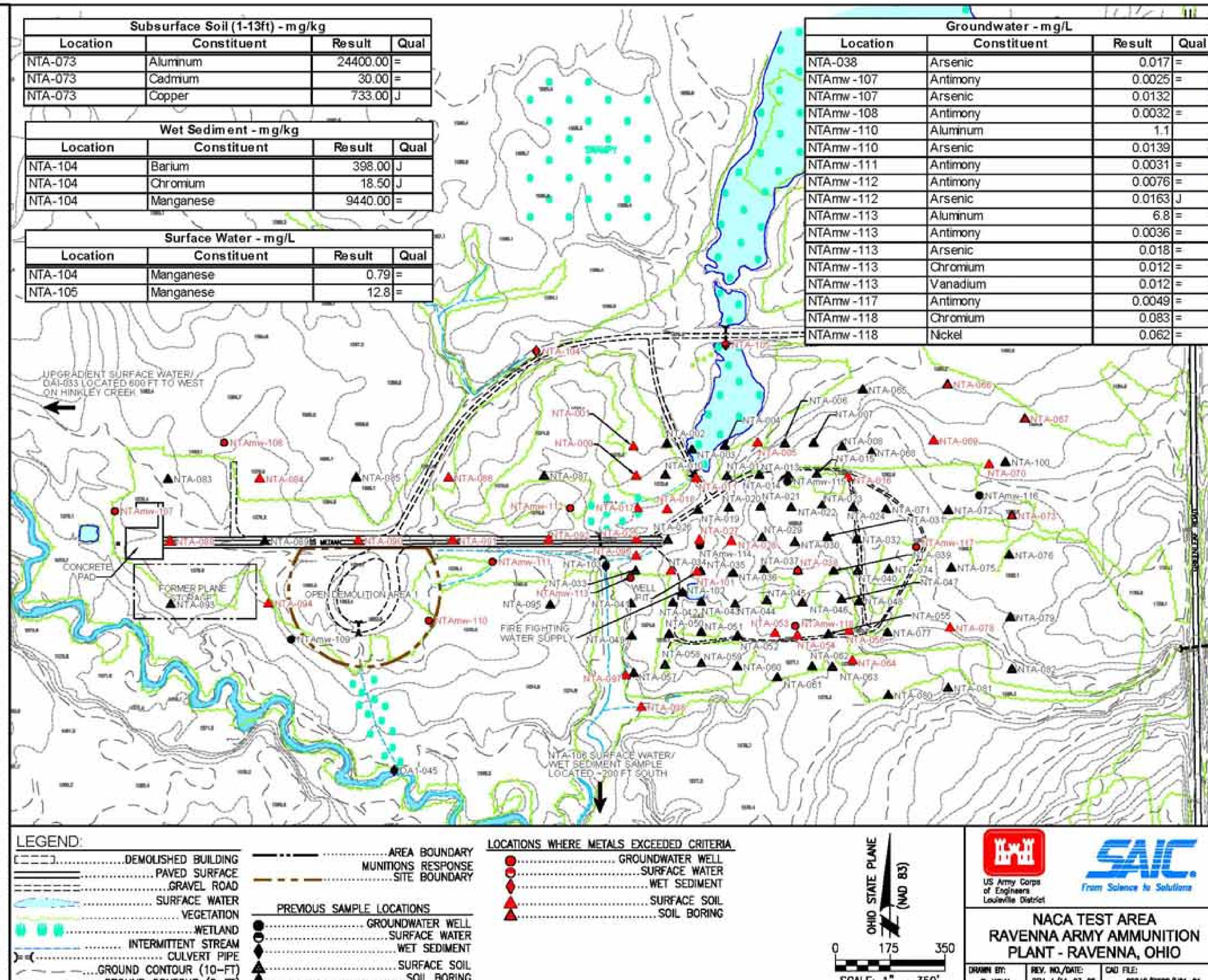

Figure G-1. Historical Sampling and Metal Exceedance Locations at NACA Test Area

Surface Soil (0-1ft) - mg/kg			
Location	Constituent	Result	Qual
NTA-021	Dibenz(a,h)anthracene	0.14	J
NTA-025	Benzo(a)pyrene	0.08	J
NTA-026	Benz(a)anthracene	1.50	=
NTA-026	Benzo(a)pyrene	1.90	=
NTA-026	Benzo(b)fluoranthene	3.20	=
NTA-026	Dibenz(a,h)anthracene	0.35	J
NTA-026	Indeno(1,2,3-cd)pyrene	1.20	=
NTA-029	Benzo(a)pyrene	0.06	J
NTA-032	Benz(a)anthracene	0.46	=
NTA-032	Benzo(a)pyrene	0.43	=
NTA-032	Benzo(b)fluoranthene	0.61	=
NTA-032	Dibenz(a,h)anthracene	0.08	J
NTA-032	Indeno(1,2,3-cd)pyrene	0.34	J
NTA-071	Benzo(a)pyrene	0.18	J
NTA-083	Benz(a)anthracene	2.40	J
NTA-083	Benzo(a)pyrene	3.50	J
NTA-083	Benzo(b)fluoranthene	4.70	=
NTA-083	Dibenz(a,h)anthracene	0.65	J
NTA-083	Indeno(1,2,3-cd)pyrene	2.70	J
NTA-084	Benzo(a)pyrene	0.10	J
NTA-088	Benz(a)anthracene	36.00	=
NTA-088	Benzo(a)pyrene	41.00	=
NTA-088	Benzo(b)fluoranthene	54.00	=
NTA-088	Benzo(k)fluoranthene	19.00	=
NTA-088	Chrysene	46.00	=
NTA-088	Dibenz(a,h)anthracene	5.70	J
NTA-088	Indeno(1,2,3-cd)pyrene	24.00	=
NTA-089	Benz(a)anthracene	3.80	=
NTA-089	Benzo(a)pyrene	5.10	=
NTA-089	Benzo(b)fluoranthene	6.80	=
NTA-089	Benzo(k)fluoranthene	2.50	=
NTA-089	Dibenz(a,h)anthracene	0.67	J
NTA-089	Indeno(1,2,3-cd)pyrene	3.20	=
NTA-090	Benz(a)anthracene	6.60	=
NTA-090	Benzo(a)pyrene	7.60	=
NTA-090	Benzo(b)fluoranthene	10.00	=
NTA-090	Benzo(k)fluoranthene	3.40	=
NTA-090	Dibenz(a,h)anthracene	0.93	J
NTA-090	Indeno(1,2,3-cd)pyrene	4.20	=
NTA-091	Benzo(a)pyrene	0.08	J
NTA-092	Benzo(a)pyrene	0.05	J
NTA-095	Benzo(a)pyrene	0.05	J

Subsurface Soil (1-13ft) - mg/kg			
Location	Constituent	Result	Qual
NTA-083	Benz(a)anthracene	0.46	=
NTA-083	Benzo(a)pyrene	0.70	=
NTA-083	Benzo(b)fluoranthene	1.00	=
NTA-083	Dibenz(a,h)anthracene	0.11	J
NTA-083	Indeno(1,2,3-cd)pyrene	0.52	=

Groundwater - mg/L			
Location	Constituent	Result	Qual
NTAmw-107	Bis(2-ethylhexyl)phthalate	0.0029	J
NTAmw-108	Bis(2-ethylhexyl)phthalate	0.003	J
NTAmw-109	Bis(2-ethylhexyl)phthalate	0.0019	J
NTAmw-110	Bis(2-ethylhexyl)phthalate	0.0024	J
NTAmw-111	Bis(2-ethylhexyl)phthalate	0.0013	J
NTAmw-112	Bis(2-ethylhexyl)phthalate	0.0031	J
NTAmw-113	Benz(a)anthracene	0.00014	J
NTAmw-113	Benzo(a)pyrene	0.00012	J
NTAmw-113	Benzo(b)fluoranthene	0.0001	J
NTAmw-113	Bis(2-ethylhexyl)phthalate	0.0076	J
NTAmw-113	Indeno(1,2,3-cd)pyrene	0.00009	J
NTAmw-115	Bis(2-ethylhexyl)phthalate	0.0018	J
NTAmw-116	Bis(2-ethylhexyl)phthalate	0.0061	J
NTAmw-116	Dibenz(a,h)anthracene	0.00024	J
NTAmw-116	Indeno(1,2,3-cd)pyrene	0.00021	J
NTAmw-117	Bis(2-ethylhexyl)phthalate	0.0013	J
NTAmw-118	Bis(2-ethylhexyl)phthalate	0.0027	J

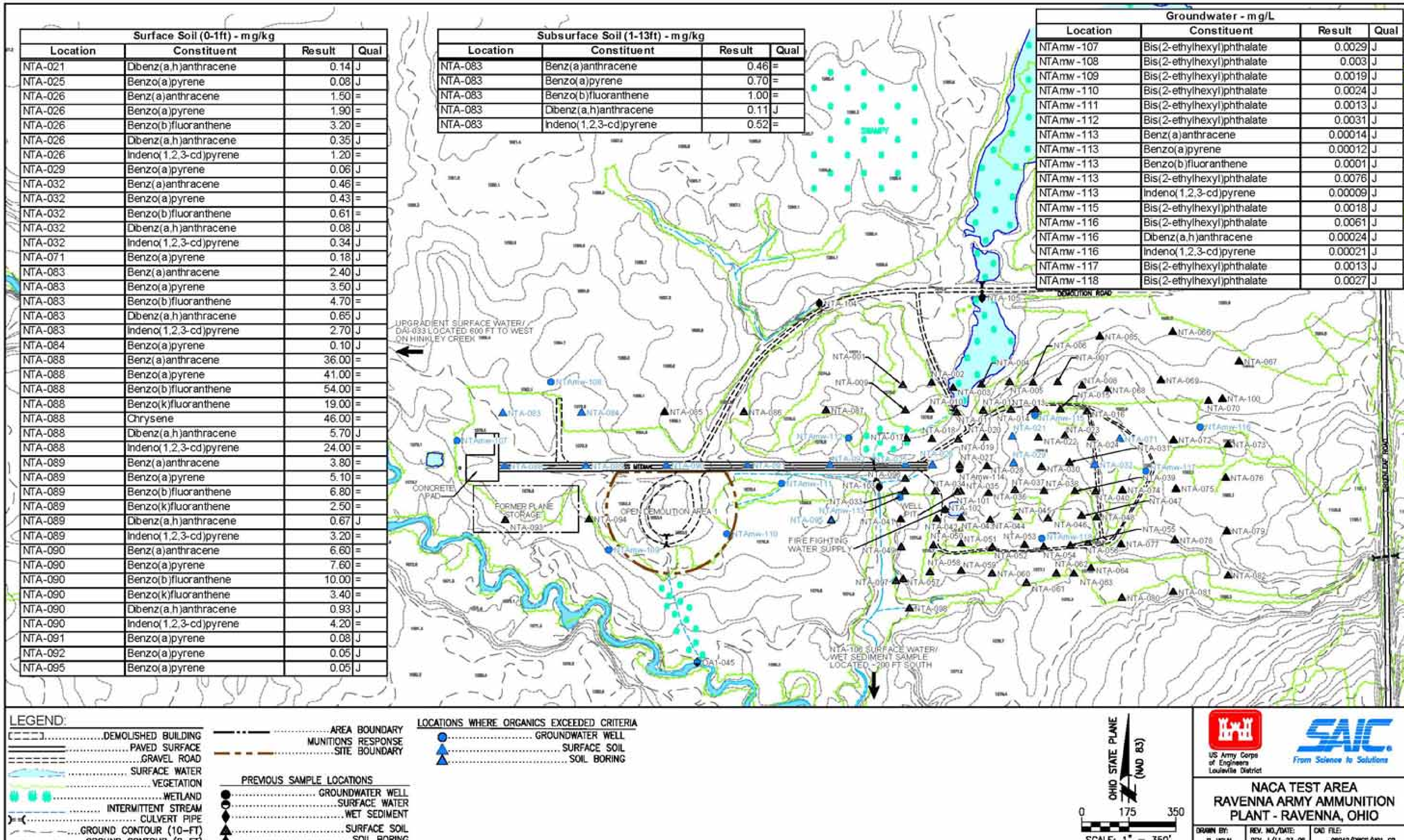

Figure G-2. Historical Sampling and Organic Exceedance Locations at NACA Test Area

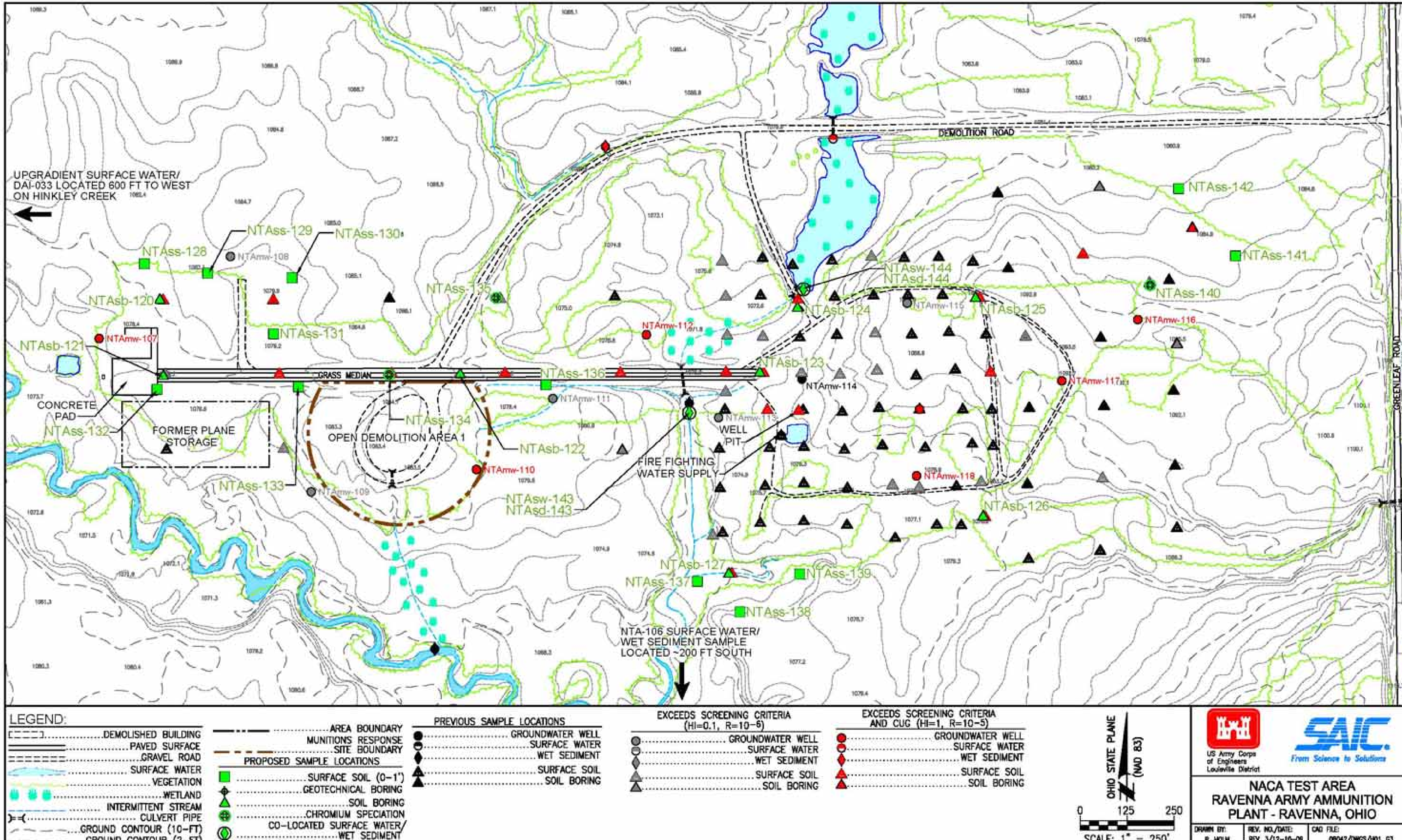

Figure G-3. Historical and Proposed Sampling Locations at NACA Test Area

APPENDIX H

Load Line 5 (RVAAP-39)

H.0 LOAD LINE 5 (RVAAP-39)

H.1 AOC DESCRIPTION

Load Line 5 is a 39-acre AOC that consisted of 18 process buildings (Figure H-1). The load line operated as a finished product assembly line from 1941 to 1945 to produce fuzes for artillery projectiles. Operations were discontinued at the end of World War II and process equipment was removed in 1945. Load Line 5 has been inactive for more than 50 years and is overgrown with vegetation consisting of young trees and scrub vegetation. The buildings, including slabs and foundations, have since been removed.

H.2 PREVIOUS INVESTIGATIONS

Since 1978, Load Line 5 has been the subject of various investigations and assessments. The 1978 Installation Assessment conducted by USATHAMA concluded that Load Line 5 was contaminated with explosive waste. In the late 1980s, as part of RCRA Facility Assessment, the USEPA conducted a Preliminary Review and Visual Site Inspection. Details of this investigation are unknown (MKM 2007a).

Load Line 5 was part of the Preliminary Assessment Screening of Boundary Load Line Areas conducted by U.S. Army Environmental Hygiene Agency (USAEHA) and reported in 1994. The USACHPPM conducted a RRSE at Load Line 5. The 1996 report indicated that groundwater and surface soil were potential mediums for contaminant migration. As a result of the investigation, the AOC was scored a “Medium” priority site (MKM 2007a).

From October 2004 through May 2005 as part of the Final Characterization of 14 AOCs at RVAAP the following field activities were conducted at Load Line 5:

- Collection of 30 MI surface soil (0 to 1 ft) samples;
- Collection of two sewer/sump sediment samples;
- Collection of six surface water samples from sanitary sewers and sumps;
- Installation and sampling of six shallow groundwater monitoring wells;
- Collection of geotechnical samples from monitoring well borings; and
- Well slug tests.

The results of this investigation concluded that there were contaminants above screening criteria (USEPA Region 9 PRGs or RVAAP background values) in all environmental media sampled (MKM 2007a).

Surface water and wet sediment were not identified within the AOC other than the sewers and sumps, which are not part of the scope of this investigation.

In August 2007, USACE conducted an investigation of the surface soil (0-1 ft) under the former building slabs and foundations. Fourteen former building footprints were sampled utilizing MI sampling techniques. All soil samples were analyzed for TAL metals and explosives. Fifteen percent of the building footprints (three) were analyzed for VOCs, SVOCs, PCBs, pesticides and herbicides. Data from the investigation were not available at the time this SAP Addendum was finalized. If available, the data will be included in the RI Report and the need for any additional sampling will be assessed.

For this SAP Addendum, all sample results were compared to the preliminary RVAAP facility-wide screening criteria (Section 3.2.2 of the FSP). Table H-1 lists the chemicals that exceeded screening criteria in each medium, as well as the maximum and minimum concentration detected.

Figures H-1 and H-2 illustrate the type and location of historical samples and identify samples that exceeded screening criteria for metals and organics, respectively.

Table H-1. Chemicals Exceeding Screening Criteria at Load Line 5

Media	Analyte	Units	Frequency of Detection	Minimum Detect	Maximum Detect	Average Result[a]	Screening Criteria[b]
Surface Soil	Aluminum	mg/kg	35/35	7400	18000	11400	17700
	Chromium	mg/kg	35/35	15.00	34.00	20.80	17.4
	Cobalt	mg/kg	35/35	1.90	13.00	8.23	10.4
	Manganese	mg/kg	35/35	240	3100	547	1450
	Mercury	mg/kg	21/35	0.03	3.00	0.26	2.3
	Benzo(a)pyrene	mg/kg	3/ 3	0.03	0.15	0.11	0.022
	Dibenz(a,h)anthracene	mg/kg	2/3	0.02	0.02	0.02	0.022
Subsurface Soil	Not sampled	--	--	--	--	--	--
Wet Sediment	Media not present	--	--	--	--	--	--
Surface Water	Media not present	--	--	--	--	--	--
Groundwater	Aluminum	mg/L	6/18	0.04	1.72	0.244	1.0
	Antimony	mg/L	3/18	0.00330	0.0041	0.00192	0.00039
	Manganese	mg/L	17/18	0.00044	2.0000	0.22800	1.02 (unconsolidated)
	Bis(2-ethylhexyl)phthalate	mg/L	6/18	0.0011	0.003	0.00482	0.0009

-- Not applicable.

[a]Average result equals the sum of the concentrations divided by the number of samples; the average includes non-detects at half the reporting limit and field duplicate samples. This can result in an average less than the range of detected values.

[b]Screening criteria are based on HI=0.1 and Target Risk=10^{-6}.

During previous investigations, surface soil (0 to 1 ft) samples have been collected at the AOC. Table H-2 summarizes the historical surface soil (including dry sediment) sampling conducted at Load Line 5 and indicates whether sample results exceeded screening criteria.

Table H-2. Load Line 5 Historical Soil Sampling Summary

Sample Location	Sample Number	Depth of Sample (ft bgs)	Analysis Performed					
			Metals	Explosives	VOCs	Pesticides/ PCBs	SVOCs	Anions
LL5ss-001M	LL5ss-001M-SO	0.0- 1.0	Cr	N	--	--	--	N
LL5ss-002M	LL5ss-002M-DUP	0.0- 1.0	Cr	N	--	--	--	N
	LL5ss-002M-SO	0.0- 1.0	Cr	N	--	--	--	N
LL5ss-003M	LL5ss-003M-SO	0.0- 1.0	N	N	--	--	--	N
LL5ss-004M	LL5ss-004M-SO	0.0- 1.0	Cr	N	--	--	--	N
LL5ss-005D	LL5ss-005D-SO	0.0- 1.0	--	--	N	--	--	--
LL5ss-005M	LL5ss-005M-SO	0.0- 1.0	**Y**	N	--	N	**Y**	N
LL5ss-006M	LL5ss-006M-SO	0.0- 1.0	Cr	N	--	--	--	N
LL5ss-007M	LL5ss-007M-SO	0.0- 1.0	Cr	N	--	--	--	N
LL5ss-008M	LL5ss-008M-SO	0.0- 1.0	Cr	N	--	--	--	N
LL5ss-009M	LL5ss-009M-SO	0.0- 1.0	Cr	N	--	--	--	N
LL5ss-010M	LL5ss-010M-DUP	0.0- 1.0	Cr	N	--	--	--	N
	LL5ss-010M-SO	0.0- 1.0	Cr	N	--	--	--	N
LL5ss-011M	LL5ss-011M-SO	0.0- 1.0	Cr	N	--	--	--	N
LL5ss-012D	LL5ss-012D-SO	0.0- 1.0	--	--	N	--	--	--
LL5ss-012M	LL5ss-012M-SO	0.0- 1.0	**Y**	N	--	N	**Y**	N
LL5ss-013M	LL5ss-013M-SO	0.0- 1.0	N	N	--	--	--	N
LL5ss-014M	LL5ss-014M-SO	0.0- 1.0	N	N	--	--	--	N
LL5ss-015M	LL5ss-015M-SO	0.0- 1.0	N	N	--	--	--	N
LL5ss-016M	LL5ss-016M-QA	0.0- 1.0	Cr	N	--	--	--	N
	LL5ss-016M-SO	0.0- 1.0	Cr	N	--	--	--	N
LL5ss-017M	LL5ss-017M-SO	0.0- 1.0	Cr	N	--	--	--	N
LL5ss-018D	LL5ss-018D-SO	0.0- 1.0	--	--	N	--	--	--
LL5ss-018M	LL5ss-018M-SO	0.0- 1.0	**Y**	N	--	N	**Y**	N
LL5ss-019M	LL5ss-019M-SO	0.0- 1.0	Cr	N	--	--	--	N
LL5ss-020M	LL5ss-020M-DUP	0.0- 1.0	**Y**	N	--	--	--	N
	LL5ss-020M-SO	0.0- 1.0	**Y**	N	--	--	--	N
LL5ss-021M	LL5ss-021M-DUP	0.0- 1.0	**Y**	N	--	--	--	N
	LL5ss-021M-SO	0.0- 1.0	**Y**	N	--	--	--	N
LL5ss-022M	LL5ss-022M-SO	0.0- 1.0	**Y**	N	--	--	--	N
LL5ss-023M	LL5ss-023M-SO	0.0- 1.0	Cr	N	--	--	--	N
LL5ss-024M	LL5ss-024M-SO	0.0- 1.0	Cr	N	--	--	--	N
LL5ss-025M	LL5ss-025M-SO	0.0- 1.0	Cr	N	--	--	--	N
LL5ss-026M	LL5ss-026M-QA	0.0- 1.0	Cr	N	--	--	--	N
	LL5ss-026M-SO	0.0- 1.0	Cr	N	--	--	--	N
LL5ss-027M	LL5ss-027M-SO	0.0- 1.0	Cr	N	--	--	--	N
LL5ss-028M	LL5ss-028M-SO	0.0- 1.0	**Y**	N	--	--	--	N
LL5ss-029M	LL5ss-029M-SO	0.0- 1.0	**Y**	N	--	--	--	N
LL5ss-030	LL5ss-030-DUP	0.0- 1.0	--	--	N	--	--	--
	LL5ss-030-SO	0.0- 1.0	--	--	N	--	--	--

Y = Analyte(s) greater than screening criteria.
Cr = Only chromium greater than screening criterion.
N = Non-detect or less than screening criteria.
-- = Analysis not performed.
Only PAHs were detected above screening criteria in the SVOC analysis.

H.3 PROPOSED SAP ADDENDUM CHARACTERIZATION ACTIVITIES

The objective of this SAP Addendum for Load Line 5 is to define the nature and extent of chemicals at concentrations greater than the screening criteria. To accomplish this further sampling and analysis of metals and PAHs in soil will be conducted and current concentrations of chemicals in groundwater will be evaluated. In addition, previous sample coverage was biased to operational areas and likely contaminant accumulation points, such as ditches. Portions of Load Line 5 between former operations buildings lack adequate sample coverage. The area outside the road encircling the former operational complex generally has not been characterized. Visual surveys and surface soil MI samples are planned for these areas to complete the characterization of these areas.

Table H-3 summarizes the chemicals that exceeded screening criteria and CUGs for each medium, the types and quantities of samples to be collected during the implementation of this SAP Addendum, and the rationale behind the proposed samples. The general approach for investigation activities is presented in Section 3.2 of the FSP. Figure H-3 illustrates the locations of the samples to be collected, as well as previous screening criteria and CUG exceedances.

Table H-4 presents the coordinates for the proposed sampling locations for this AOC. The locations may be altered during implementation of this SAP Addendum for a variety of reasons (e.g., soil boring refusal and MEC avoidance). The final coordinates of the sample locations (including elevations) will be presented in the RI Report.

Table H-3. Summary of Sampling at Load Line 5

Medium	Historical Sample Type	Historical Screening Criteria Exceedances	Number of SAP Addendum Sample Locations	Rationale for SAP Addendum Field Activities
Surface soil	MI Areas	Al LL5ss-005M Co LL5ss-018M, 020M, 021M, 022M, 028M, 029M Mn **LL5ss-005M** Hg LL5ss-012M SVOCs LL5ss-005M, 012M, 018M	16	A total of 16 MI areas are planned. These include: one boundary MI area to further define the lateral extent of manganese at LL5ss-005, five MI samples (nominal 2-acre grid) within the former operational area to complete characterization, two MI areas around former buildings 1F-13 and 1F-14, one within a ditch outside the operational area, and seven MI samples (nominal 4-acre grid) to characterize non-operational portions of the AOC. Samples will be analyzed for TAL metals, explosives and PAHs; 15% RVAAP full suite.
	Chromium speciation	Cr LL5ss-001M, 002M, 004M, 005M, 006M, 007M, 008M, 009M, 010M, 011M, 012M, 016M, 017M, 018M, 019M, 020M, 021M, 022M, 023M, 024M, 025M, 026M, 027M, 028M, 029M	3	Discrete surface soil samples will be collected at existing locations: LL5ss-005M (34 mg/kg – max), LL5ss-027M (21 mg/kg), and LL5ss-015M (15 mg/kg). Refer to Section 4.1.3 of the FSP for a discussion about chromium speciation sampling.
Subsurface soil	None previously collected	N/A	7	A total of seven borings are planned to define the vertical extent of chemicals, including one in the single MI sample area (LL5ss-005M) where manganese exceeded the CUG, three within ditches downstream from the operational area where chemicals exceeded screening criteria (LL5ss-018M, ss-021M and ss-029M), and three within the former operational area in MI areas where chemicals in surface soil exceeded screening criteria (LL5ss-001M, ss-002M and ss-012M). Samples will be analyzed for TAL metals, explosives and PAHs; 15% RVAAP full suite.
	Geotechnical	N/A	0	Geotechnical samples will be collected at Load Lines 7, 10, and 11. The soil type and geotechnical data from these load lines is considered to also be representative of Load Line 5.

Table H-3. Summary of Sampling at Load Line 5

Medium	Historical Sample Type	Historical Screening Criteria Exceedances	Number of SAP Addendum Sample Locations	Rationale for SAP Addendum Field Activities
Surface water	N/A		0	There are no permanent water bodies on the AOC; therefore, there is nothing to measure in terms of wet sediment and surface water. While ditches are present, they are expected to contain water only a small part of the year; historical measurements are available for this limited exposure to receptors. Potential transport beyond the AOC boundary will be further assessed under the Fuze and Booster Hill sample locations (Section 3.2.5.3 of the FSP).
Wet sediment	N/A	N/A	0	Refer to surface water above.
Groundwater	Discrete	Al LL5mw-003 Sb **LL5mw-001**, 005, **006** Mn **LL5mw-005** SVOCs LL5mw-001, 002, 003, 004, 005, 006	0	No additional sampling is proposed. All six groundwater wells at Load Line 5 (LL5mw-001 through -006) are currently being sampled under the FWGWMP. Four quarters of sampling were completed in October 2008. No additional groundwater sampling is required for completion of the FS.

Bold indicates locations where concentration also exceeded the CUG (HI=1.0, Target Risk=10^{-5}) for the identified chemical.

Table H-4. Coordinates for Proposed Sampling Locations at Load Line 5

Sample Location ID	Coordinate Point	Sample Type	Easting	Northing
LL5sb-052	N/A	Grab	554686.0000	2354754.0000
LL5sb-053	N/A	Grab	554387.5823	2354603.2242
LL5sb-054	N/A	Grab	554378.0000	2354765.0000
LL5sb-055	N/A	Grab	554225.0531	2354529.7550
LL5sb-056	N/A	Grab	554025.0000	2354740.0000
LL5sb-057	N/A	Grab	553803.1773	2354855.3298
LL5sb-058	N/A	Grab	554173.9804	2355243.5719
LL5ss-059	N/A	Grab	554063.8453	2354909.9549
LL5ss-060	N/A	Grab	554074.1331	2354819.7651
LL5ss-061	N/A	Grab	554240.5321	2354512.3545
LL5ss-062M	54	MI	2354423.5108	554283.9353
	55	MI	2354440.7023	554301.7488
	56	MI	2354451.4957	554291.3323
	57	MI	2354443.1469	554282.9835
	58	MI	2354482.6725	554301.5581
	59	MI	2354493.4430	554311.9983
	60	MI	2354563.6721	554163.4491
	61	MI	2354591.0597	554189.7414
	62	MI	2354563.3951	554142.3898
	63	MI	2354612.3209	554189.3589
LL5ss-063M	6	MI	2354637.8749	554604.3982
	7	MI	2354667.7335	554650.9960
	8	MI	2354710.0093	554652.1695
	9	MI	2354816.8844	554555.0074
	13	MI	2354544.3163	554458.3894
	14	MI	2354951.2159	554424.1649
	17	MI	2354759.2505	554234.3630
	18	MI	2354771.5058	554246.4801
LL5ss-064M	14	MI	2354951.2159	554424.1649
	18	MI	2354771.5058	554246.4801
	19	MI	2355126.2264	554251.7286
	20	MI	2355157.9177	554194.9164
	28	MI	2355008.7498	554012.9845
	29	MI	2355023.9134	554027.1025
LL5ss-065M	12	MI	2354420.4486	554265.0798
	13	MI	2354544.3163	554458.3894
	16	MI	2354390.1041	554205.3224
	17	MI	2354759.2505	554234.3630
	24	MI	2354552.1880	554029.6339
	25	MI	2354601.5917	554078.4809
	55	MI	2354440.7023	554301.7488

Table H-4. Coordinates for Proposed Sampling Locations at Load Line 5 (continued)

Sample Location ID	Coordinate Point	Sample Type	Easting	Northing
LL5ss-066M	17	MI	2354759.2505	554234.3630
	18	MI	2354771.5058	554246.4801
	25	MI	2354601.5917	554078.4809
	27	MI	2354788.9959	553881.2961
	28	MI	2355008.7498	554012.9845
LL5ss-067M	16	MI	2354390.1041	554205.3224
	23	MI	2354386.1711	553983.7868
	24	MI	2354552.1880	554029.6339
	25	MI	2354601.5917	554078.4809
	26	MI	2354572.6282	553892.2234
	27	MI	2354788.9959	553881.2961
LL5ss-068M	1	MI	2354528.3370	555005.2830
	2	MI	2354865.5510	555000.5000
	3	MI	2354398.3668	554876.3256
	4	MI	2355058.1017	554806.3476
	6	MI	2354637.8749	554604.3982
	7	MI	2354667.7335	554650.9960
	8	MI	2354710.0093	554652.1695
	9	MI	2354816.8844	554555.0074
	36	MI	2354571.9410	554735.8032
	37	MI	2354612.9295	554694.3246
LL5ss-069M	4	MI	2355058.1017	554806.3476
	9	MI	2354816.8844	554555.0074
	14	MI	2354951.2159	554424.1649
	15	MI	2355418.6472	554442.8030
	19	MI	2355126.2264	554251.7286
	20	MI	2355157.9177	554194.9164
LL5ss-070M	15	MI	2355418.6472	554442.8030
	20	MI	2355157.9177	554194.9164
	21	MI	2355505.8330	554354.8920
	29	MI	2355023.9134	554027.1025
	30	MI	2355506.8000	554021.9040
	35	MI	2355263.5625	553783.0726
LL5ss-071M	27	MI	2354788.9959	553881.2961
	28	MI	2355008.7498	554012.9845
	29	MI	2355023.9134	554027.1025
	33	MI	2354694.2210	553544.1510
	34	MI	2354954.7530	553479.8570
	35	MI	2355263.5625	553783.0726
LL5ss-072M	23	MI	2354386.1711	553983.7868
	26	MI	2354572.6282	553892.2234
	27	MI	2354788.9959	553881.2961

Table H-4. Coordinates for Proposed Sampling Locations at Load Line 5 (continued)

Sample Location ID	Coordinate Point	Sample Type	Easting	Northing
LL5ss-072M (continued)	31	MI	2354079.7062	553788.3975
	32	MI	2354201.6920	553665.6970
	33	MI	2354694.2210	553544.1510
LL5ss-073M	11	MI	2353997.3825	554417.1669
	12	MI	2354420.4486	554265.0798
	16	MI	2354390.1041	554205.3224
	22	MI	2353995.6640	553872.9320
	23	MI	2354386.1711	553983.7868
	31	MI	2354079.7062	553788.3975
	43	MI	2354362.9548	554284.4397
LL5ss-074M	3	MI	2354398.3668	554876.3256
	5	MI	2354144.5735	554624.5102
	6	MI	2354637.8749	554604.3982
	10	MI	2353997.4840	554449.3200
	11	MI	2353997.3825	554417.1669
	12	MI	2354420.4486	554265.0798
	13	MI	2354544.3163	554458.3894
	36	MI	2354571.9410	554735.8032
	37	MI	2354612.9295	554694.3246
	43	MI	2354362.9548	554284.4397
LL5ss-075M	40	MI	2354432.6453	554419.8695
	41	MI	2354465.9243	554386.1925
	42	MI	2354329.6757	554318.1168
	43	MI	2354362.9548	554284.4397
LL5ss-076M	36	MI	2354571.9410	554735.8032
	37	MI	2354612.9295	554694.3246
	38	MI	2354467.1195	554632.2205
	39	MI	2354508.1080	554590.7418
LL5ss-077M	44	MI	2354369.2033	553963.9980
	45	MI	2354592.3907	553871.3745
	46	MI	2354822.7280	553875.2490
	47	MI	2354938.4895	553931.0182
	48	MI	2355030.2207	554013.5018
	49	MI	2355043.7668	553999.1999
	50	MI	2354940.6935	553908.2046
	51	MI	2354805.3766	553849.2112
	52	MI	2354566.5780	553856.4369
	53	MI	2354352.7639	553950.7320

Surface Soil (0-1ft) - mg/kg			
Location	Constituent	Result	Qual
LL5ss-001M	Chromium	33.00	
LL5ss-002M	Chromium	22.00	
LL5ss-004M	Chromium	20.00	
LL5ss-005M	Aluminum	18000.00	
LL5ss-005M	Chromium	34.00	
LL5ss-005M	Manganese	3100.00	
LL5ss-006M	Chromium	20.00	
LL5ss-007M	Chromium	27.00	
LL5ss-008M	Chromium	18.00	
LL5ss-009M	Chromium	24.00	
LL5ss-010M	Chromium	19.00	
LL5ss-011M	Chromium	21.00	
LL5ss-012M	Chromium	19.00	
LL5ss-012M	Mercury	3.00	
LL5ss-016M	Chromium	21.00	
LL5ss-017M	Chromium	18.00	
LL5ss-018M	Chromium	19.00	
LL5ss-018M	Cobalt	11.00	
LL5ss-019M	Chromium	21.00	
LL5ss-020M	Chromium	21.00	
LL5ss-020M	Cobalt	11.00	
LL5ss-021M	Chromium	20.00	
LL5ss-021M	Cobalt	12.00	
LL5ss-022M	Chromium	20.00	
LL5ss-022M	Cobalt	11.00	
LL5ss-023M	Chromium	19.00	
LL5ss-024M	Chromium	22.00	
LL5ss-025M	Chromium	19.00	
LL5ss-026M	Chromium	22.00	
LL5ss-027M	Chromium	21.00	
LL5ss-028M	Chromium	21.00	
LL5ss-028M	Cobalt	13.00	
LL5ss-029M	Chromium	23.00	
LL5ss-029M	Cobalt	13.00	

Groundwater - mg/L			
Location	Constituent	Result	Qual
LL5mw-001	Antimony	0.0041	=
LL5mw-003	Aluminum	1.72	
LL5mw-005	Antimony	0.0033	=
LL5mw-005	Manganese	2	=
LL5mw-006	Antimony	0.0039	=

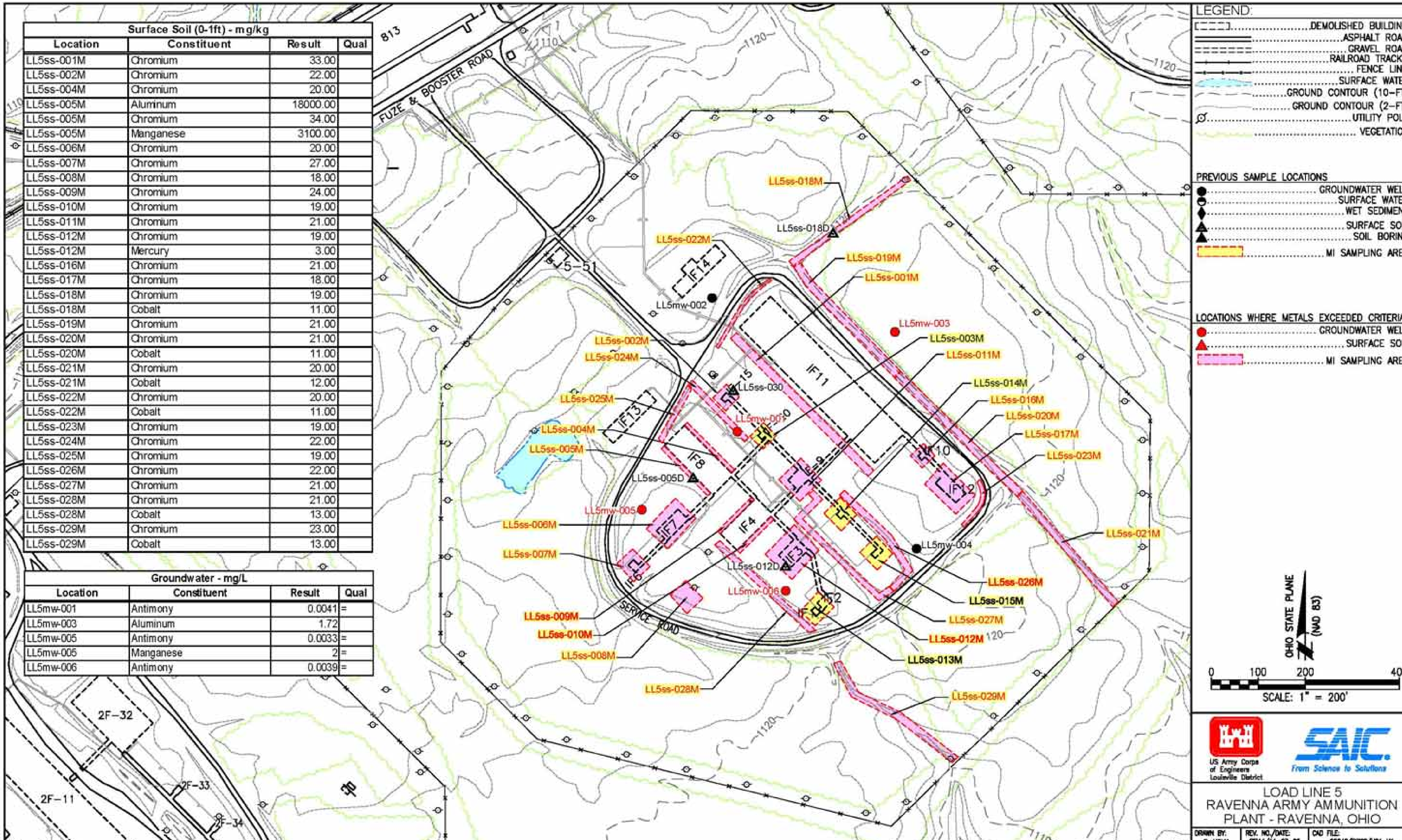

Figure H-1. Historical Sampling and Metal Exceedance Locations at Load Line 5

Surface Soil (0-1ft) - mg/kg			
Location	Constituent	Result	Qual
LL5ss-005M	Benzo(a)pyrene	0.15	
LL5ss-005M	Dibenz(a,h)anthracene	0.02	J
LL5ss-012M	Benzo(a)pyrene	0.15	
LL5ss-018M	Benzo(a)pyrene	0.03	

Groundwater - mg/L			
Location	Constituent	Result	Qual
LL5mw-001	Bis(2-ethylhexyl)phthalate	0.0011	J
LL5mw-002	Bis(2-ethylhexyl)phthalate	0.003	J
LL5mw-003	Bis(2-ethylhexyl)phthalate	0.0015	J
LL5mw-004	Bis(2-ethylhexyl)phthalate	0.0026	J
LL5mw-005	Bis(2-ethylhexyl)phthalate	0.0022	J
LL5mw-006	Bis(2-ethylhexyl)phthalate	0.002	J

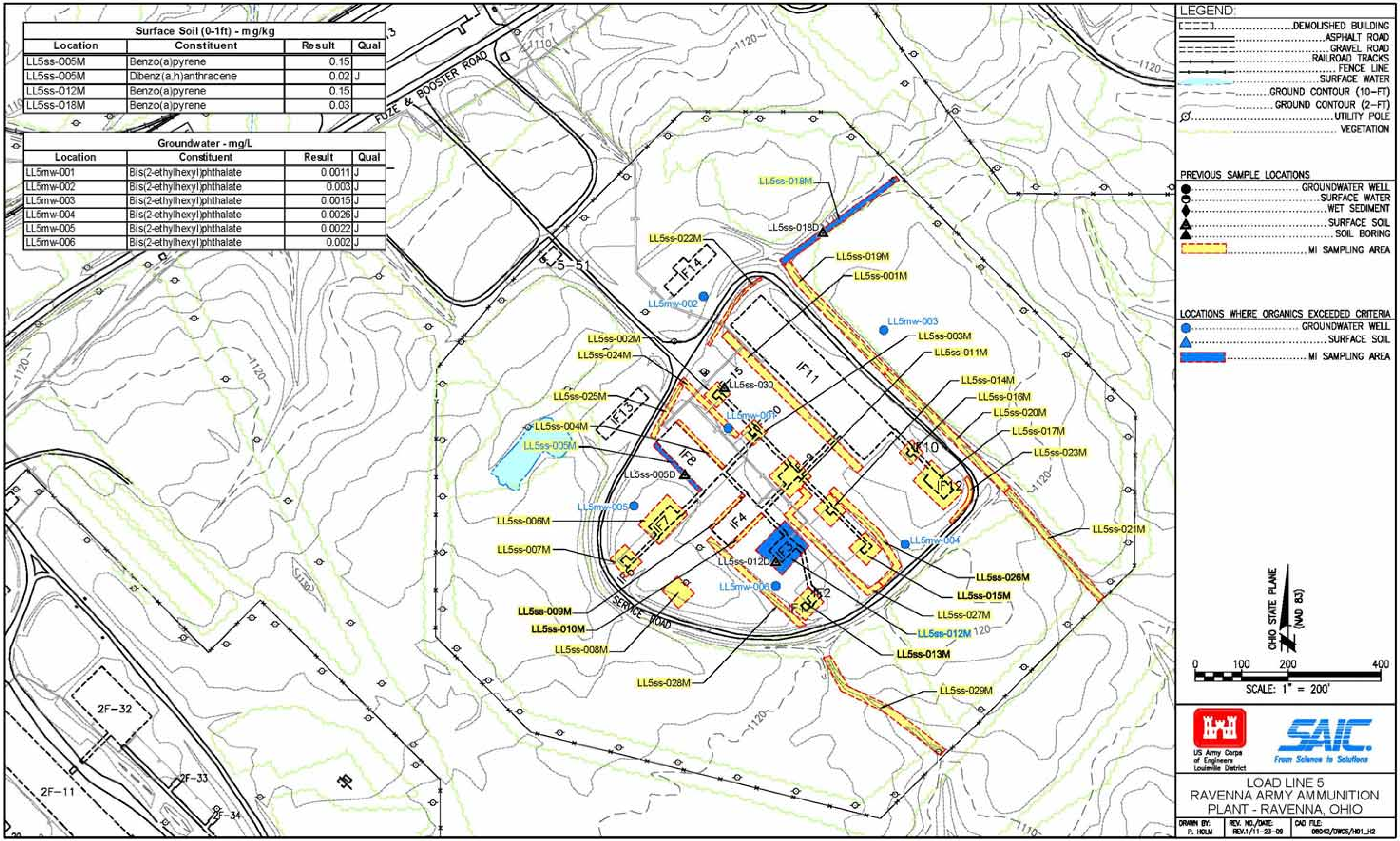

Figure H-2. Historical Sampling and Organic Exceedance Locations at Load Line 5

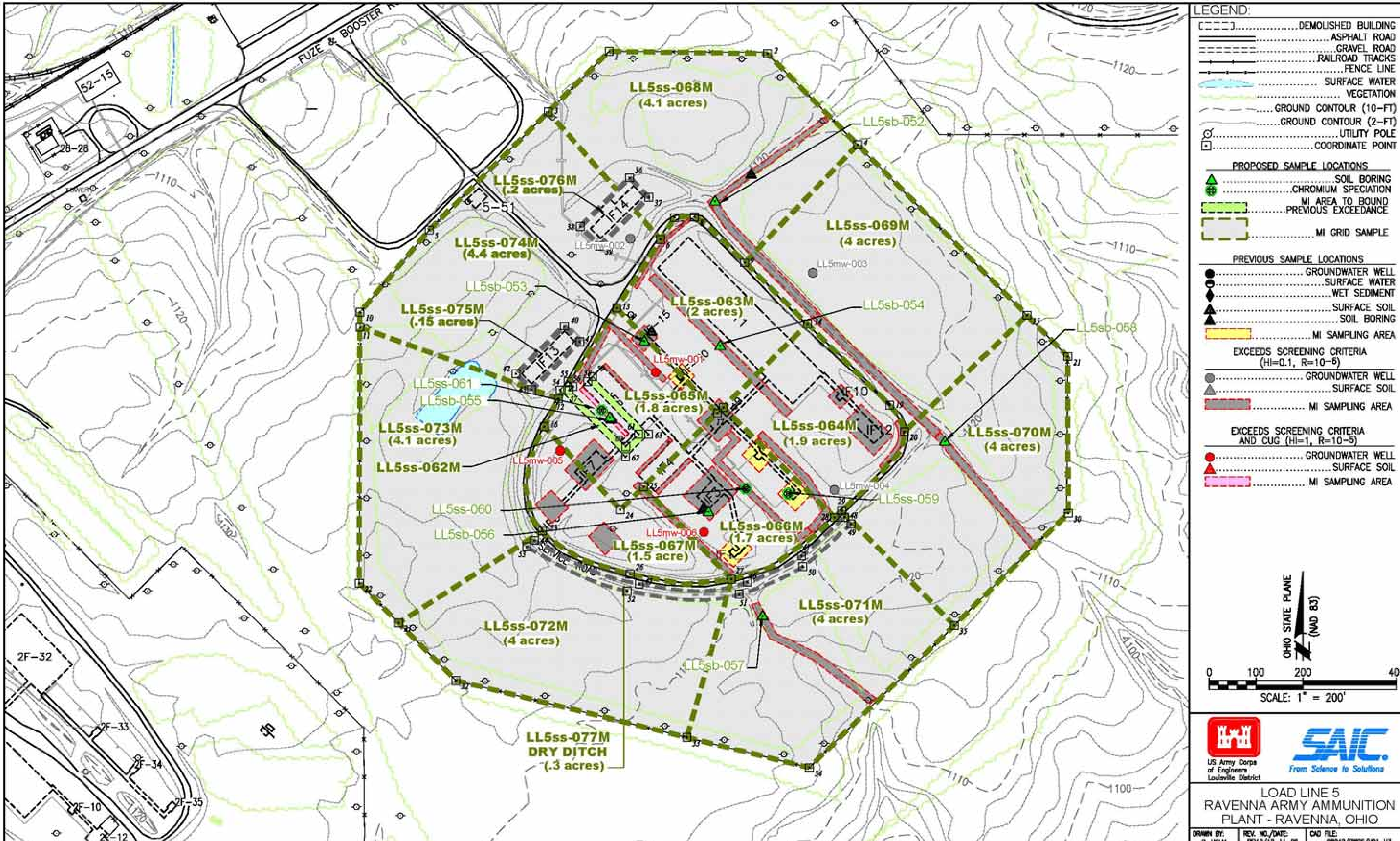

Figure H-3. Historical Exceedances and Proposed Sampling Locations at Load Line 5

APPENDIX I

Load Line 7 (RVAAP-40)

I.0 LOAD LINE 7 (RVAAP-40)

I.1 AOC DESCRIPTION

Load Line 7 is a 37-acre AOC formerly used as a booster loading and assembly line for artillery projectiles (Figure I-1). Operations occurred from 1941 until the end of World War II and the booster process equipment was removed in 1945. In 1968, the line was modified to produce M-406 High Explosive and M-407A1 practice 40 mm rounds. A total of 16,000,000 (40-mm) projectiles were assembled at Load Line 7 from 1969-1970, at which time the line was deactivated and the equipment removed. The line was reactivated for the research and development of high explosive shaped charges until 1993. From 1989 through 1993, pink water associated with TNT processing was treated at the Load Line 7 treatment plant operating under an Ohio wastewater discharge permit. Load Line 7 has been inactive since 1993 and is overgrown with young trees and scrub vegetation. The buildings, including slabs and foundations, have since been removed.

I.2 PREVIOUS INVESTIGATIONS

Since 1978, Load Line 7 has been the subject of various investigations and assessments. The 1978 Installation Assessment conducted by USATHAMA concluded that Load Line 7 was contaminated with explosive waste. In the late 1980s, as part of RCRA Facility Assessment, the USEPA conducted a Preliminary Review and Visual Site Inspection. Details of this investigation are unknown (MKM 2007a).

Load Line 7 was part of the Preliminary Assessment Screening of Boundary Load Line Areas conducted by USAEHA and reported in 1994. Additionally, two RRSEs have been conducted by USACHPPM at Load Line 7. The most recent report indicated that groundwater and surface soil were potential media for contaminant migration. As a result of the investigations, the AOC was scored a “medium” priority site (USACHPPM 1998).

From October 2004 through May 2005, as part of the Final Characterization of 14 AOCs at RVAAP, the following field activities were conducted at Load Line 7:

- Collection of 31 MI surface soil (0 to 1 ft) samples;
- Collection of two wet sediment samples and eight surface water samples from sanitary sewers/sumps;
- Installation and sampling of six shallow groundwater monitoring wells;
- Collection of geotechnical samples from monitoring well borings; and
- Well slug tests.

No surface water or wet sediment was identified within the AOC other than the sewers and sumps, which are not part of the scope of this investigation. The results of this investigation concluded that there were contaminants above screening criteria (e.g., USEPA Region 9 PRGs and RVAAP background values) in all environmental media sampled (MKM 2007a).

In August 2007, USACE conducted an investigation of the surface soil (0-1 ft) under the former building slabs and foundations. Twelve former building footprints were sampled utilizing MI sampling techniques. All soil samples were analyzed for TAL metals and explosives. Fifteen percent of the building footprints (three) were analyzed for VOCs, SVOCs, PCBs, pesticides and herbicides. Data from the investigation were not available at the time this SAP Addendum was finalized. If available, the data will be included in the RI Report, and the need for any additional sampling will be assessed.

For this SAP Addendum, all sample results were compared to the preliminary RVAAP facility-wide screening criteria (Section 3.2.2 of the FSP). Table I-1 lists the chemicals that exceeded screening criteria in each medium, as well as the maximum and minimum concentration detected.

Figures I-1 and I-2 illustrate the type and location of historical samples and identify samples that exceeded screening criteria for metals and organics, respectively.

Table I-1. Chemicals Exceeding Screening Criteria at Load Line 7

Medium	Analyte	Units	Frequency of Detection	Minimum Detect	Maximum Detect	Average Result[a]	Screening Criteria[b]
Surface Soil	Aluminum	mg/kg	36/36	5100	18000	10200	17700
	Arsenic	mg/kg	36/36	7.9	16	11.2	15.4
	Chromium	mg/kg	36/36	12.00	33	20.8	17.4
	Cobalt	mg/kg	36/36	3.80	13	7.78	10.4
	Manganese	mg/kg	36/36	290	1600	633	1450
	Silver	mg/kg	3/36	0.59	80	2.8	39
	RDX	mg/kg	5/36	0.08	45	1.49	8
	Benz(a)anthracene	mg/kg	5/5	0.02	3.60	1.47	0.22
	Benzo(a)pyrene	mg/kg	5/5	0.03	2.90	1.16	0.022
	Benzo(b)fluoranthene	mg/kg	5/5	0.06	3.40	1.44	0.22
	Dibenz(a,h)anthracene	mg/kg	4/5	0.01	0.46	0.19	0.022
	Indeno(1,2,3-cd)pyrene	mg/kg	5/5	0.01	1.00	0.42	0.22
Subsurface Soil	Not sampled	--	--	--	--	--	--
Wet Sediment	Medium not present	--	--	--	--	--	--
Surface Water	Medium not present	--	--	--	--	--	--

Table I-1. Chemicals Exceeding Screening Criteria at Load Line 7 (continued)

Medium	Analyte	Units	Frequency of Detection	Minimum Detect	Maximum Detect	Average Result[a]	Screening Criteria[b]
Groundwater[d]	Arsenic	mg/L	1/6	0.00092	0.00092[c]	0.00099	0.000056 (bedrock)
	Manganese	mg/L	6/6	0.36000	2.0000	1.20000	1.34 (bedrock)

-- Not applicable.

[a]Average result equals the sum of the concentrations divided by the number of samples; the average includes non-detects at half the reporting limit and field duplicate samples. This can result in an average less than the range of detected values.

[b]Screening criteria are based on HI=0.1 and Target Risk=10^{-6}.

[c]The maximum concentration of arsenic was detected in a field duplicate at 0.0011 mg/L; field duplicates are not typically used for statistical analysis.

[d]All screening criteria exceedances were detected in the bedrock zone. Only one monitoring well LL7mw-001 is screened in the unconsolidated zone.

During previous investigations, surface soil samples have been collected at the 0-0.5 and 0-1 ft intervals at Load Line 7. Table I-2 summarizes the historical surface soil sampling conducted at Load Line 7 and indicates whether sample results exceeded screening criteria.

Table I-2. Load Line 7 Historical Soil Sampling Summary

Sample Location	Sample Number	Depth of Sample (ft bgs)	Analysis Performed					
			Metals	**Explosives**	**VOCs**	**Pesticides/ PCBs**	**SVOCs**	**Anions**
LL7ss-001M	LL7ss-001M-SO	0.0- 0.5	N	N	--	--	--	N
LL7ss-002M	LL7ss-002M-SO	0.0- 0.5	**Y**	N	--	--	--	N
LL7ss-003M	LL7ss-003M-DUP	0.0- 0.5	Cr	N	--	--	--	N
	LL7ss-003M-SO	0.0- 0.5	Cr	N	--	--	--	N
LL7ss-004M	LL7ss-004M-SO	0.0- 0.5	Cr	N	--	--	--	N
LL7ss-005D	LL7ss-005D-SO	0.0- 0.5	--	--	N	--	--	--
LL7ss-005M	LL7ss-005M-SO	0.0- 0.5	Cr	N	--	N	**Y**	N
LL7ss-006M	LL7ss-006M-SO	0.0- 0.5	N	N	--	--	--	N
LL7ss-007M	LL7ss-007M-SO	0.0- 1.0	Cr	N	--	--	--	N
LL7ss-008M	LL7ss-008M-SO	0.0- 1.0	Cr	N	--	--	--	N
LL7ss-009M	LL7ss-009M-SO	0.0- 1.0	**Y**	N	--	--	--	N
LL7ss-010M	LL7ss-010M-SO	0.0- 1.0	N	N	--	--	--	N
LL7ss-011M	LL7ss-011M-SO	0.0- 1.0	Cr	N	--	--	--	N
LL7ss-012M	LL7ss-012M-SO	0.0- 1.0	N	N	--	--	--	N
LL7ss-013D	LL7ss-013D-DUP	0.0- 1.0	--	--	N	--	--	--
	LL7ss-013D-SO	0.0- 1.0	--	--	N	--	--	--
LL7ss-013M	LL7ss-013M-DUP	0.0- 1.0	Cr	N	--	N	**Y**	N
	LL7ss-013M-SO	0.0- 1.0	Cr	N	--	N	**Y**	N
LL7ss-014M	LL7ss-014M-SO	0.0- 1.0	N	**Y**	--	--	--	N
LL7ss-015M	LL7ss-015M-SO	0.0- 1.0	**Y**	N	--	--	--	N
LL7ss-016M	LL7ss-016M-SO	0.0- 1.0	N	N	--	--	--	N
LL7ss-017M	LL7ss-017M-SO	0.0- 0.5	Cr	N	--	--	--	N
LL7ss-018M	LL7ss-018M-QA	0.0- 1.0	Cr	N	--	--	--	N
	LL7ss-018M-SO	0.0- 1.0	Cr	N	--	--	--	N
LL7ss-019M	LL7ss-019M-SO	0.0- 1.0	Cr	N	--	--	--	N
LL7ss-020M	LL7ss-020M-SO	0.0- 1.0	Cr	N	--	--	--	N
LL7ss-021M	LL7ss-021M-SO	0.0- 1.0	Cr	N	--	--	--	N
LL7ss-022M	LL7ss-022M-SO	0.0- 1.0	Cr	N	--	--	--	N
LL7ss-023D	LL7ss-023D-SO	0.0- 1.0	--	--	N	--	--	--
LL7ss-023M	LL7ss-023M-SO	0.0- 1.0	Cr	N	--	N	**Y**	N
LL7ss-024M	LL7ss-024M-DUP	0.0- 1.0	Cr	N	--	--	--	N
	LL7ss-024M-SO	0.0- 1.0	Cr	N	--	--	--	N
LL7ss-025M	LL7ss-025M-SO	0.0- 1.0	Cr	N	--	--	--	N
LL7ss-026M	LL7ss-026M-SO	0.0- 1.0	Cr	N	--	--	--	N
LL7ss-027M	LL7ss-027M-SO	0.0- 1.0	**Y**	N	--	--	--	N
LL7ss-028M	LL7ss-028M-SO	0.0- 1.0	N	N	--	--	--	N
LL7ss-030M	LL7ss-030M-SO	0.0- 1.0	N	N	--	--	--	N

Table I-2. Load Line 7 Historical Soil Sampling Summary (continued)

Sample Location	Sample Number	Depth of Sample (ft bgs)	Analysis Performed					
			Metals	Explosives	VOCs	Pesticides/ PCBs	SVOCs	Anions
LL7ss-031M	LL7ss-031M-SO	0.0- 1.0	N	N	--	--	--	N
LL7ss-032D	LL7ss-032D-SO	0.0- 1.0	--	--	N	--	--	--
LL7ss-032M	LL7ss-032M-SO	0.0- 1.0	**Y**	N		N	**Y**	N
LL7ss-041	LL7ss-041-SO	0.0- 1.0	--	--	N	--	--	--
LL7sd-029M	LL7sd-029M-SD	0.0- 0.5	N	N	--	--	--	N

Y = Analyte(s) greater than screening criteria.
Cr = Only chromium greater than screening criterion.
N = Non-detect or less than screening criteria.
-- = Analysis not performed.
Only PAHs were detected above screening criteria in the SVOC analysis.

I.3 PROPOSED SAP ADDENDUM CHARACTERIZATION ACTIVITIES

The objective of this SAP Addendum for Load Line 7 is to define the extent of chemicals at concentrations greater than the screening criteria. To accomplish this further sampling and analysis of metals, explosives, and PAHs in soil will be conducted and current concentrations of chemicals in groundwater will be evaluated. In addition, previous sample coverage was biased to operational areas and likely contaminant accumulation points, such as ditches. Portions of Load Line 7 between former operations buildings lack adequate sample coverage. The area outside the road encircling most of the former operational complex generally has not been characterized. Visual surveys and surface soil MI samples are planned for these areas to complete the characterization of the AOC.

Table I-3 summarizes the chemicals that exceeded screening criteria and CUGs for each medium, the types and quantities of samples to be collected during the implementation of this SAP Addendum, and the rationale behind the proposed samples. The general approach for investigation activities is presented in Section 3.2 of the FSP. Figure I-3 illustrates the locations of the samples to be collected as well as previous exceedances.

Table I-4 presents the coordinates for the proposed sampling locations for this AOC. The locations may be altered during implementation of this SAP Addendum for a variety of reasons (e.g., soil boring refusal and MEC avoidance). The final coordinates of the sample locations (including elevations) will be presented in the RI Report.

Table I-3. Summary of Sampling at Load Line 7

Medium	Historical Sample Type	Historical Screening Criteria Exceedances	Number of SAP Addendum Sample Locations	Rationale for SAP Addendum Field Activities
Surface soil	MI	Al LL7ss-002M As **LL7ss-015M** Co LL7ss-009M, 032M Mn **LL7ss-002M**, Ag LL7ss-027M Explosives LL7ss-014M SVOCs **LL7ss-005M**, **013M**, 023M, 032M	17	Four boundary MI areas are planned around the former MI areas (LL7ss-002M, ss-005M, ss-013M and ss-015M) where chemicals were detected greater than screening criteria and CUGs to further define the lateral extent of chemicals. Six MI samples (nominal 2-acre grid) are planned within the former operational area to complete characterization and define extent of chemicals greater than screening criteria. An additional seven MI samples (nominal 4-acre grid) are planned to characterize non-operational portions of the AOC. Samples will be analyzed for TAL metals, explosives, and PAHs; 15% RVAAP full suite.
	Cr speciation	Cr LL7ss-002M, 003M, 004M, 005M, 007M, 008M, 009M, 011M, 013M, 015M, 017M, 018M, 019M, 020M, 021M, 022M, 023M, 024M, 025M, 026M, 027M, 032M	3	Discrete surface soil samples will be collected at previous locations LL7ss-004M (33 mg/kg – previous maximum concentration of total chromium), ss-013M (18 mg/kg), and ss-019M (25 mg/kg). Refer to Section 4.1.3 of the FSP for a discussion about chromium speciation sampling.

Table I-3. Summary of Sampling at Load Line 7 (continued)

Medium	Historical Sample Type	Historical Screening Criteria Exceedances	Number of SAP Addendum Sample Locations	Rationale for SAP Addendum Field Activities
Subsurface soil	None collected.	N/A	9	Nine boring locations are placed to further define the vertical extent of chemicals greater than screening criteria and CUGs. These include four in former MI areas (LL7ss-014M, ss-017M, ss-019M, ss-027M, and ss-032M) where chemicals were detected above screening criteria and four in former MI areas where chemicals were detected above both the screening criteria and CUGs (LL7ss-002M, ss-005M, ss-013M and ss-015M). Samples will be analyzed for TAL metals, explosives, and PAHs; 15% RVAAP full suite.
	Geotechnical (one previously collected)	N/A	1	Two samples shall be collected from one location to provide soil data for modeling.
Surface water	None collected.	N/A	0	There are no permanent water bodies on the AOC; therefore, there is nothing to measure in terms of wet sediment and surface water. While ditches are present, they are expected to contain water only a small part of the year; historical measurements are available for this limited exposure to receptors. Potential transport beyond the AOC boundary will be further assessed under the Fuze and Booster Hill sample locations (Section 3.2.5.3 of the FSP).
Wet sediment	None collected.	N/A	0	Refer to surface water above.
Groundwater	Grab	<u>As</u> **LL7mw-003** <u>Mn</u> **LL7mw-003, 005, 006**	0	No additional groundwater sampling is proposed. All six groundwater well at Load Line 7 are currently being sampled under the FWGWMP. Four quarters of sampling will be completed by April 2010. No additional groundwater sampling is required for completion of the FS.

Bold indicates locations where concentration also exceeded the CUG (HI=1.0, Target Risk=10^{-5}) for the identified chemical.

Table I-4. Coordinates for Proposed Sampling Locations at Load Line 7

Sample Location ID	Coordinate Point	Sample Type	Easting	Northing
LL7sb-060	NA	Grab	2352076.1031	555993.6272
LL7sb-061	NA	Grab	2352102.3373	555722.3843
LL7sb-062	NA	Grab	2352365.8442	555099.2796
LL7sb-063	NA	Grab	2352472.0000	555090.0000
LL7sb-064	NA	Grab	2352124.7937	555201.6431
LL7sb-065	NA	Grab	2351913.0000	555337.0000
LL7sb-066	NA	Grab	2351918.2370	555472.8272
LL7sb-067	NA	Grab	2351911.6330	555588.5163
LL7sb-068	NA	Grab	2351902.6719	555614.4383
LL7sb-069	NA	Grab	2351751.6719	555890.4383
LL7ss-070	NA	Grab	2351922.5933	555442.4102
LL7ss-071	NA	Grab	2352096.8427	555135.2306
LL7ss-072M	69	MI	2352309.8755	555113.3902
	70	MI	2352409.2547	555152.4902
	68	MI	2352329.3259	555104.9235
	71	MI	2352400.7881	555133.0399
	72	MI	2352344.2015	555067.1147
	73	MI	2352415.6637	555095.2310
	74	MI	2352335.7349	555047.6644
	75	MI	2352435.1140	555086.7644
	76	MI	2352185.2729	555176.1792
LL7ss-073M	61	MI	2352069.6477	555237.7383
	62	MI	2352151.2710	555265.6096
	63	MI	2352082.7907	555226.3758
	64	MI	2352142.4013	555246.7306
	65	MI	2352107.3344	555163.5475
	66	MI	2352165.8597	555185.0315
	67	MI	2352106.4146	555147.2311
	68	MI	2352185.2729	555176.1792
LL7ss-074M	53	MI	2351844.5747	555534.8800
	54	MI	2351917.5059	555560.5046
	55	MI	2351864.1650	555525.8642
	56	MI	2351908.8277	555541.5565
	57	MI	2351915.7474	555392.9835
	58	MI	2351961.0473	555408.4807
	59	MI	2351906.9759	555374.1292
	60	MI	2351980.7384	555399.3636
LL7ss-075M	39	MI	2352041.9002	555749.1917
	40	MI	2352127.6222	555788.0163
	41	MI	2352047.7589	555733.4770
	42	MI	2352132.2474	555774.7667
	43	MI	2352054.0035	555718.2114

Table I-4. Coordinates for Proposed Sampling Locations at Load Line 7 (continued)

Sample Location ID	Coordinate Point	Sample Type	Easting	Northing
LL7ss-075M (continued)	44	MI	2352067.0406	555726.1413
	45	MI	2352069.7644	555676.5678
	46	MI	2352083.4734	555682.7225
	47	MI	2352126.3732	555748.7169
	48	MI	2352143.3066	555746.3989
	49	MI	2352108.0485	555689.5391
	50	MI	2352143.7463	555703.0935
	51	MI	2352114.2270	555675.8402
	52	MI	2352163.1075	555694.4001
LL7ss-076M	1	MI	2351442.4820	556197.5570
	2	MI	2351865.9561	556361.1107
	5	MI	2351372.2422	556038.5942
	6	MI	2351736.0124	555875.4430
	7	MI	2351957.5441	555970.9312
LL7ss-077M	2	MI	2351865.9561	556361.1107
	3	MI	2352018.6370	556420.0790
	4	MI	2352263.5446	556307.7467
	7	MI	2351957.5441	555970.9312
	8	MI	2352009.5802	555989.1083
	9	MI	2352077.6585	555966.7666
	10	MI	2352131.6894	555854.0831
	11	MI	2352376.0047	556012.7950
LL7ss-078M	10	MI	2352131.6894	555854.0831
	11	MI	2352376.0047	556012.7950
	15	MI	2352152.5376	555787.1887
	17	MI	2352241.8035	555562.7821
	18	MI	2352271.5920	555474.6907
	19	MI	2352544.3870	555571.1750
LL7ss-079M	18	MI	2352271.5920	555474.6907
	19	MI	2352544.3870	555571.1750
LL7ss-079M (continued)	22	MI	2352184.1800	555189.9106
	23	MI	2352175.4277	555151.0290
	24	MI	2352184.5732	555121.3924
	25	MI	2352465.4976	555279.7771
	26	MI	2352458.5547	555081.2516
	27	MI	2352246.8486	554949.3393
	37	MI	2352386.2668	554679.4614
	38	MI	2352455.2160	554705.8420
	68	MI	2352329.3259	555104.9235
LL7ss-080M	24	MI	2352184.5732	555121.3924
	25	MI	2352465.4976	555279.7771
	26	MI	2352458.5547	555081.2516
	27	MI	2352246.8486	554949.3393

Table I-4. Coordinates for Proposed Sampling Locations at Load Line 7 (continued)

Sample Location ID	Coordinate Point	Sample Type	Easting	Northing
LL7ss-081M	27	MI	2352246.8486	554949.3393
	28	MI	2352227.0454	555004.0512
	33	MI	2352098.9214	554952.0331
	36	MI	2352153.6939	554591.8826
	37	MI	2352386.2668	554679.4614
LL7ss-082M	29	MI	2351658.2851	554986.2444
	30	MI	2351872.8098	555034.1486
	31	MI	2351966.0587	555052.8581
	32	MI	2352020.9522	555006.3724
	33	MI	2352098.9214	554952.0331
	34	MI	2351770.8910	554693.3460
	35	MI	2352071.8410	554559.1590
	36	MI	2352153.6939	554591.8826
LL7ss-083M	13	MI	2351481.4937	555446.0953
	14	MI	2351823.2342	555643.0133
	16	MI	2351913.3633	555414.5415
	20	MI	2351779.2510	555253.6639
	21	MI	2351970.3825	555266.3593
	29	MI	2351658.2851	554986.2444
	30	MI	2351872.8098	555034.1486
	55	MI	2351864.1650	555525.8642
LL7ss-084M	5	MI	2351372.2422	556038.5942
	6	MI	2351736.0124	555875.4430
	12	MI	2351308.8560	555895.1420
	13	MI	2351481.4937	555446.0953
	14	MI	2351823.2342	555643.0133
LL7ss-085M	6	MI	2351736.0124	555875.4430
	7	MI	2351957.5441	555970.9312
	8	MI	2352009.5802	555989.1083
	9	MI	2352077.6585	555966.7666
	10	MI	2352131.6894	555854.0831
	14	MI	2351823.2342	555643.0133
	15	MI	2352152.5376	555787.1887
LL7ss-086M	14	MI	2351823.2342	555643.0133
	15	MI	2352152.5376	555787.1887
	16	MI	2351913.3633	555414.5415
	17	MI	2352241.8035	555562.7821
LL7ss-087M	16	MI	2351913.3633	555414.5415
	17	MI	2352241.8035	555562.7821
	18	MI	2352271.5920	555474.6907
	21	MI	2351970.3825	555266.3593
	22	MI	2352184.1800	555189.9106

Table I-4. Coordinates for Proposed Sampling Locations at Load Line 7 (continued)

Sample Location ID	Coordinate Point	Sample Type	Easting	Northing
LL7ss-088M	20	MI	2351779.2510	555253.6639
	21	MI	2351970.3825	555266.3593
	22	MI	2352184.1800	555189.9106
	23	MI	2352175.4277	555151.0290
	24	MI	2352184.5732	555121.3924
	28	MI	2352227.0454	555004.0512
	30	MI	2351872.8098	555034.1486
	31	MI	2351966.0587	555052.8581
	32	MI	2352020.9522	555006.3724
	33	MI	2352098.9214	554952.0331
	68	MI	2352185.2729	555176.1792
LL7ss-089	NA	Grab	2352046.7459	555999.9640

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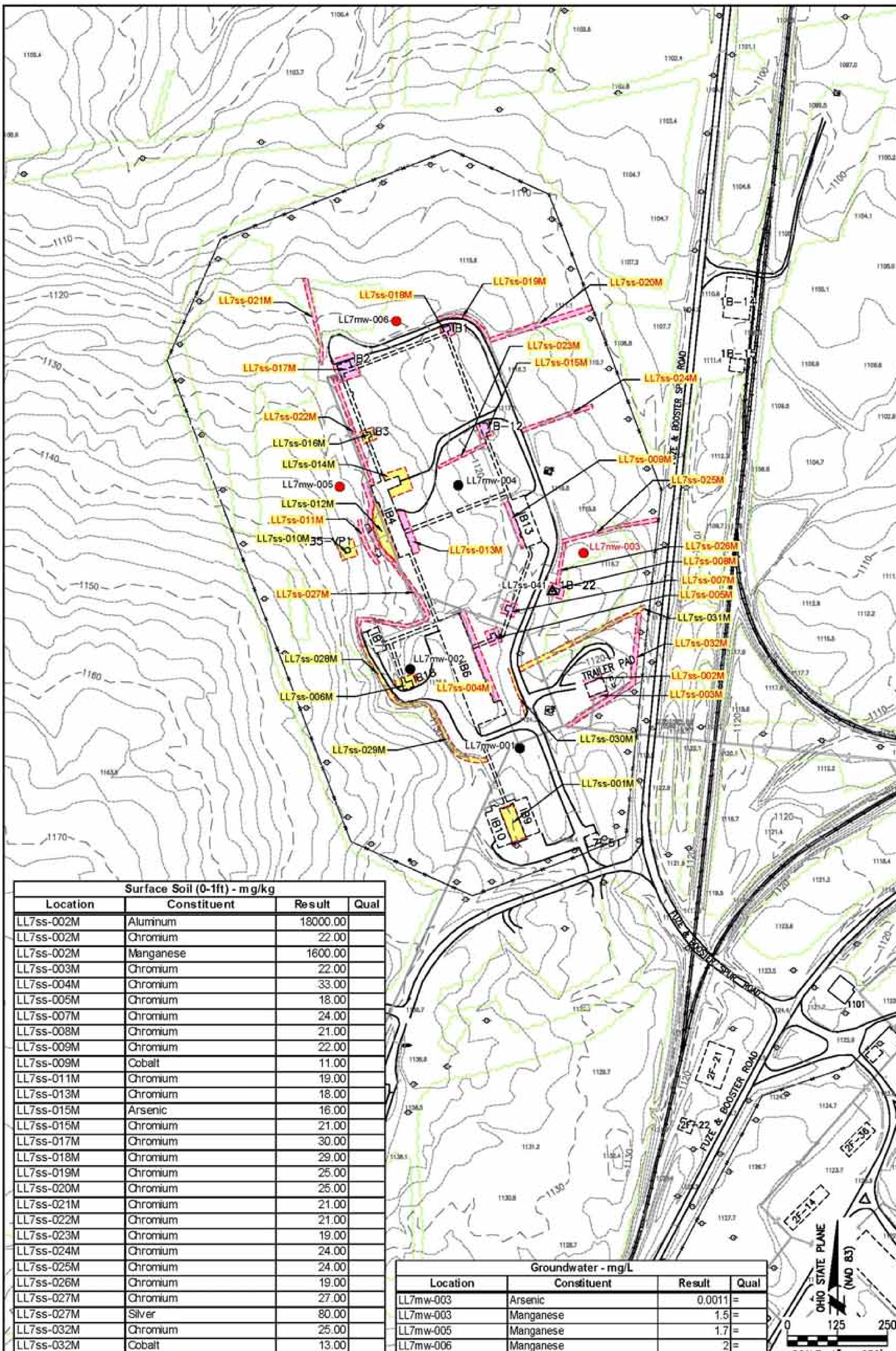


Surface Soil (0-1ft) - mg/kg			
Location	**Constituent**	**Result**	**Qual**
LL7ss-002M	Aluminum	18000.00	
LL7ss-002M	Chromium	22.00	
LL7ss-002M	Manganese	1600.00	
LL7ss-003M	Chromium	22.00	
LL7ss-004M	Chromium	33.00	
LL7ss-005M	Chromium	18.00	
LL7ss-007M	Chromium	24.00	
LL7ss-008M	Chromium	21.00	
LL7ss-009M	Chromium	22.00	
LL7ss-009M	Cobalt	11.00	
LL7ss-011M	Chromium	19.00	
LL7ss-013M	Chromium	18.00	
LL7ss-015M	Arsenic	16.00	
LL7ss-015M	Chromium	21.00	
LL7ss-017M	Chromium	30.00	
LL7ss-018M	Chromium	29.00	
LL7ss-019M	Chromium	25.00	
LL7ss-020M	Chromium	25.00	
LL7ss-021M	Chromium	21.00	
LL7ss-022M	Chromium	21.00	
LL7ss-023M	Chromium	19.00	
LL7ss-024M	Chromium	24.00	
LL7ss-025M	Chromium	24.00	
LL7ss-026M	Chromium	19.00	
LL7ss-027M	Chromium	27.00	
LL7ss-027M	Silver	80.00	
LL7ss-032M	Chromium	25.00	
LL7ss-032M	Cobalt	13.00	

Groundwater - mg/L			
Location	**Constituent**	**Result**	**Qual**
LL7mw-003	Arsenic	0.0011	=
LL7mw-003	Manganese	1.5	=
LL7mw-005	Manganese	1.7	=
LL7mw-006	Manganese	2	=

LEGEND:

DEMOLISHED BUILDING
ASPHALT ROAD
GRAVEL ROAD
RAILROAD TRACKS
FENCE LINE
VEGETATION
GROUND CONTOUR (10-FT)
GROUND CONTOUR (2-FT)
UTILITY POLE

PREVIOUS SAMPLE LOCATIONS
GROUNDWATER WELL
SURFACE WATER
WET SEDIMENT
SURFACE SOIL
SOIL BORING
MI SAMPLING AREA

LOCATIONS WHERE METALS EXCEEDED CRITERIA
GROUNDWATER WELL
SURFACE SOIL
MI SAMPLING AREA

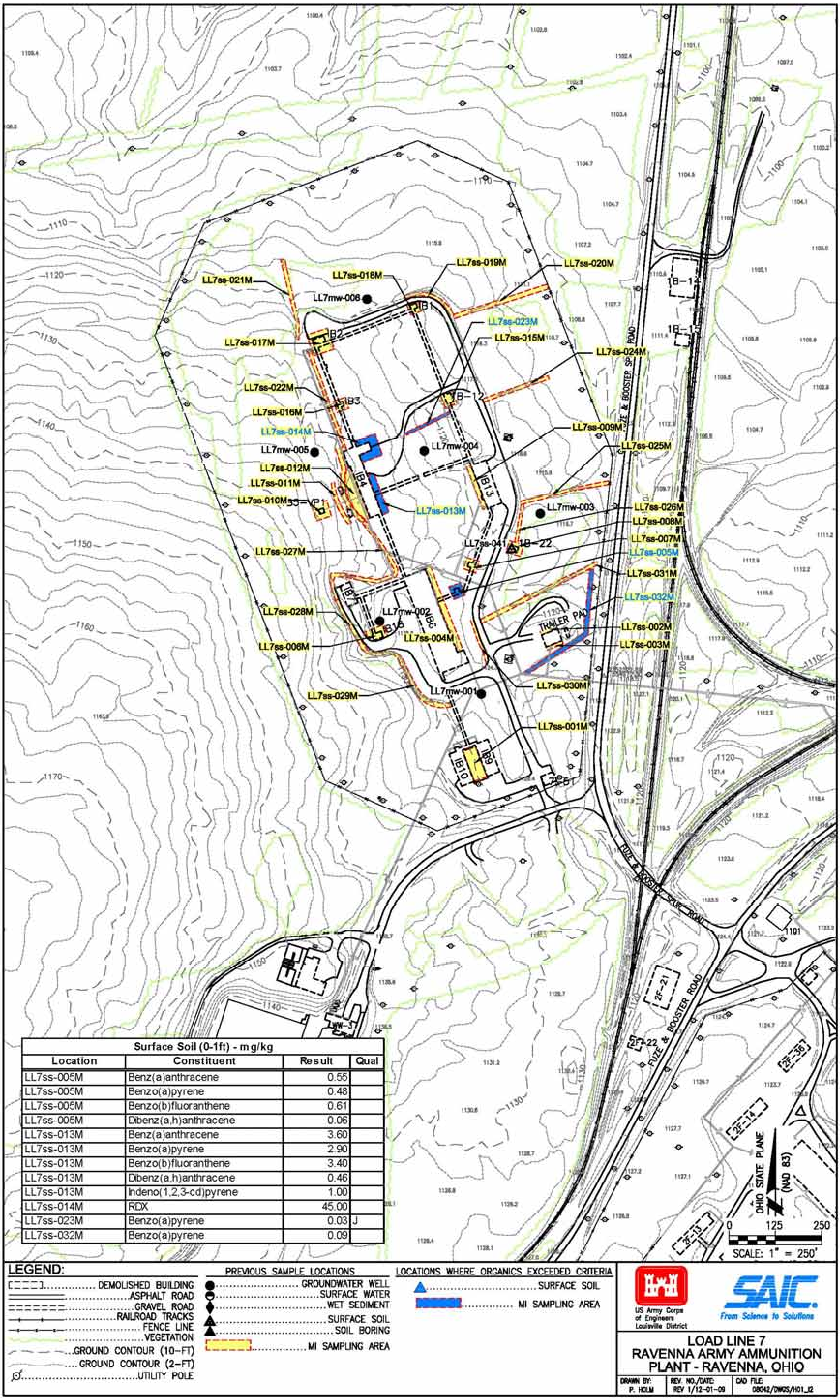
US Army Corps of Engineers Louisville District

SAIC. From Science to Solutions

LOAD LINE 7
RAVENNA ARMY AMMUNITION PLANT - RAVENNA, OHIO

DRAWN BY:	REV. NO./DATE:	CAD FILE:
P. HOLM	REV 1/12-01-09	08042/DWGS/H01_I1

Figure I-1. Historical Sampling and Metal Exceedance Locations at Load Line 7



Surface Soil (0-1ft) - mg/kg			
Location	**Constituent**	**Result**	**Qual**
LL7ss-005M	Benz(a)anthracene	0.55	
LL7ss-005M	Benzo(a)pyrene	0.48	
LL7ss-005M	Benzo(b)fluoranthene	0.61	
LL7ss-005M	Dibenz(a,h)anthracene	0.06	
LL7ss-013M	Benz(a)anthracene	3.60	
LL7ss-013M	Benzo(a)pyrene	2.90	
LL7ss-013M	Benzo(b)fluoranthene	3.40	
LL7ss-013M	Dibenz(a,h)anthracene	0.46	
LL7ss-013M	Indeno(1,2,3-cd)pyrene	1.00	
LL7ss-014M	RDX	45.00	
LL7ss-023M	Benzo(a)pyrene	0.03	J
LL7ss-032M	Benzo(a)pyrene	0.09	

Figure I-2. Historical Sampling and Organic Exceedance Locations at Load Line 7

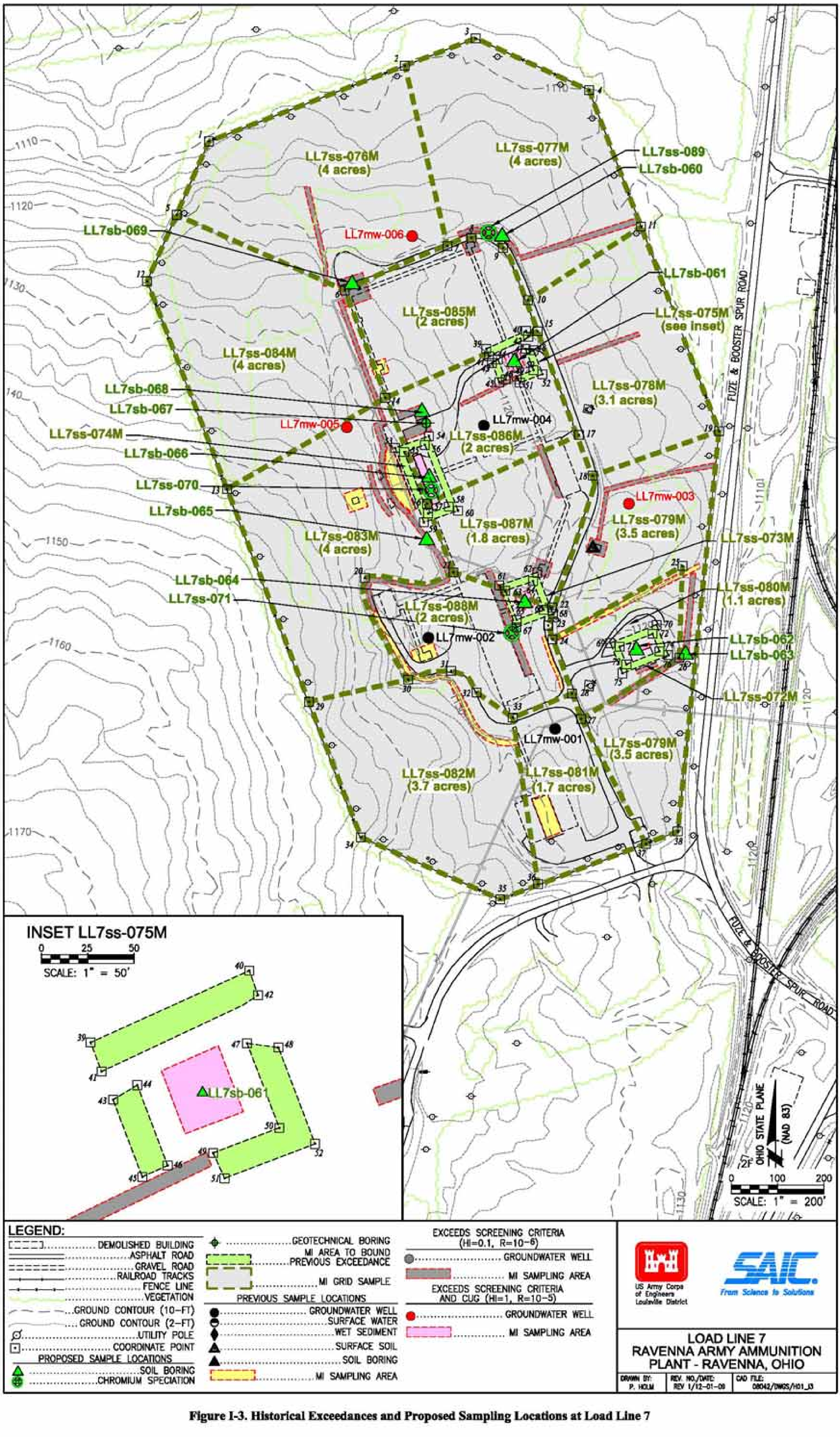


Figure I-3. Historical Exceedances and Proposed Sampling Locations at Load Line 7

APPENDIX J

Load Line 8 (RVAAP-41)

J.0 LOAD LINE 8 (RVAAP-41)

J.1 AOC DESCRIPTION

Load Line 8 is a 44-acre AOC that operated as a booster loading and assembly line from 1941 to 1945 (Figure J-1). Operations were discontinued at the end of World War II and the process equipment was removed in 1945. The AOC consisted of 15 process buildings, which have since been removed. Load Line 8 has not been used since 1945 and is currently overgrown by trees and scrub vegetation.

J.2 PREVIOUS INVESTIGATIONS

Since 1978, Load Line 8 has been the subject of various investigations and assessments. The 1978 Installation Assessment conducted by USATHAMA concluded that Load Line 8 was contaminated with explosive waste. In the late 1980s, as part of RCRA Facility Assessment, the USEPA conducted a Preliminary Review and Visual Site Inspection. Details of this investigation are unknown (MKM 2007a).

Load Line 8 was part of the Preliminary Assessment Screening of Boundary Load Line Areas conducted by USAEHA and reported in 1994. Two RRSEs have been conducted by USACHPPM at Load Line 8. The most recent report indicated that groundwater, sediment and surface soil were potential media for contaminant migration. As a result of the investigations, the AOC was scored a “Medium” priority site (USACHPPM 1998).

From October 2004 to May 2005 as part of the Final Characterization of 14 AOCs at RVAAP the following field activities were conducted at Load Line 8:

- Collection of 18 MI surface soil (0 to 1 ft) samples;
- Collection of six wet sediment samples from sanitary sewer locations;
- Collection of six wet sediment MI samples (to depths varying from 0.1 ft to 1 ft) from ditches;
- Collection of 11 surface water samples from sewer and basement locations;
- Collection of six surface water samples from ditches;
- Installation and sampling of six shallow groundwater monitoring wells;
- Collection of geotechnical samples from monitoring well borings, and
- Well slug tests.

The results of this investigation concluded that there were contaminants above screening criteria (e.g., USEPA Region 9 PRGs and RVAAP background values) in all environmental media sampled (MKM 2007a).

In August 2007, USACE conducted an investigation of the surface soil (0-1 ft) under the former building slabs and foundations. Twelve former building footprints were sampled utilizing MI sampling techniques. All soil samples were analyzed for TAL metals and explosives. Fifteen percent of the building footprints (three) were analyzed for VOCs, SVOCs, PCBs, pesticides and herbicides. Data from the investigation were not available at the time this SAP Addendum was finalized. If available, the data will be included in the RI Report and the need for any additional sampling will be assessed.

For this SAP Addendum, all sample results were compared to the preliminary RVAAP facility-wide screening criteria (Section 3.2.2 of the FSP). Table J-1 lists the chemicals that exceeded screening criteria in each medium, as well as the maximum and minimum concentration detected.

Figures J-1 and J-2 illustrate the type and location of historical samples and identify samples that exceeded screening criteria for metals and organics, respectively.

Table J-1. Chemicals Exceeding Screening Criteria at Load Line 8

Medium	Analyte	Units	Frequency of Detection	Minimum Detect	Maximum Detect	Average Result[a]	Screening Criteria[b]
Surface Soil	Chromium	mg/kg	21/21	14	39	26	17.4
	Manganese	mg/kg	21/21	380	2400	815	1450
	Benzo(a)pyrene	mg/kg	3/3	0.04	0.12	0.08	0.022
Subsurface Soil	Not sampled	--	--	--	--	--	--
Wet Sediment	Benzo(a)pyrene	mg/kg	1/2	0.092	0.092	0.0678	0.022
Surface Water	Nitrate	mg/L	3/7	0.06	2200	314	25
	Manganese	mg/L	7/ 7	0.061	2.100	0.60	0.63
	Bis(2-ethylhexyl)phthalate	mg/L	1/ 7	0.016	0.016	0.0086	0.0035
Groundwater	Antimony	mg/L	3/6	0.00370	0.0068	0.00426	0.00039
	Manganese	mg/L	6/6	0.16000	1.8000	0.62500	1.02 (unconsolidated)

-- Not applicable.
[a]Average result equals the sum of the concentrations divided by the number of samples; the average includes non-detects at half the reporting limit and field duplicate samples. This can result in an average less than the range of detected values.
[b]Screening criteria are based on HI=0.1 and Target Risk=10^{-6}.

During previous investigations, surface soil samples have been collected at the 0-0.5 ft and 0-1 ft intervals at Load Line 8. Table J-2 summarizes the historical surface soil sampling conducted at Load Line 8, and indicates whether sample results exceeded screening criteria.

Table J-2. Load Line 8 Historical Soil Sampling Summary

Sample Location	Sample Number	Depth of Sample (ft bgs)	Analysis Performed				
			Metals	Explosives	VOCs	Pesticides/ PCBs	SVOCs
LL8ss-001M	LL8ss-001M-SO	0.0- 1.0	Cr	N	--	--	--
LL8ss-002M	LL8ss-002M-SO	0.0- 0.5	Cr	N	--	--	--
LL8ss-003M	LL8ss-003M-SO	0.0- 0.5	Y	N	--	--	--
LL8ss-004M	LL8ss-004M-SO	0.0- 1.0	N	N	--	--	--
LL8ss-005D	LL8ss-005D-DUP	0.0- 0.5	--	--	N	--	--
	LL8ss-005D-SO	0.0- 0.5	--	--	N	--	--
LL8ss-005M	LL8ss-005M-DUP	0.0- 0.5	**Y**	N	--	N	**Y**
	LL8ss-005M-SO	0.0- 0.5	**Y**	N	--	N	**Y**
LL8ss-006M	LL8ss-006M-SO	0.0- 1.0	Cr	N	--	--	--
LL8ss-007M	LL8ss-007M-SO	0.0- 1.0	Cr	N	--	--	--
LL8ss-008M	LL8ss-008M-SO	0.0- 1.0	Cr	N	--	--	--
LL8ss-009M	LL8ss-009M-SO	0.0- 0.5	**Y**	N	--	--	--
LL8ss-010M	LL8ss-010M-DUP	0.0- 1.0	Cr	N	--	--	--
	LL8ss-010M-SO	0.0- 1.0	Cr	N	--	--	--
LL8ss-011M	LL8ss-011M-SS	0.0- 1.0	Cr	N	--	--	--
LL8ss-012M	LL8ss-012M-SS	0.0- 0.5	Cr	N	--	--	--
LL8ss-013M	LL8ss-013M-QA	0.0- 1.0	Cr	N	--	--	--
	LL8ss-013M-SS	0.0- 1.0	Cr	N	--	--	--
LL8ss-014M	LL8ss-014M-SO	0.0- 1.0	Cr	N	--	--	--
LL8ss-015D	LL8ss-015D-SO	0.0- 1.0	--	--	N	--	--
LL8ss-015M	LL8ss-015M-SO	0.0- 1.0	Cr	N	--	N	**Y**
LL8ss-016M	LL8ss-016M-SO	0.0- 1.0	Cr	N	--	--	--
LL8ss-017M	LL8ss-017M-SO	0.0- 1.0	Cr	N	--	--	--
LL8ss-018M	LL8ss-018M-SO	0.0- 1.0	Cr	N	--	--	--
LL8ss-019	LL8ss-019-SO	0.0- 1.0	--	--	N	--	--

Y = Analyte(s) greater than screening criteria.
Cr = Only chromium greater than screening criterion.
N = Non-detect or less than screening criteria.
-- = Analysis not performed.
Only PAHs were detected above screening criteria in the SVOC analysis.

J.3 PROPOSED SAP ADDENDUM CHARACTERIZATION ACTIVITIES

The objective of this SAP Addendum for Load Line 8 is to define the nature and extent of chemicals at concentrations greater than the screening criteria. To accomplish this further sampling and analysis of: metals and PAHs in soil; nitrates, metals, and SVOCs in surface water; and SVOCs in wet sediment will be conducted. Current chemical concentrations in groundwater will also be evaluated. In addition, since previous sample coverage was biased to operational areas and likely contaminant accumulation points, such as ditches. Portions of Load Line 8 between former operations buildings lack adequate sample coverage. The area outside the former operational complex to the AOC boundary fence generally has not been characterized. Visual surveys and surface soil MI samples are planned for these areas to complete the characterization of the AOC.

Table J-3 summarizes the chemicals that exceeded screening criteria and CUGs for each medium, the types and quantities of samples to be collected during the implementation of this SAP Addendum, and the rationale behind the proposed samples. The general approach for investigation activities is presented in Section 3.2 of the FSP. Figure J-3 illustrates the locations of the samples to be collected, as well as previous screening criteria and CUG exceedances.

Table J-4 presents the coordinates for the proposed sampling locations for this AOC. The locations may be altered during implementation of this SAP Addendum for a variety of reasons (e.g., soil boring refusal and MEC avoidance). The final coordinates of the sample locations (including elevations) will be presented in the RI Report.

Table J-3. Summary of Sampling at Load Line 8

Medium	Historical Sample Type	Historical Screening Criteria Exceedances	Number of SAP Addendum Sample Locations	Rationale for SAP Addendum Field Activities
Surface soil	MI	Mn **LL8ss-003M, 005M, 009M** SVOCs LL8ss-005M, 015M	19	Three boundary MI areas are planned around former MI areas LL8ss-003M, ss-005, and ss-009 to further define the lateral extent of metals greater than the screening criteria and CUGs and PAHs greater than screening criteria that may indicate potential sources. Sixteen additional MI samples are planned to further characterize the AOC with respect to the occurrence of chemicals above screening levels. These include four MI samples (nominal 2-acre grid) within the former operational area, one MI sample area around former Buildings 2B-9 and 2B-10 in the northeastern portion of the former operational area, two MI sample areas in the ditches outside the former operational area, and nine MI samples (nominal 4-acre grid) in former non-operational portions of the AOC. Samples will be analyzed for TAL metals, explosives, and PAHs; 15% RVAAP full suite.
	Cr speciation	Cr LL8ss-001M, 002M, 003M, 005M, 006M, 007M, 008M, 009M, 010M, 011M, 012M, 013M, 014M, 015M, 016M, 017M, 018M	3	Discrete surface soil samples will be collected at previous locations LL8ss-003M (39 mg/kg – previous maximum concentration of total chromium), ss-008M (19 mg/kg) and ss-017M (22 mg/kg). Refer to Section 4.1.3 of the FSP for a discussion about chromium speciation sampling.
Subsurface soil	None collected.	N/A	8	Eight boring locations are planned to further define the vertical extent of metals and PAHs. These include four within former MI areas where chemicals were greater than screening criteria (LL8ss-001M, ss-007M, ss-014M, and ss-015M), three within MI areas where chemicals were detected above both screening criteria and CUGs (LL8ss-003M, ss-005M, and ss-009M), and one between former buildings 2B9 and 2B10 (not previously investigated). Samples will be analyzed for TAL metals, explosives and PAHs; 15% RVAAP full suite.
	Geotechnical (None collected)	NA	0	Geotechnical samples will be collected at Load Lines 7, 10, and 11. The soil type is considered to be representative of Load Line 8.

Table J-3. Summary of Sampling at Load Line 8 (continued)

Medium	Historical Sample Type	Historical Screening Criteria Exceedances	Number of SAP Addendum Sample Locations	Rationale for SAP Addendum Field Activities
Surface water	Discrete	Nitrate **LL8sw-013** Mn LL8sw-014, 015 SVOCs LL8sw-015	3	Three surface water and co-located composite wet sediment samples will be collected to characterize current conditions and/or assess potential exit pathways from the AOC. One sample will be collected from each of the main drainage ditches near the former operational areas, and one sample will be collected at the drainage ditch exit point at the southwest boundary. No previous facility-wide samples have been collected along this conveyance. Surface water samples will be analyzed for the RVAAP full suite analysis and nitrate. Composite wet sediment samples will be analyzed for explosives, TAL metals, and SVOCs. The RVAAP full suite of parameters will be analyzed for 15% of the composite wet sediment samples.
Wet sediment	MI	SVOCs LL8sd-001M	3	Refer to surface water above.
Groundwater	Discrete	Sb LL8mw-002, **003**, 004 Mn **LL8mw-005** Tl **LL8mw-001**	0	No additional groundwater sampling is proposed. All six groundwater wells at Load Line 8 wells are currently being sampled under the FWGWMP. Four quarters of sampling will be completed in April 2010. No additional groundwater sampling is required for completion of the FS.

Bold indicates locations where concentration also exceeded the CUG (HI=1.0, Target Risk=10^{-5}) for the identified chemical.

Table J-4. Coordinates for Proposed Sampling Locations at Load Line 8

Sample Location ID	Coordinate Point	Sample Type	Easting	Northing
LL8ss-071M	19	MI	2351201.7554	551845.9066
	75	MI	2351156.6630	551960.5578
	76	MI	2351218.2967	551989.6573
	77	MI	2351175.7594	551952.9861
	78	MI	2351210.1167	551969.2074
	79	MI	2351209.6980	551866.6944
	80	MI	2351243.2075	551883.5543
	81	MI	2351262.1024	551876.2694
LL8ss-072M	55	MI	2351001.1407	552298.2486
	56	MI	2351065.3039	552322.1449
	57	MI	2351020.8091	552289.5672
	58	MI	2351056.8477	552302.9891
	59	MI	2351089.3899	552119.3183
	60	MI	2351124.5172	552134.9594
	61	MI	2351081.2865	552099.2904
	62	MI	2351143.8363	552127.1417
LL8ss-073M	63	MI	2351260.4355	552398.4102
	64	MI	2351328.1662	552420.0635
	65	MI	2351280.1935	552388.9789
	66	MI	2351319.2423	552401.4626
	67	MI	2351330.9415	552216.9788
	68	MI	2351344.9229	552222.4121
	69	MI	2351348.6991	552171.2837
	70	MI	2351362.6805	552176.7170
	71	MI	2351386.4219	552115.6238
	72	MI	2351424.1880	552128.2340
	73	MI	2351377.6171	552096.8698
	74	MI	2351443.8136	552118.9729
LL8ss-074M	2	MI	2351078.9028	552711.6926
	3	MI	2351616.3650	552895.3540
	8	MI	2351171.9851	552393.3142
	9	MI	2351339.5971	552479.1626
	10	MI	2351501.1365	552560.3137
	11	MI	2351725.2793	552691.1019
LL8ss-075M	9	MI	2351339.5971	552479.1626
	10	MI	2351501.1365	552560.3137
	11	MI	2351725.2793	552691.1019
	13	MI	2351820.4465	552469.1342
	16	MI	2351500.9671	552055.0486
	17	MI	2351762.0825	552199.4956
	6	MI	2351033.7124	552244.2596
	7	MI	2351056.2087	552325.4593
	8	MI	2351171.9851	552393.3142

Table J-4. Coordinates for Proposed Sampling Locations at Load Line 8 (continued)

Sample Location ID	Coordinate Point	Sample Type	Easting	Northing
LL8ss-075M (continued)	12	MI	2351239.8413	552189.6221
	14	MI	2351225.7007	552076.5493
	19	MI	2351201.7554	551845.9066
	20	MI	2351457.9440	551955.2060
LL8ss-076M	51	MI	2351542.0099	552467.0337
	52	MI	2351629.4903	552501.6292
	53	MI	2351588.8359	552348.6263
	54	MI	2351676.3164	552383.2217
LL8ss-077M	13	MI	2351820.4465	552469.1342
	17	MI	2351762.0825	552199.4956
	28	MI	2351671.0824	551749.6577
	29	MI	2352038.8089	551912.6581
	82	MI	2351543.966	552079.0127
LL8ss-078M	27	MI	2351748.4273	551549.2387
	28	MI	2351671.0824	551749.6577
	29	MI	2352038.8089	551912.6581
	30	MI	2352173.4480	551569.5440
	31	MI	2352059.1876	551308.6758
LL8ss-079M	24	MI	2351442.1452	551559.0946
	26	MI	2351713.9048	551536.1499
	27	MI	2351748.4273	551549.2387
	31	MI	2352059.1876	551308.6758
	32	MI	2352012.6660	551202.4620
	33	MI	2351632.9099	551053.7756
LL8ss-080M	22	MI	2351063.5045	551174.0277
	23	MI	2351343.2617	551509.3059
	24	MI	2351442.1452	551559.0946
	33	MI	2351632.9099	551053.7756
	34	MI	2351442.6279	550979.2743
	35	MI	2351085.1590	551132.6490
LL8ss-081M	18	MI	2350842.3598	551736.8678
	19	MI	2351201.7554	551845.9066
	22	MI	2351063.5045	551174.0277
	23	MI	2351343.2617	551509.3059
LL8ss-082M	5	MI	2350649.7197	552227.1600
	6	MI	2351033.7124	552244.2596
	18	MI	2350842.3598	551736.8678
	19	MI	2351201.7554	551845.9066
LL8ss-083M	1	MI	2350760.6600	552604.9040
	2	MI	2351078.9028	552711.6926
	4	MI	2350625.4690	552288.8810
	5	MI	2350649.7197	552227.1600
	6	MI	2351033.7124	552244.2596

Table J-4. Coordinates for Proposed Sampling Locations at Load Line 8 (continued)

Sample Location ID	Coordinate Point	Sample Type	Easting	Northing
LL8ss-083M (continued)	8	MI	2351171.9851	552393.3142
	39	MI	2351156.8382	552445.1227
	46	MI	2351007.4497	552340.3023
	47	MI	2351165.1634	552416.6469
LL8ss-084M	8	MI	2351171.9851	552393.3142
	9	MI	2351339.5971	552479.1626
	12	MI	2351239.8413	552189.6221
	14	MI	2351225.7007	552076.5493
	15	MI	2351468.9873	552031.1713
	16	MI	2351500.9671	552055.0486
	20	MI	2351457.9440	551955.2060
LL8ss-086M	19	MI	2351201.7554	551845.9066
	20	MI	2351457.9440	551955.2060
	21	MI	2351474.1294	551703.5184
	23	MI	2351343.2617	551509.3059
	24	MI	2351442.1452	551559.0946
LL8ss-087M	15	MI	2351468.9873	552031.1713
	16	MI	2351500.9671	552055.0486
	20	MI	2351457.9440	551955.2060
	21	MI	2351474.1294	551703.5184
	24	MI	2351442.1452	551559.0946
	25	MI	2351638.4750	551549.7122
	26	MI	2351713.9048	551536.1499
	27	MI	2351748.4273	551549.2387
	28	MI	2351671.0824	551749.6577
	82	MI	2351543.966	552079.0127
LL8ss-088M	36	MI	2351600.2083	552705.5285
	37	MI	2351474.6484	552611.1028
	38	MI	2351309.3576	552517.4633
	39	MI	2351156.8382	552445.1227
	47	MI	2351165.1634	552416.6469
	48	MI	2351307.2352	552485.0027
	49	MI	2351463.6182	552576.5695
	50	MI	2351612.1663	552679.8303
LL8ss-089M	39	MI	2351156.8382	552445.1227
	40	MI	2351027.4186	552389.4219
	41	MI	2350971.2696	552311.8764
	42	MI	2351004.6928	552171.8204
	43	MI	2351135.7965	551874.1467
	44	MI	2351156.3646	551884.4261
	45	MI	2351008.1211	552216.2724
	46	MI	2351007.4497	552340.3023
	47	MI	2351165.1634	552416.6469

Table J-4. Coordinates for Proposed Sampling Locations at Load Line 8 (continued)

Sample Location ID	Coordinate Point	Sample Type	Easting	Northing
LL8sb-060	NA	Grab	2351608.6072	552418.4831
LL8sb-061	NA	Grab	2351637.0000	552203.0000
LL8sb-062	NA	Grab	2351319.3662	552348.0973
LL8sb-063	NA	Grab	2351309.2036	552130.0462
LL8sb-064	NA	Grab	2351074.2135	552207.5189
LL8sb-065	NA	Grab	2351209.2189	551917.4192
LL8sb-066	NA	Grab	2351335.0000	551684.0000
LL8sb-067	NA	Grab	2351431.0000	551413.0000
LL8sd-089	NA	Composite	2351088.5034	551175.2780
LL8sd-090	NA	Composite	2351294.3488	551488.9743
LL8sd-091	NA	Composite	2351201.4741	551617.9934
LL8ss-068	NA	Grab	2351353.9534	552256.7020
LL8ss-069	NA	Grab	2351232.9613	552143.4211
LL8ss-070	NA	Grab	2351152.1777	552046.7342
LL8sw-089	NA	Grab	2351088.5034	551175.2780
LL8sw-090	NA	Grab	2351294.3488	551488.9743
LL8sw-091	NA	Grab	2351201.4741	551617.9934

Surface Soil (0-1ft) - mg/kg			
Location	Constituent	Result	Qual
LL8ss-001M	Chromium	26.00	
LL8ss-002M	Chromium	36.00	
LL8ss-003M	Chromium	39.00	
LL8ss-003M	Manganese	2400.00	
LL8ss-005M	Chromium	36.00	
LL8ss-005M	Manganese	1800.00	
LL8ss-006M	Chromium	22.00	
LL8ss-007M	Chromium	22.00	
LL8ss-008M	Chromium	19.00	
LL8ss-009M	Chromium	34.00	
LL8ss-009M	Manganese	1700.00	
LL8ss-010M	Chromium	27.00	
LL8ss-011M	Chromium	25.00	
LL8ss-012M	Chromium	19.00	
LL8ss-013M	Chromium	20.00	
LL8ss-014M	Chromium	21.00	
LL8ss-015M	Chromium	23.00	
LL8ss-016M	Chromium	27.00	
LL8ss-017M	Chromium	22.00	
LL8ss-018M	Chromium	33.00	

Surface Water - mg/L			
Location	Constituent	Result	Qual
LL8sw-014	Manganese	2.1	
LL8sw-015	Manganese	1	

Groundwater - mg/L			
Location	Constituent	Result	Qual
LL8mw-001	Thallium	0.0022	=
LL8mw-002	Antimony	0.0037	=
LL8mw-003	Antimony	0.0068	=
LL8mw-004	Antimony	0.0038	=
LL8mw-005	Manganese	1.8	=

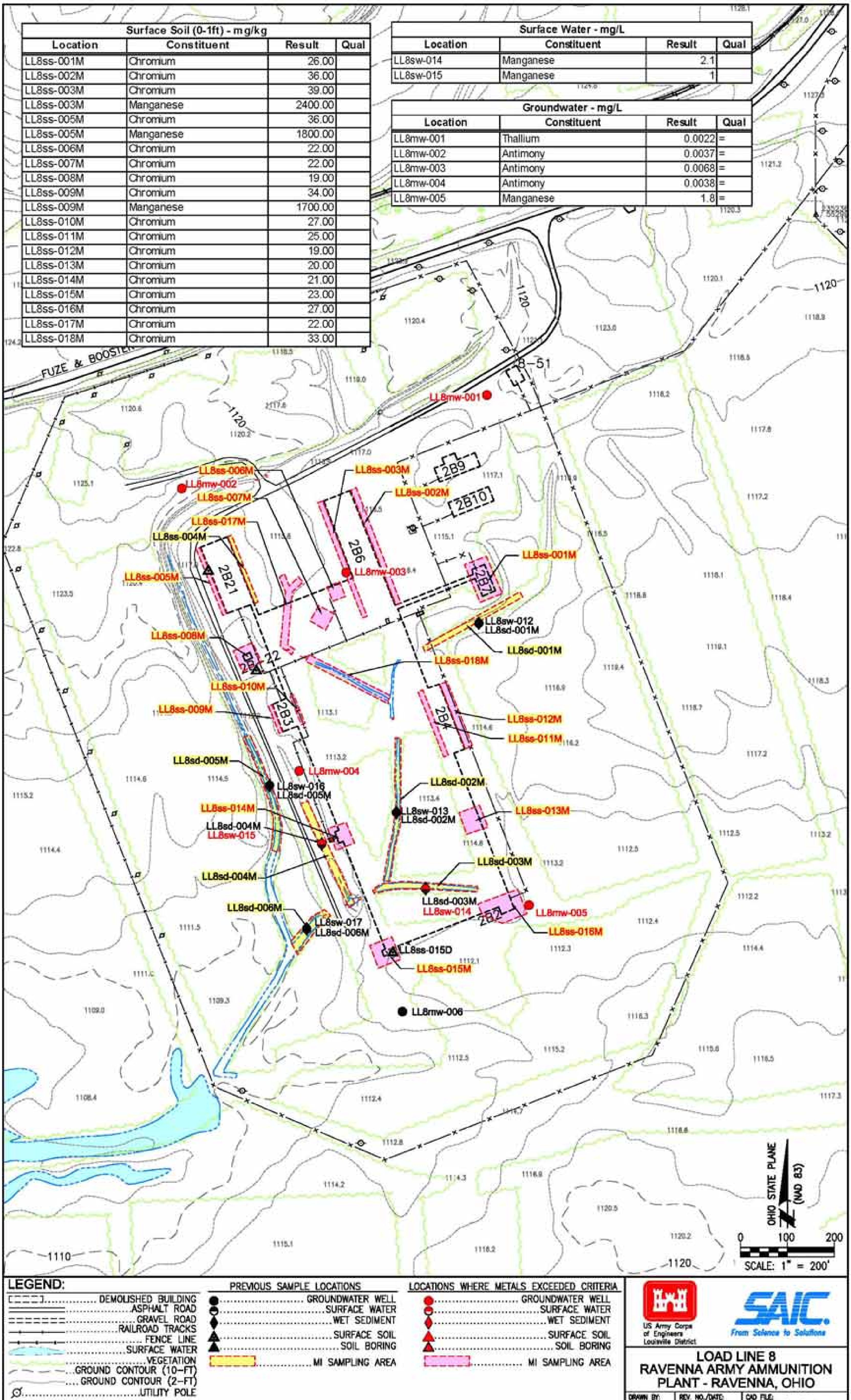


Figure J-1. Historical Sampling and Metal Exceedance Locations at Load Line 8

Surface Soil (0-1ft) - mg/kg			
Location	Constituent	Result	Qual
LL8ss-005M	Benzo(a)pyrene	0.12	
LL8ss-015M	Benzo(a)pyrene	0.04	

Wet Sediment - mg/kg			
Location	Constituent	Result	Qual
LL8sd-001M	Benzo(a)pyrene	0.092	J

Surface Water - mg/L			
Location	Constituent	Result	Qual
LL8sw-013	Nitrate	2200	
LL8sw-015	Bis(2-ethylhexyl)phthalate	0.016	

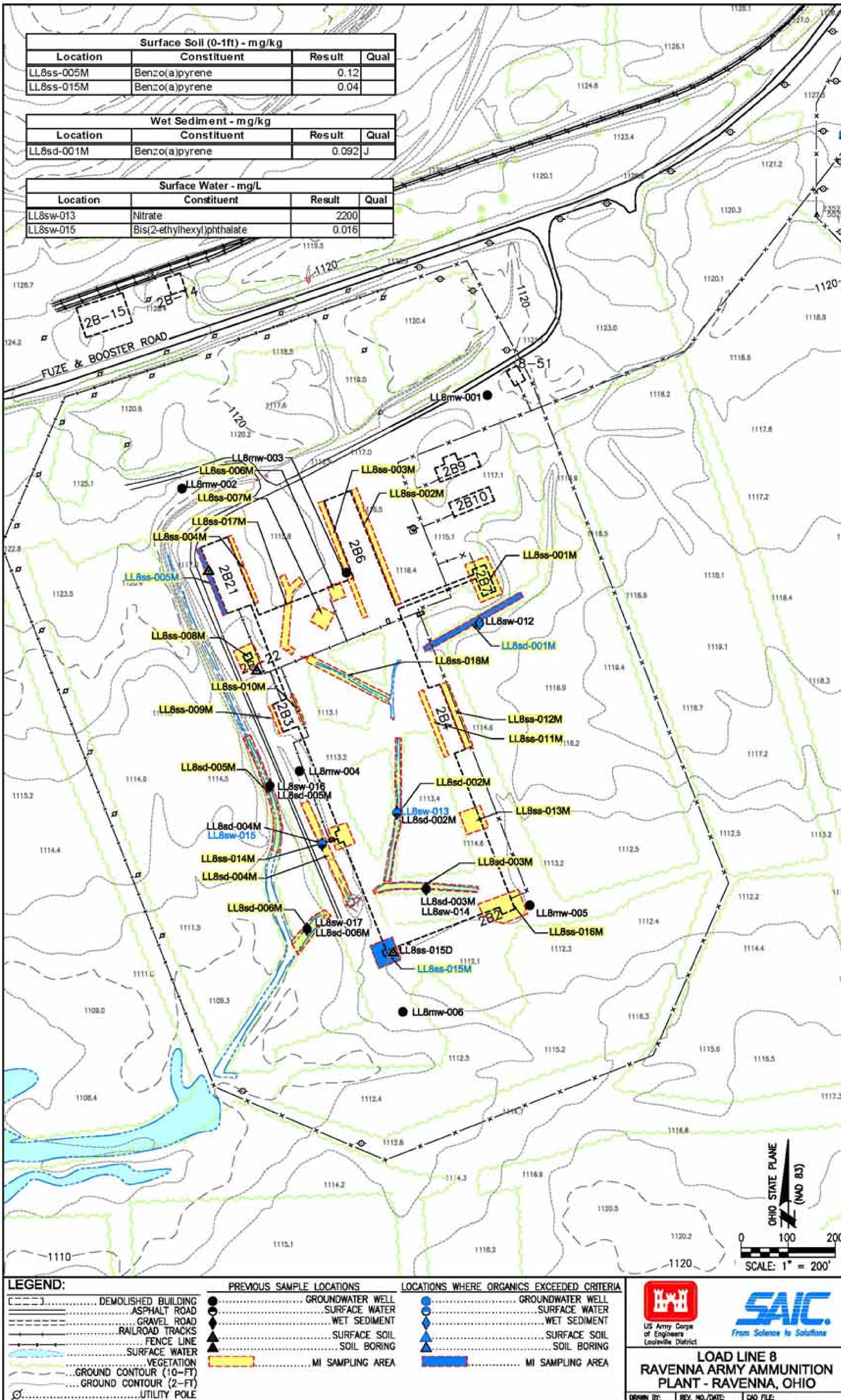


Figure J-2. Historical Sampling and Organic Exceedance Locations at Load Line 8

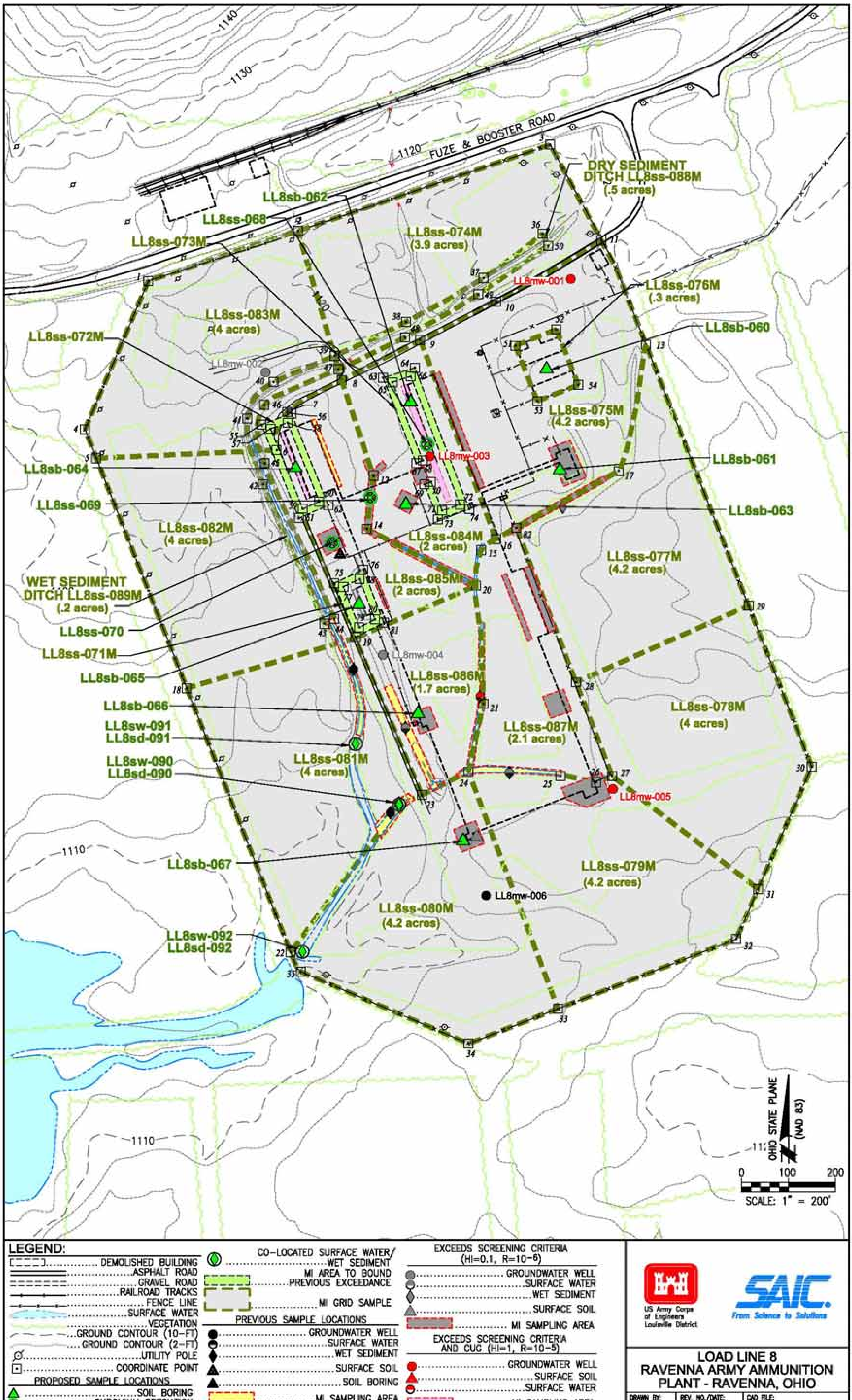


Figure J-3. Historical Exceedances and Proposed Sampling Locations at Load Line 8

APPENDIX K

Load Line 9 (RVAAP-42)

K.0 RVAAP-42 LOAD LINE 9

K.1 AOC DESCRIPTION

Load Line 9 is a 69-acre AOC located in the south-central portion of RVAAP (Figure K-1). From 1941 to 1945, Load Line 9 produced detonators. In 1945, the load line was deactivated and the equipment was removed. There have been no documented activities at Load Line 9 since 1945. Infrastructure at Load Line 9 consists mainly of a gravel road following the perimeter of the main production area and a drywell and vitrified clay sewer pipe (VSP) network. This system consists of two 6-inch VSP pipe lines that originate from former buildings DT-2 (fulminate mix house) and DT-5 (azide mix house) and run northeast where they converge at a 6-inch drywell (approximately 10 ft deep) located approximately 190 ft outside of the Load Line 9 fence line.

The buildings at Load Line 9 were thermally decontaminated and demolished to 2 ft below ground surface in 2003. The concrete and brick were crushed to maintain the roads at RVAAP. Between May 2006 and March 2007, Lakeshore Engineering Services, Inc removed 22 building floor slabs and foundations to a minimum depth of four ft below ground surface, and all remaining stream stanchions and unused utility poles. An unused water tower is the only structure remaining at Load Line 9.

K.2 PREVIOUS INVESTIGATIONS

Since 1978, various assessments and investigations have been conducted at RVAAP. In the 1998 RRSE, conducted by USACHPPM, Load Line 9 was scored as a "medium" priority site. This report indicated that groundwater and surface soil were potential media for contaminant migration (USACHPPM 1998).

An azide screening was performed at Load Line 9 in March 2002 by the Operation Support Command and USACE. The purpose of the screening was to evaluate the health and safety of future operations, as well as provide additional information for an RI. The screening indicated there were no detectable safety concerns related to azide contamination.

From October to December 2004 as part of a Phase I RI, the following field activities were conducted at Load Line 9:

- Collection of 40 surface soil (0 to 1 ft) samples;
- Collection of 53 subsurface soil samples (1 to 3 ft);
- Collection of eleven wet sediment (0 to 0.5 ft) samples and one sewer sediment sample;
- Collection of four surface water and two sump/sewer water samples;
- Installation and sampling of seven shallow groundwater monitoring wells;
- Collection of geotechnical samples from monitoring well borings; and
- Well slug tests.

The COPCs identified in this investigation report were multiple metals and SVOCs in soil, antimony and manganese in groundwater; multiple metals in surface water, and several metals in wet sediment (MKM 2007c).

For this SAP Addendum, all sample results were compared to the preliminary RVAAP facility-wide screening criteria (Section 3.2.2 of the FSP). Table K-1 lists the chemicals that exceeded screening criteria in each medium, as well as the maximum and minimum concentration detected.

Figures K-1 and K-2 illustrate the type and location of historical samples and identify samples that exceeded screening criteria for metals and organics, respectively.

Table K-1. Chemicals Exceeding Screening Criteria at Load Line 9

Medium	Analyte	Units	Frequency of Detection	Minimum Detect	Maximum Detect	Average Result[a]	Screening Criteria[b]
Surface Soil	Aluminum	mg/kg	60/60	5700	20000	9760	17700
	Arsenic	mg/kg	60/60	3.10	24.	11.40	15.4
	Chromium	mg/kg	60/60	8.10	110	15	17.4
	Cobalt	mg/kg	60/60	1.70	18	7.96	10.4
	Copper	mg/kg	60/60	6.40	1240	39.10	310
	Lead	mg/kg	60/60	9.20	1330	58.80	400
	Manganese	mg/kg	60/60	150	3800	620	1450
	Mercury	mg/kg	60/60	0.0057	882.00	15.30	2.3
	Benz(a)anthracene	mg/kg	7/9	0.0072	0.23	0.05	0.22
	Benzo(a)pyrene	mg/kg	7/9	0.0068	0.24	0.05	0.022
	Benzo(b)fluoranthene	mg/kg	7/9	0.0073	0.24	0.05	0.22
	Dibenz(a,h)anthracene	mg/kg	5/9	0.01	0.13	0.03	0.022
Subsurface Soil	Arsenic	mg/kg	45/45	3.4	32	12.4	19.8
	Chromium	mg/kg	45/45	4.70	54	14.20	27.2
	Mercury	mg/kg	45/45	0.01	9.70	0.28	2.3
	Thallium	mg/kg	2/45	0.33	1.00	0.23	0.91
	Benzo(a)pyrene	mg/kg	4/ 11	0.0061	0.05	0.01	0.022
	Dibenz(a,h)anthracene	mg/kg	3/11	0.0064	0.03	0.0055	0.022
Wet Sediment	Aluminum	mg/kg	16/16	5500	15600	11600	13900
	Chromium	mg/kg	16/16	6.3	22	15.5	18.1
	Mercury	mg/kg	16/16	0.026	2.9	0.406	2.3
	Benzo(a)pyrene	mg/kg	2/2	0.021	0.025	0.023	0.022
	Dibenz(a,h)anthracene	mg/kg	1/2	0.043	0.043	0.0224	0.022
Surface Water	Aluminum	mg/L	10/10	0.2430	17.8000	4.0900	15
	Arsenic	mg/L	6/10	0.0019	0.3510	0.0381	0.0032
	Chromium	mg/L	6/10	0.0033	0.0488	0.0129	0.025
	Lead	mg/L	9/10	0.0012	3.1500	0.5740	0.015
	Manganese	mg/L	10/10	0.0101	1.7400	0.6760	0.63
	Mercury	mg/L	9/10	0.000065	0.0219	0.0033	0.0044
Groundwater	Antimony	mg/L	5/7	0.00250	0.0040	0.00253	0.00039
	Cobalt	mg/L	2/7	0.011	0.034	0.00679	0.021
	Manganese	mg/L	7/7	0.01500	2.4000	0.55400	1.34 (bedrock)
	Bis(2-ethylhexyl)phthalate	mg/L	1/7	0.0043	0.0043	0.00226	0.0009

[a]Average result equals the sum of the concentrations divided by the number of samples; the average includes non-detects at half the reporting limit and field duplicate samples. This can result in an average less than the range of detected values.
[b]Screening criteria are based on HI=0.1 and Target Risk=10^{-6}.

During previous investigations, surface and subsurface soil sampling has been primarily accomplished at the 0-1 ft and 1-3 ft depth intervals. There are some instances in which samples have been collected at deeper depths (e.g., 8-10 ft). However, these samples were taken from soil borings for the installation of monitoring wells and samples were not collected at depth intervals between surface soil and the vadose zone. Table K-2 summarizes the historical surface and subsurface soil sampling conducted at Load Line 9 and indicates whether results exceeded screening criteria.

Table K-2. Load Line 9 Historical Soil Sampling Summary

Sample Location	Sample Number	Depth of Sample (ft bgs)	Analysis Performed					
			Metals	Explosives	VOCs	Pesticides/ PCBs	SVOCs	TPH
LL9ss/sb-001	LL9ss-001-0001-SO	0.0- 1.0	**Y**	N	--	--	--	--
	LL9sb-001-0001-SO	1.0- 3.0	N	N	--	--	--	--
LL9ss/sb-002	LL9ss-002-0001-SO	0.0- 1.0	N	--	--	--	--	--
	LL9sb-002-0001-SO	1.0- 3.0	N	--	--	--	--	--
LL9ss/sb-003	LL9ss-003-0001-SO	0.0- 1.0	**Y**	N	--	--	--	--
	LL9sb-003-0001-SO	1.0- 3.0	N	--	--	--	--	--
LL9ss/sb-004	LL9ss-004-0001-SO	0.0- 1.0	N	--	--	--	--	--
	LL9sb-004-0001-SO	1.0- 3.0	N	--	--	--	--	--
LL9ss/sb-005	LL9ss-005-0001-SO	0.0- 1.0	N	N	--	--	--	--
	LL9sb-005-0001-FD	1.0- 3.0	N	N	N	N	N	--
	LL9sb-005-0001-SO	1.0- 3.0	N	N	N	N	N	--
LL9ss/sb-006	LL9ss-006-0001-SO	0.0- 1.0	N	--	--	--	--	--
	LL9sb-006-0001-SO	1.0- 2.0	N	--	--	--	--	--
LL9ss/sb-007	LL9ss-007-0001-SO	0.0- 1.0	N	N	--	--	--	--
	LL9sb-007-0001-SO	1.0- 3.0	N	--	--	--	--	--
LL9ss/sb-008	LL9ss-008-0001-SO	0.0- 1.0	N	--	--	--	--	--
	LL9sb-008-0001-SO	1.0- 3.0	N	--	--	--	--	--
LL9ss/sb-009	LL9ss-009-0001-SO	0.0- 1.0	N	N	--	--	--	--
	LL9sb-009-0001-SO	1.0- 3.0	**Y**	--	--	--	--	--
LL9ss/sb-010	LL9ss-010-0001-SO	0.0- 1.0	N	--	--	--	--	--
	LL9sb-010-0001-SO	1.0- 2.5	**Y**	--	--	--	--	--
LL9ss-011	LL9ss-011-0001-SO	0.0- 1.0	**Y**	N	--	--	--	--
LL9ss/sb-012	LL9ss-012-0001-SO	0.0- 1.0	N	--	--	--	--	--
	LL9sb-012-0001-SO	1.0- 3.0	N	--	--	--	--	--
LL9ss/sb-013	LL9ss-013-0001-SO	0.0- 1.0	N	--	--	--	--	--
	LL9sb-013-0001-SO	1.0- 3.0	N	--	--	--	--	--
LL9ss/sb-014	LL9ss-014-0001-FD	0.0- 1.0	N	N	N	N	N	--
	LL9ss-014-0001-SO	0.0- 1.0	N	N	N	N	N	--
	LL9sb-014-0001-SO	1.0- 3.0	N	--	--	--	--	--
LL9ss/sb-015	LL9ss-015-0001-SO	0.0- 1.0	**Y**	--	--	--	--	--
	LL9sb-015-0001-SO	1.0- 3.0	N	--	--	--	--	--

Table K-2. Load Line 9 Historical Soil Sampling Summary (continued)

Sample Location	Sample Number	Depth of Sample (ft bgs)	Analysis Performed					
			Metals	Explosives	VOCs	Pesticides/ PCBs	SVOCs	TPH
LL9ss/sb-016	LL9ss-016-0001-FD	0.0- 1.0	N	--	--	--	--	--
	LL9ss-016-0001-SO	0.0- 1.0	N	--	--	--	--	--
	LL9sb-016-0001-SO	1.0- 3.0	N	--	--	--	--	--
LL9ss/sb-017	LL9ss-017-0001-SO	0.0- 1.0	N	--	--	--	--	--
	LL9sb-017-0001-SO	1.0- 3.0	N	--	--	--	--	--
LL9ss/sb-018	LL9ss-018-0001-SO	0.0- 1.0	N	--	--	--	--	--
	LL9sb-018-0001-SO	1.0- 3.0	N	--	--	--	--	--
LL9ss/sb-019	LL9ss-019-0001-SO	0.0- 1.0	**Y**	N	N	N	N	--
	LL9sb-019-0001-SO	1.0- 3.0	**Y**	--	--	--	--	--
LL9ss/sb-020	LL9ss-020-0001-SO	0.0- 1.0	N	--	--	--	--	--
	LL9sb-020-0001-SO	1.0- 3.0	N	--	--	--	--	--
LL9ss/sb-021	LL9ss-021-0001-SO	0.0- 1.0	**Y**	--	--	--	--	--
	LL9sb-021-0001-SO	1.0- 3.0	**Y**	--	--	--	--	--
LL9ss/sb-022	LL9ss-022-0001-FD	0.0- 1.0	N	--	--	--	--	--
	LL9ss-022-0001-SO	0.0- 1.0	N	--	--	--	--	--
	LL9sb-022-0001-SO	1.0- 3.0	N	--	--	--	--	--
LL9ss/sb-023	LL9ss-023-0001-SO	0.0- 1.0	**Y**	--	--	--	--	--
	LL9sb-023-0001-SO	1.0- 3.0	**Y**	--	--	--	--	--
LL9ss/sb-024	LL9ss-024-0001-SO	0.0- 1.0	**Cr**	--	--	--	--	--
	LL9sb-024-0001-SO	1.0- 3.0	**Cr**	--	--	--	--	--
LL9ss/sb-025	LL9ss-025-0001-SO	0.0- 1.0	N	N	N	N	**Y**	--
	LL9sb-025-0001-SO	1.0- 3.0	N	--	--	--	--	--
LL9ss/sb-026	LL9ss-026-0001-SO	0.0- 1.0	**Y**	--	--	--	--	--
	LL9sb-026-0001-SO	1.0- 3.0	N	--	--	--	--	--
LL9ss/sb-027	LL9ss-027-0001-SO	0.0- 1.0	**Y**	--	--	--	--	--
	LL9sb-027-0001-SO	1.0- 3.0	N	--	--	--	--	--
LL9ss/sb-028	LL9ss-028-0001-FD	0.0- 1.0	N	--	--	--	--	--
	LL9ss-028-0001-SO	0.0- 1.0	N	--	--	--	--	--
	LL9sb-028-0001-SO	1.0- 3.0	N	--	--	--	--	--
LL9ss/sb-029	LL9ss-029-0001-SO	0.0- 1.0	N	--	--	--	--	--
	LL9sb-029-0001-SO	1.0- 3.0	N	--	--	--	--	--
LL9ss/sb-030	LL9ss-030-0001-SO	0.0- 1.0	N	--	--	--	--	--
	LL9sb-030-0001-SO	1.0- 3.0	N	--	--	--	--	--
LL9ss/sb-031	LL9ss-031-0001-SO	0.0- 1.0	**Y**	--	--	--	--	--
	LL9sb-031-0001-SO	1.0- 3.0	N	N	--	--	--	--
LL9ss/sb-032	LL9ss-032-0001-SO	0.0- 1.0	N	--	--	--	--	--
	LL9sb-032-0001-SO	1.0- 3.0	N	N	N	N	**Y**	--
LL9ss-033	LL9ss-033-0001-SO	0.0- 1.0	**Y**	N	N	N	**Y**	--
LL9ss-034	LL9ss-034-0001-FD	0.0- 1.0	**Y**	N	N	N	**Y**	--
	LL9ss-034-0001-SO	0.0- 1.0	**Y**	N	N	N	**Y**	--
LL9ss-035	LL9ss-035-0001-SO	0.0- 1.0	N	N	--	--	--	--

Table K-2. Load Line 9 Historical Soil Sampling Summary (continued)

Sample Location	Sample Number	Depth of Sample (ft bgs)	Analysis Performed					
			Metals	Explosives	VOCs	Pesticides/ PCBs	SVOCs	TPH
LL9ss-036	LL9ss-036-0001-FD	0.0- 1.0	N	--	--	--	--	--
	LL9ss-036-0001-SO	0.0- 1.0	N	--	--	--	--	--
LL9ss-037	LL9ss-037-0001-SO	0.0- 1.0	**Y**	N	--	--	--	--
LL9ss-038	LL9ss-038-0001-SO	0.0- 1.0	**Y**	--	--	--	--	--
LL9ss-039	LL9ss-039-0001-FD	0.0- 1.0	N	N	--	--	--	--
	LL9ss-039-0001-SO	0.0- 1.0	N	N	--	--	--	--
LL9sb-040	LL9sb-040-0001-SO	6.0- 7.0	N	N	N	N	**Y**	--
LL9sb-041	LL9sb-041-0001-SO	6.5- 7.5	N	N	N	N	N	--
LL9ss/sb-042	LL9ss-042-0001-SO	0.0- 1.0	N	--	--	--	--	--
	LL9sb-042-0001-SO	8.0-10.0	N	--	--	--	--	--
LL9ss/sb-043	LL9ss-043-0001-SO	0.0- 1.0	N	--	--	--	--	--
	LL9sb-043-0001-FD	9.0-11.0	N	N	N	N	N	--
	LL9sb-043-0001-SO	9.0-11.0	**Y**	N	N	N	N	--
LL9ss/sb-044	LL9ss-044-0001-SO	0.0- 1.0	**Y**	--	--	--	--	--
	LL9sb-044-0001-SO	8.0-10.0	N	--	--	--	--	--
LL9ss/sb-045	LL9ss-045-0001-SO	0.0- 1.0	**Y**	--	--	--	--	--
	LL9sb-045-0001-SO	8.0-10.0	N	--	--	--	--	--
LL9ss/sb-046	LL9ss-046-0001-SO	0.0- 1.0	**Y**	--	--	--	--	--
	LL9sb-046-0001-SO	4.0- 6.0	N	--	--	--	--	--
LL9ss/sb-047	LL9ss-047-0001-SO	0.0- 1.0	N	--	--	--	--	--
	LL9sb-047-0001-SO	3.0- 5.0	N	--	--	--	--	--
LL9sb-048	LL9sb-048-0001-SO	0.0- 1.0	N	--	--	--	--	--
LL9sb-049	LL9sb-049-0001-SO	0.0- 1.0	**Cr**	--	--	--	--	--
LL9sb-050	LL9sb-050-0001-SO	0.0- 1.0	N	N	N	N	**Y**	--
LL9sb-051	LL9sb-051-0001-SO	0.0- 1.0	**Y**	--	--	--	--	--
LL9sb-052	LL9sb-052-0001-SO	0.0- 1.0	**Y**	--	--	--	--	--
LL9sb-053	LL9sb-053-0001-FD	0.0- 1.0	N	N	--	--	--	--
	LL9sb-053-0001-SO	0.0- 1.0	N	N	--	--	--	--
LL9sb-055	LL9sb-055-0001-SO	1.5- 3.5	**--**	--	N	--	N	N
LL9sb-056	LL9sb-056-0001-SO	2.0- 4.0	**--**	--	N	--	N	N
LL9sb-059	LL9sb-059-0001-SO	3.0- 5.0	**--**	--	N	--	**Y**	N
LL9sb-061	LL9sb-061-0001-SO	1.0- 3.0	**--**	--	N	--	N	N
LL9sb-065	LL9sb-065-0001-SO	3.0- 5.0	**Y**	--	--	--	--	--
LL9sb-066	LL9sb-066-0001-SO	5.0- 7.0	N	--	--	--	--	--
LL9ss-068	LL9ss-068-0001-SO	0.0- 1.0	N	N	N	N	**Y**	--
LL9sb-069	LL9sb-069-0001-SO	6.5- 7.5	N	--	--	--	--	--
LL9sb-070	LL9sb-070-0001-SO	6.0- 7.0	N	--	--	--	--	--

Y = Analyte(s) greater than screening criteria.
Cr = Only chromium greater than screening criteria.
N = Non-detect or less than screening criteria.
-- = Analysis not performed.
TPH = total petroleum hydrocarbons.
Only PAHs were detected above screening criteria in the SVOC analysis.

K.3 PROPOSED SAP ADDENDUM CHARACTERIZATION ACTIVITIES

The objective of this SAP Addendum for Load Line 9 is to define the nature and extent of chemicals at concentrations greater than the screening criteria. To accomplish this further sampling and analysis of metals and PAHs in soil, metals in surface water, and metals and PAHs in wet sediment will be conducted. In addition, current concentrations of chemicals in groundwater will be evaluated.

Table K-3 summarizes the chemicals that exceeded screening criteria and CUGs for each medium, the types and quantities of samples to be collected during the implementation of this SAP Addendum, and the rationale behind the proposed samples. All historical soil and wet sediment sampling at this AOC has been conducted using discrete sample methods; therefore, this addendum proposes discrete samples so that consistent sample types can be used in nature and extent evaluation and future risk management decisions. The general approach for investigation activities is presented in Section 3.2 of the FSP. Figure K-3 illustrates the locations of the samples to be collected as well as previous screening criteria and CUG exceedances.

Table K-4 presents the coordinates for the proposed sampling locations for this AOC. The locations may be altered during implementation of this SAP Addendum for a variety of reasons (e.g., soil boring refusal and MEC avoidance). The final coordinates of the sample locations (including elevations) will be presented in the RI Report.

Table K-3. Summary of Sampling at Load Line 9

Medium	Historical Sample Type	Historical Screening Criteria Exceedances[a]	Number of SAP Addendum Sample Locations	Rationale for SAP Addendum Field Activities
Surface soil	Discrete	Al LL9ss-023 As **LL9ss-001, 003, 011**, **015, 019, 021, 023, 044, 045, 046**, **LL9sb-051, 052** Co LL9ss-026, 027, 031, 033, 037, 038, 046 Cu LL9ss-011 Pb **LL9ss-011** Mn **LL9ss-027, 031** Hg **LL9ss-011**, 034 SVOCs LL9sb-050 LL9ss-025, 033, 034, **068**	13	A total of 13 surface soil locations are planned. Four are near former buildings not previously sampled and nine are placed to laterally bound an exceedance of multiple chemicals greater than screening criteria and/or a CUG at each location. Samples will be analyzed for explosives, TAL metals, and PAHs; 10% RVAAP full suite.
	Cr speciation	Cr LL9sb-049, 052 LL9ss-015, 021, 023, 024	3	Discrete surface soil samples will be at previous locations: LL9ss-049 (54 mg/kg), ss-021(18 mg/kg), and ss-024 (110 mg/kg). Refer to Section 4.1.3 of the FSP for a discussion about chromium speciation sampling.

Table K-3. Summary of Sampling at Load Line 9 (continued)

Medium	Historical Sample Type	Historical Screening Criteria Exceedances[a]	Number of SAP Addendum Sample Locations	Rationale for SAP Addendum Field Activities
Subsurface soil	Discrete	<u>As</u> **LL9sb-009, 010, 019, 021, 023** <u>Cr</u> LL9sb-024 <u>Hg</u> LL9sb-065 <u>Ti</u> LL9sb-043 <u>SVOCs</u> LL9sb-032, 040, 059	8	Eight boring locations are planned, including three within the area of the former drywell and VSP pipe network to the north and seven to define the vertical extent of chemicals in soil. There are ten previous soil sample locations (LL9sb-051, LL9sb-052, LL9ss-001, LL9ss-003, LL9ss-015, LL9ss-027 LL9ss-031, LL9ss-044, LL9ss-045. LL9ss-046) where sample results exceeded CUGs at the 0-1 ft interval and the 1-3 ft interval at the sample location or an adjacent subsurface boring at the 1-3 ft interval did not indicate chemicals greater than screening criteria. Additional surface soil samples were placed to define the lateral extent of these exceedances. Where no subsurface data was available to vertically bound CUG and/or screening criteria exceedance in surface soil (e.g., locations LL9ss-011, LL9ss-034 and LL9ss-068), a boring was placed down gradient of the sample location to define the lateral and vertical extent. There are three areas where multiple sample locations in close proximity exceed a CUG, in either one or both of the surface and subsurface soil sample. These groupings include the following: 1) LL9ss-019, LL9ss-046, and LL9sb-010; 2) LL9ss-021 and LL9ss-045, and 3) LL9ss-023, LL9sb-009, and LL9ss-044. These soil groupings are being further evaluated by the placement one boring in the vicinity or within representative soil. Samples will be analyzed for TAL metals, explosives, and PAHs; 10% RVAAP full suite.
	Geotechnical	NA	0	Geotechnical samples will be collected at Load Lines 7, 10, and 11. The soil type is considered to be representative of Load Line 9.

Table K-3. Summary of Sampling at Load Line 9 (continued)

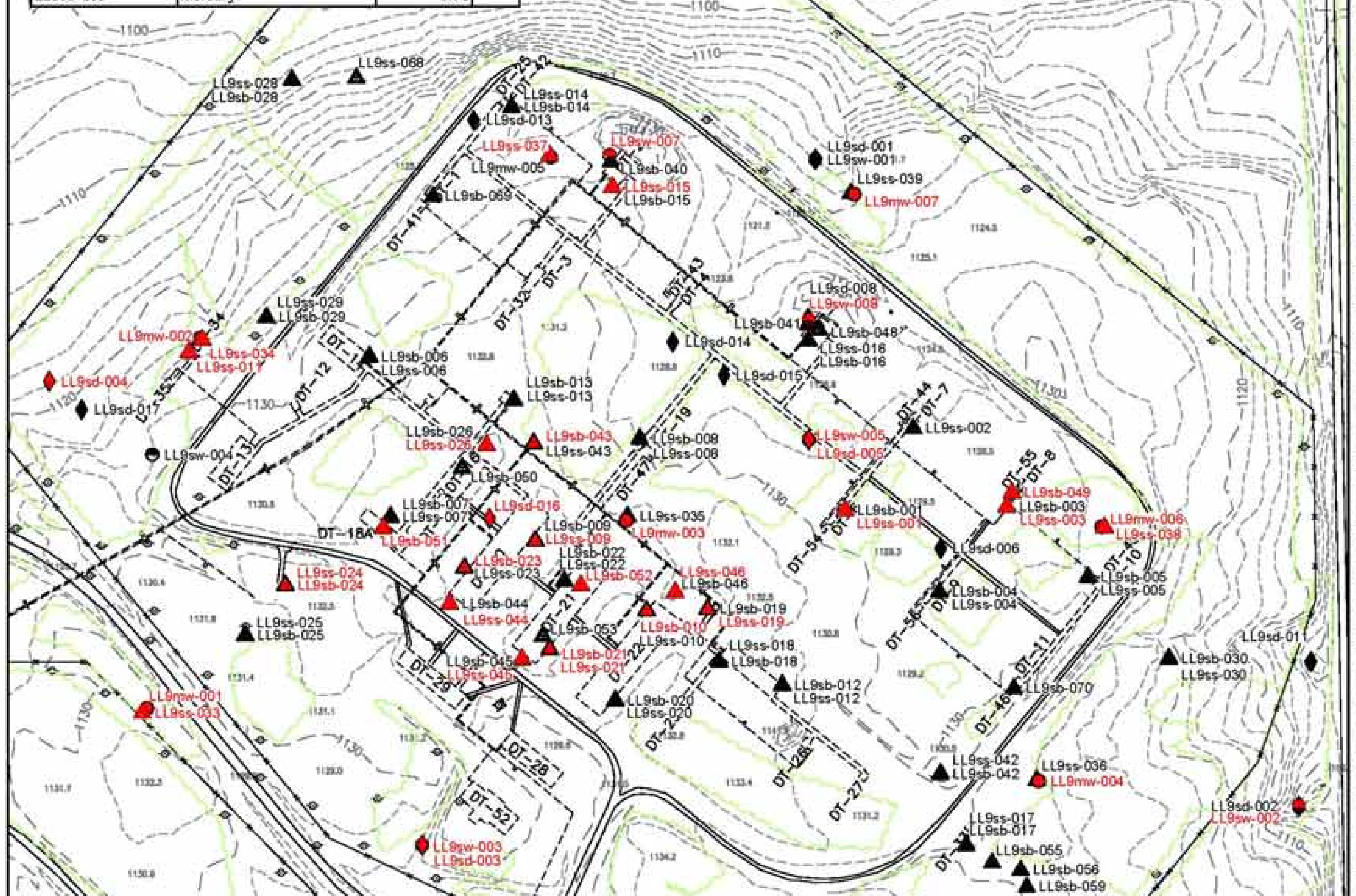
Medium	Historical Sample Type	Historical Screening Criteria Exceedances[a]	Number of SAP Addendum Sample Locations	Rationale for SAP Addendum Field Activities
Surface water	Discrete	<u>Al</u> LL9sw-005 <u>As</u> LL9sw-002, 003, 005, 007, 008 <u>Cr</u> LL9sw-007, 008 <u>Pb</u> LL9sw-003, 005, 007, 008 <u>Mn</u> LL9sw-002, 003 ,005, 007, 008 <u>Hg</u> LL9sw-007, 008	4	Four surface water and co-located composite wet sediment samples are planned to characterize current conditions at the AOC. Samples will be collected at four previous locations, including location LL9sd-016, where chromium was detected above the CUG for the National Guard Trainee, but less than the CUG for the Residential Subsistence Farmer. Surface water samples will be analyzed for the RVAAP full suite. Composite wet sediment samples will be analyzed for explosives, TAL metals, and SVOCs; 10% RVAAP full suite. Potential transport beyond the AOC boundary will be further assessed under the Fuze and Booster Hill sample locations (Section 3.2.5.3 of the FSP).
Wet sediment	Discrete	<u>Al</u> LL9sd-003, 004, 005 <u>Cr</u> LL9sd-003,005, 016 <u>Hg</u> LL9sd-012 <u>SVOCs</u> LL9sd-015	4	Refer to surface water above.
Groundwater	Discrete	<u>Sb</u> LL9mw-001, 002, **003**, 006, 007 <u>Co</u> LL9mw-004 <u>Mn</u> **LL9mw-004** <u>SVOCs</u> LL9mw-007	0	No additional groundwater sampling is proposed. All seven groundwater wells at Load Line 9 wells are currently being sampled under the FWGWMP. Four quarters of sampling will be completed by April 2010. No additional groundwater sampling is required for the completion of the FS.

Bold indicates locations where concentration also exceeded the CUG (HI=1.0, Target Risk=10^{-5}) for the identified chemical.

Table K-4. Coordinates for Proposed Sampling Locations at Load Line 9

Sample Location ID	Sample Type	Easting	Northing
LL9sb-087	Grab	2356497.1871	556203.1179
LL9sb-088	Grab	2356413.3996	556327.7097
LL9sb-089	Grab	2356717.8955	556290.9449
LL9sb-090	Grab	2355905.9258	556796.3323
LL9sb-091	Grab	2356646.2033	557139.5109
LL9sb-092	Grab	2356990.9404	556884.5561
LL9sb-093	Grab	2357120.7377	557463.9788
LL9sb-094	Grab	2356176.1089	557230.6663
LL9sd-111	Composite	2356979.5992	557060.4069
LL9sd-112	Composite	2356412.2110	556441.1334
LL9sd-113	Composite	2355834.6322	556536.1567
LL9sd-114	Composite	2356283.0424	555881.2117
LL9ss-095	Grab	2356541.9158	555733.5493
LL9ss-096	Grab	2356433.4203	556003.4472
LL9ss-097	Grab	2356487.8095	556077.9413
LL9ss-098	Grab	2356559.3741	556120.9187
LL9ss-099	Grab	2356324.6421	556195.4127
LL9ss-100	Grab	2356523.5324	556209.8205
LL9ss-101	Grab	2356086.5552	556338.4211
LL9ss-102	Grab	2356141.4366	556416.0301
LL9ss-103	Grab	2356001.1699	556593.6698
LL9ss-104	Grab	2356064.1468	556665.2987
LL9ss-105	Grab	2356464.9088	556897.3766
LL9ss-106	Grab	2356645.2518	556974.7358
LL9ss-107	Grab	2356888.1467	556389.6782
LL9ss-108	Grab	2357320.8220	556530.6364
LL9ss-109	Grab	2357298.0563	556491.5668
LL9ss-110	Grab	2356625.4283	557601.3404
LL9sw-111	Grab	2356979.5992	557060.4069
LL9sw-112	Grab	2356412.2110	556441.1334
LL9sw-113	Grab	2355834.6322	556536.1567
LL9sw-114	Grab	2356283.0424	555881.2117

Subsurface Soil (1-13ft) - mg/kg			
Location	Constituent	Result	Qual
LL9sb-009	Arsenic	22.00	=
LL9sb-010	Arsenic	22.00	=
LL9sb-019	Arsenic	32.00	=
LL9sb-021	Arsenic	26.00	=
LL9sb-023	Arsenic	24.00	=
LL9sb-024	Chromium	54.00	=
LL9sb-043	Thallium	1.00	J
LL9sb-065	Mercury	9.70	=



Groundwater - mg/L			
Location	Constituent	Result	Qual
LL9mw-001	Antimony	0.0032	J
LL9mw-002	Antimony	0.0028	J
LL9mw-003	Antimony	0.004	J
LL9mw-004	Cobalt	0.034	=
LL9mw-004	Manganese	2.4	=
LL9mw-006	Antimony	0.0025	J
LL9mw-007	Antimony	0.003	J

Surface Soil (0-1ft) - mg/kg			
Location	Constituent	Result	Qual
LL9sb-049	Chromium	24.00	=
LL9sb-051	Arsenic	18.00	=
LL9sb-052	Arsenic	16.00	=
LL9sb-052	Chromium	21.00	=
LL9ss-001	Arsenic	18.20	=
LL9ss-003	Arsenic	16.90	=
LL9ss-011	Arsenic	16.90	=
LL9ss-011	Copper	1240.00	=
LL9ss-011	Lead	1330.00	=
LL9ss-011	Mercury	882.00	=
LL9ss-015	Arsenic	24.00	=
LL9ss-015	Chromium	23.00	=
LL9ss-019	Arsenic	17.00	=
LL9ss-021	Arsenic	16.00	=
LL9ss-021	Chromium	18.00	=
LL9ss-023	Aluminum	20000.00	=
LL9ss-023	Arsenic	21.00	=
LL9ss-023	Chromium	21.00	=
LL9ss-024	Chromium	110.00	=
LL9ss-026	Cobalt	11.00	=
LL9ss-027	Cobalt	18.00	=
LL9ss-027	Manganese	3800.00	=
LL9ss-031	Cobalt	13.00	=
LL9ss-031	Manganese	2000.00	=
LL9ss-033	Cobalt	11.00	=
LL9ss-034	Mercury	17.00	=
LL9ss-037	Cobalt	17.00	=
LL9ss-038	Cobalt	14.00	=
LL9ss-044	Arsenic	18.00	=
LL9ss-045	Arsenic	17.00	=
LL9ss-046	Arsenic	18.00	=
LL9ss-046	Cobalt	11.00	=

Surface Water - mg/L			
Location	Constituent	Result	Qual
LL9sw-002	Arsenic	0.0043	=
LL9sw-002	Manganese	1.2	=
LL9sw-003	Arsenic	0.0099	=
LL9sw-003	Lead	0.07	=
LL9sw-003	Manganese	1.4	=
LL9sw-005	Aluminum	17.8	=
LL9sw-005	Arsenic	0.008	=
LL9sw-005	Lead	0.0629	=
LL9sw-005	Manganese	0.633	=
LL9sw-007	Arsenic	0.351	=
LL9sw-007	Chromium	0.0488	=
LL9sw-007	Lead	2	=
LL9sw-007	Manganese	1.74	=
LL9sw-007	Mercury	0.0219	=
LL9sw-008	Arsenic	0.0033	=
LL9sw-008	Chromium	0.0271	=
LL9sw-008	Lead	3.15	=
LL9sw-008	Manganese	0.802	=
LL9sw-008	Mercury	0.0077	=

Wet Sediment - mg/kg			
Location	Constituent	Result	Qual
LL9sd-003	Aluminum	15600.00	=
LL9sd-003	Chromium	20.60	=
LL9sd-004	Aluminum	14000.00	=
LL9sd-005	Aluminum	14500.00	=
LL9sd-005	Chromium	18.90	=
LL9sd-012	Mercury	2.90	=
LL9sd-016	Chromium	22.00	=

LEGEND:

DEMOLISHED BUILDING
ASPHALT ROAD
GRAVEL ROAD
RAILROAD TRACKS
FENCE LINE
SURFACE WATER
GROUND CONTOUR (10-FT)
GROUND CONTOUR (2-FT)
UTILITY POLE
DEMOLISHED STEAM LINE
VEGETATION

PREVIOUS SAMPLE LOCATIONS

GROUNDWATER WELL
SURFACE WATER
WET SEDIMENT
SURFACE SOIL
SOIL BORING

LOCATIONS WHERE METALS EXCEEDED CRITERIA

GROUNDWATER WELL
SURFACE WATER
WET SEDIMENT
SURFACE SOIL
SOIL BORING

OHIO STATE PLANE (NAD 83)

0 125 250 500

SCALE: 1" = 250'

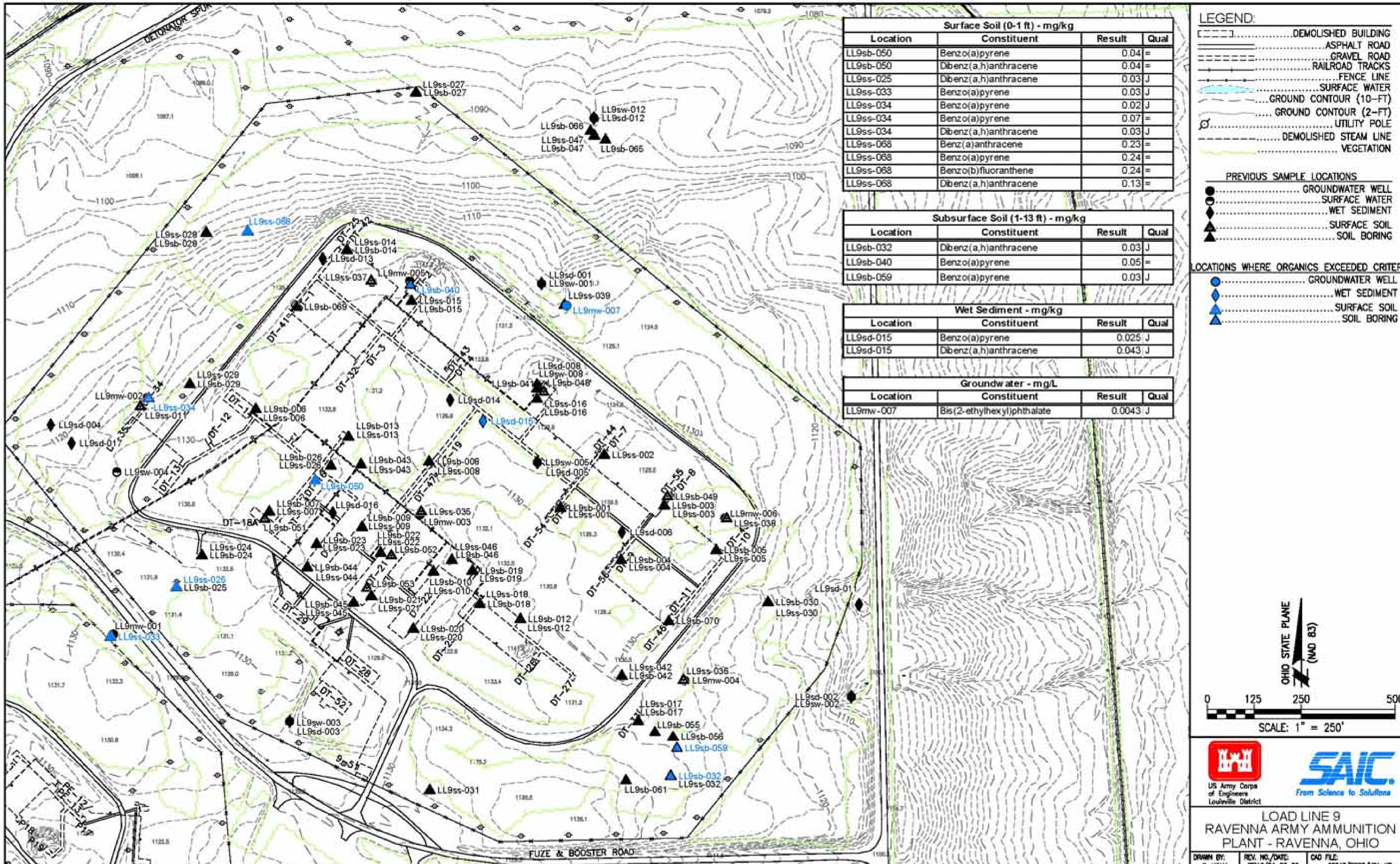
US Army Corps of Engineers Louisville District

SAIC. From Science to Solutions

LOAD LINE 9
RAVENNA ARMY AMMUNITION PLANT - RAVENNA, OHIO

DRAWN BY:	REV. NO./DATE:	CAD FILE:
P. HOLM	REV.0/04-27-09	08042/DWGS/H01_K1

Figure K-1. Historical Sampling and Metal Exceedance Locations at Load Line 9



Surface Soil (0-1 ft) - mg/kg			
Location	Constituent	Result	Qual
LL9sb-050	Benzo(a)pyrene	0.04	=
LL9sb-050	Dibenz(a,h)anthracene	0.04	=
LL9ss-025	Dibenz(a,h)anthracene	0.03	J
LL9ss-033	Benzo(a)pyrene	0.03	J
LL9ss-034	Benzo(a)pyrene	0.02	J
LL9ss-034	Benzo(a)pyrene	0.07	=
LL9ss-034	Dibenz(a,h)anthracene	0.03	J
LL9ss-068	Benz(a)anthracene	0.23	=
LL9ss-068	Benzo(a)pyrene	0.24	=
LL9ss-068	Benzo(b)fluoranthene	0.24	=
LL9ss-068	Dibenz(a,h)anthracene	0.13	=

Subsurface Soil (1-13 ft) - mg/kg			
Location	Constituent	Result	Qual
LL9sb-032	Dibenz(a,h)anthracene	0.03	J
LL9sb-040	Benzo(a)pyrene	0.05	=
LL9sb-059	Benzo(a)pyrene	0.03	J

Wet Sediment - mg/kg			
Location	Constituent	Result	Qual
LL9sd-015	Benzo(a)pyrene	0.025	J
LL9sd-015	Dibenz(a,h)anthracene	0.043	J

Groundwater - mg/L			
Location	Constituent	Result	Qual
LL9mw-007	Bis(2-ethylhexyl)phthalate	0.0043	J

Figure K-2. Historical Sampling and Organic Exceedance Locations at Load Line 9

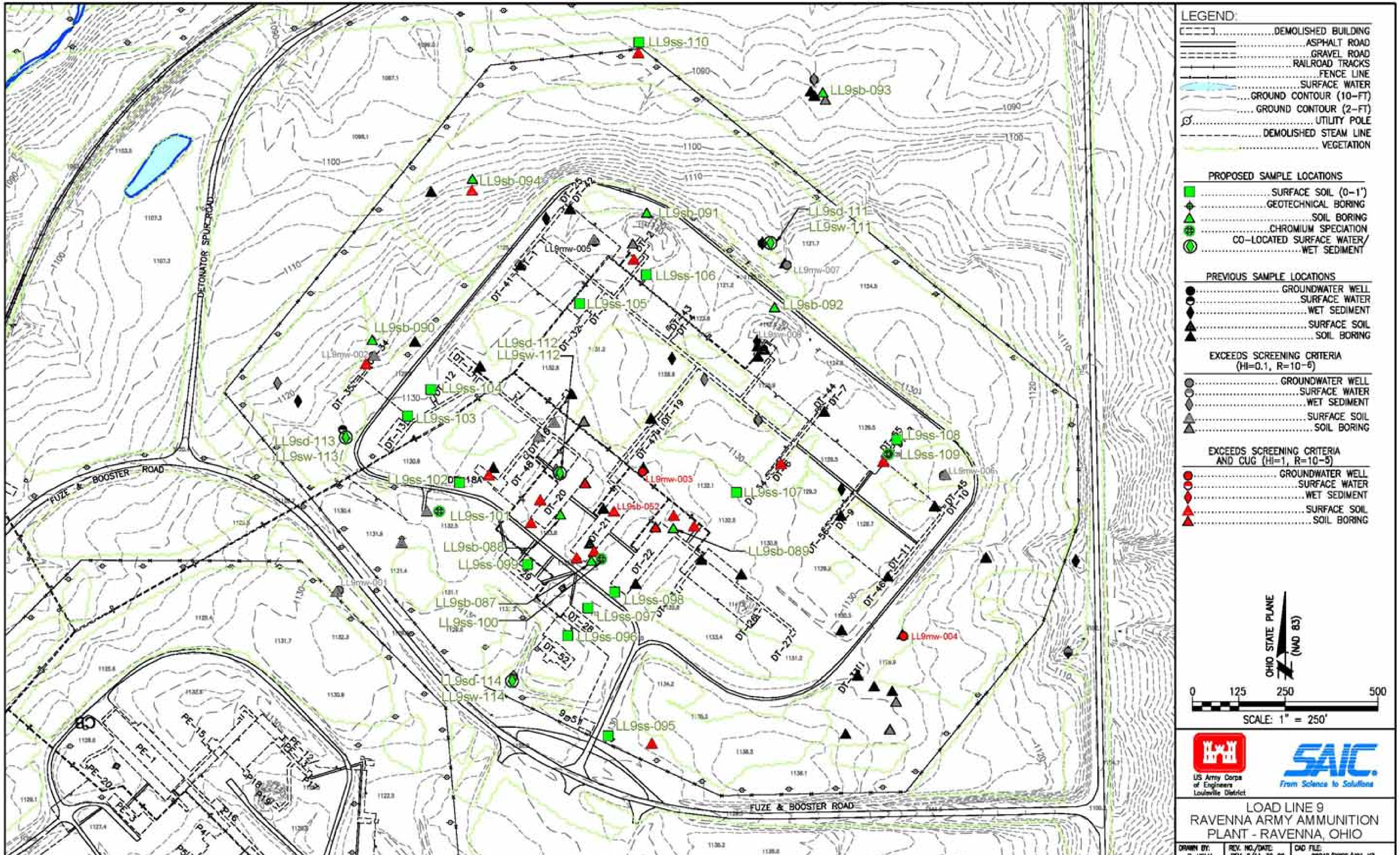


Figure K-3. Historical Exceedances and Proposed Sampling Locations at Load Line 9

APPENDIX L

Load Line 10 (RVAAP-43)

L.0 LOAD LINE 10 (RVAAP-43)

L.1 AOC DESCRIPTION

Load Line 10 is a 43-acre AOC, formerly known as the Percussion Element Manufacturing Line, which operated as an initiator blending and loading line from 1941 to 1945 (Figure L-1). At the end of World War II, the process equipment and production line was placed on standby status. The line was reactivated in 1951 and used to produce primers and percussion elements until it was again placed on standby status in 1956. The line was activated again in 1969 to produce primers until 1971 at which time the line was deactivated permanently and the production equipment removed. The AOC is currently overgrown by trees and scrub vegetation. The buildings, including slabs and foundations, have since been removed.

L.2 PREVIOUS INVESTIGATIONS

Since 1978, Load Line 10 has been the subject of various investigations and assessments. The 1978 Installation Assessment conducted by USATHAMA concluded that Load Line 10 was contaminated with explosive waste. In the late 1980s, as part of RCRA Facility Assessment, the USEPA conducted a Preliminary Review and Visual Site Inspection. Details of this investigation are unknown (MKM 2007a).

Load Line 10 was part of the Preliminary Assessment Screening of Boundary Load Line Areas conducted by USAEHA and reported in 1994. Two RRSEs have been conducted by USACHPPM at Load Line 10. The most recent report indicated that groundwater and surface soil were potential media for contaminant migration. As a result of the investigations, the AOC was scored a “Medium” priority site (USACHPPM 1998).

From October 2004 through May 2005 as part of the Final Characterization of 14 AOCs at RVAAP the following field activities were conducted at Load Line 10:

- Collection of 37 MI surface soil (0 to 1 ft) samples, 14 of which were collected from ditches;
- Collection of six sediment (0 to 0.5 ft) samples from sumps, basins, and sanitary sewers;
- Collection of 19 surface water samples from sumps, basins, sanitary sewers, and basements;
- Installation and sampling of six shallow groundwater monitoring wells;
- Collection of geotechnical samples from monitoring well borings; and
- Well slug tests.

The results of this investigation concluded that there were contaminants above screening criteria (e.g., USEPA Region 9 PRGs and RVAAP background values) in all environmental media sampled (MKM 2007a).

In August 2007, USACE conducted an investigation of the surface soil (0-1 ft) under the former building slabs and foundations. Twenty former building footprints were sampled utilizing MI sampling techniques. All soil samples were analyzed for TAL metals and explosives. Fifteen percent of the building footprints (three) were analyzed for VOCs, SVOCs, PCBs, pesticides and herbicides. Data from the investigation were not available at the time this SAP Addendum was finalized. If available, the data will be included in the RI Report and the need for any additional sampling will be assessed.

For this SAP Addendum, all sample results were compared to the preliminary RVAAP facility-wide screening criteria (Section 3.2.2 of the FSP). Table L-1 lists the chemicals that exceeded screening criteria in each medium, as well as the maximum and minimum concentration detected.

Figures L-1 and L-2 illustrate the type and location of historical samples and identify samples that exceeded screening criteria for metals and organics, respectively.

Table L-1. Chemicals Exceeding Screening Criteria at Load Line 10

Medium	Analyte	Units	Frequency of Detection	Minimum Detect	Maximum Detect	Average Result[a]	Screening Criteria[b]
Surface Soil	Aluminum	mg/kg	42/42	7000	22000	10900	17700
	Arsenic	mg/kg	42/42	4.90	18.00	11.80	15.4
	Chromium	mg/kg	42/42	12.00	33.00	20.10	17.4
	Cobalt	mg/kg	42/42	2.90	13.00	8.40	10.4
	Lead	mg/kg	42/42	15	430	54	400
	Benzo(a)pyrene	mg/kg	5/5	0.012	0.047	0.03	0.022
Subsurface Soil	Not sampled	--	--	--	--	--	--
Wet Sediment[c]	No exceedances	--	--	--	--	--	--
Surface Water[c]	No exceedances	--	--	--	--	--	--
Groundwater	Antimony	mg/L	1/6	0.00440	0.00440	0.00386	0.00039
	Thallium	mg/L	1/6	0.00150	0.00150	0.00192	0.000083
	2,4,6-Trinitrotoluene	mg/L	2/6	0.00017	0.0012	0.00035	0.00052
	Carbon tetrachloride	mg/L	2/6	0.0012	0.0016	0.0008	0.0002

-- Not applicable.

[a]Average result equals the sum of the concentrations divided by the number of samples; the average includes non-detects at half the reporting limit and field duplicate samples. This can result in an average less than the range of detected values.

[b]Screening criteria are based on HI=0.1 and Target Risk=10^{-6}.

[c]Wet sediment and surface water samples collected during the previous investigation were only associated with infrastructure (i.e., sumps and sewers) and not with ditches.

During previous investigations at Load Line 10 surface soil samples have been collected at the 0-1 ft interval. Table L-2 summarizes the historical surface soil sampling conducted at Load Line 10 and indicates whether sample results exceeded screening criteria.

Table L-2. Load Line 10 Historical Soil Sampling Summary

Sample Location	Sample Number	Depth of Sample (ft bgs)	Analysis Performed				
			Metals	Explosives	VOCs	Pesticides/ PCBs	SVOCs
L10ss-001M	L10ss-001M-SO	0.0- 1.0	N	N	--	--	--
L10ss-002M	L10ss-002M-SO	0.0- 1.0	**Y**	N	--	--	--
L10ss-003M	L10ss-003M-SO	0.0- 1.0	**Y**	N	--	--	--
L10ss-004M	L10ss-004M-SO	0.0- 1.0	Cr	N	--	--	--
L10ss-005M	L10ss-005M-DUP	0.0- 1.0	Cr	N	--	--	--
	L10ss-005M-SO	0.0- 1.0	Cr	N	--	--	--
L10ss-006M	L10ss-006M-SO	0.0- 1.0	Cr	N	--	--	--
L10ss-007M	L10ss-007M-SO	0.0- 1.0	Cr	N	--	--	--
L10ss-008M	L10ss-008M-SO	0.0- 1.0	Cr	N	--	--	--
L10ss-009M	L10ss-009M-SO	0.0- 1.0	Cr	N	--	--	--
L10ss-010D	L10ss-010D-SO	0.0- 1.0	--	--	N	--	--
L10ss-010M	L10ss-010M-SO	0.0- 1.0	N	N	--	N	**Y**
L10ss-011M	L10ss-011M-SO	0.0- 1.0	**Y**	N	--	--	--
L10ss-012M	L10ss-012M-SO	0.0- 1.0	Cr	N	--	--	--
L10ss-013M	L10ss-013M-QA	0.0- 1.0	Cr	N	--	--	--
	L10ss-013M-SO	0.0- 1.0	Cr	N	--	--	--
L10ss-014M	L10ss-014M-SO	0.0- 1.0	N	N	--	--	--
L10ss-015M	L10ss-015M-SO	0.0- 1.0	Cr	N	--	--	--
L10ss-016M	L10ss-016M-SO	0.0- 1.0	Cr	N	--	--	--
L10ss-017M	L10ss-017M-DUP	0.0- 1.0	N	N	--	--	--
	L10ss-017M-SO	0.0- 1.0	N	N	--	--	--
L10ss-018M	L10ss-018M-SO	0.0- 1.0	Cr	N	--	--	--
L10ss-019M	L10ss-019M-SO	0.0- 1.0	Cr	N	--	--	--
L10ss-020M	L10ss-020M-SO	0.0- 1.0	Cr	N	--	--	--
L10ss-021D	L10ss-021D-SO	0.0- 1.0	--	--	N	--	--
L10ss-021M	L10ss-021M-SO	0.0- 1.0	Cr	N		N	N
L10ss-022M	L10ss-022M-SO	0.0- 1.0	Cr	N	--	--	--
L10ss-023M	L10ss-023M-SO	0.0- 1.0	Cr	N	--	--	--
L10ss-024M	L10ss-024M-SO	0.0- 1.0	**Y**	N	--	--	--
L10ss-025M	L10ss-025M-SO	0.0- 1.0	Cr	N	--	--	--
L10ss-026M	L10ss-026M-SO	0.0- 1.0	Cr	N	--	--	--
L10ss-027D	L10ss-027D-SO	0.0- 1.0	--	--	N	--	--
L10ss-027M	L10ss-027M-DUP	0.0- 1.0	**Y**	N	--	N	**Y**
	L10ss-027M-SO	0.0- 1.0	**Y**	N	--	N	**Y**
L10ss-028M	L10ss-028M-SO	0.0- 1.0	Cr	N	--	--	--
L10ss-029M	L10ss-029M-SO	0.0- 1.0	Cr	N	--	--	--
L10ss-030M	L10ss-030M-QA	0.0- 1.0	**Y**	N	--	--	--
	L10ss-030M-SO	0.0- 1.0	**Y**	N	--	--	--
L10ss-031M	L10ss-031M-SO	0.0- 1.0	Cr	N	--	--	--
L10ss-032M	L10ss-032M-SO	0.0- 1.0	Cr	N	--	--	--
L10ss-033D	L10ss-033D-SO	0.0- 1.0	--	--	N	--	--
L10ss-033M	L10ss-033M-SO	0.0- 1.0	**Y**	N		N	N
L10ss-034M	L10ss-034M-SO	0.0- 1.0	**Y**	N	--	--	--
L10ss-035M	L10ss-035M-SO	0.0- 1.0	**Y**	N	--	--	--

Table L-2. Load Line 10 Historical Soil Sampling Summary (continued)

Sample Location	Sample Number	Depth of Sample (ft bgs)	Analysis Performed				
			Metals	Explosives	VOCs	Pesticides/ PCBs	SVOCs
L10ss-036M	L10ss-036M-SO	0.0- 1.0	Cr	N	--	--	--
L10ss-037	L10ss-037-DUP	0.0- 1.0	--	--	N	--	--
	L10ss-037-SO	0.0- 1.0	--	--	N	--	--
L10ss-038	L10ss-038-SO	0.0- 1.0	--	--	N	--	--
L10ss-039	L10ss-039-SO	0.0- 1.0	--	--	N	--	--
L10ss-040M	L10ss-040M-SO	0.0- 1.0	Cr	N	--	--	--

Y = Analyte(s) greater than screening criteria.
Cr = Only chromium greater than screening criterion.
N = Non-detect or less than screening criteria.
-- = Analysis not performed.
Only PAHs were detected above screening criteria in the SVOC analysis.

L.3 PROPOSED SAP ADDENDUM CHARACTERIZATION ACTIVITIES

The objective of this SAP Addendum for Load Line 10 is to define the nature and extent of chemicals at concentrations greater than the screening criteria. To accomplish this further sampling and analysis of metals and PAHs in soil will be conducted, surface water and wet sediment (if present) at the AOC exit point will be evaluated, and current concentrations of chemicals in groundwater will be evaluated. In addition, since previous sample coverage was biased to operational areas and likely contaminant accumulation points (such as ditches), portions of Load Line 10 between former operations buildings lack adequate sample coverage. The area outside the road encircling the former operational complex generally has not been characterized. Visual surveys and surface soil MI samples are planned for these areas to complete the characterization of these areas.

Table L-3 summarizes the chemicals that exceeded screening criteria and CUGs for each medium, the types and quantities of samples to be collected during the implementation of this SAP Addendum, and the rationale behind the proposed samples. The general approach for investigation activities is presented in Section 3.2 of the FSP. Figure L-3 illustrates the locations of the samples to be collected as well as previous screening criteria and CUG exceedances.

Table L-4 presents the coordinates for the proposed sampling locations for this AOC. The locations may be altered during implementation of this SAP Addendum for a variety of reasons (e.g., soil boring refusal and MEC avoidance). The final coordinates of the sample locations (including elevations) will be presented in the RI Report.

Table L-3. Summary of Sampling at Load Line 10

Medium	Historical Sample Type	Historical Screening Criteria Exceedances	Number of SAP Addendum Sample Locations	Rationale for SAP Addendum Field Activities
Surface soil	MI	Al L10ss-002M As **L10ss-011M, 028M, 030M** Co L10ss-024M, 027M, 033M, 034M, 035M Pb **L10ss-003M** SVOCs L10ss-010M, 027M	15	Three boundary MI areas are established around four former MI areas with chemicals exceeding screening criteria and CUGs to further define the lateral extent of contamination. In one case, one boundary MI area was used to define two MI areas (L10ss-011M and L10ss-030M). Twelve additional MI areas are planned to complete characterization of the AOC, including five MI samples (nominal 2-acre grid) within the former operational area, six MI samples (nominal 4-acre grid) within the non-operational portions of the AOC, and one MI sample within the ditch outside the former operational area. Samples will be analyzed for TAL metals, explosives and PAHs; 15% RVAAP full suite.
	Cr speciation	Cr LL10ss-003M, 004M, 005M, 006M, 007M, 008M, 009M, 011M, 012M, 013M, 015M, 016M, 018M, 019M, 020M, 021M, 022M, 023M, 024M, 025M, 026M, 027M, 028M, 029M, 030M, 031M, 032M, 033M, 034M, 036M, 040M	3	Discrete surface soil samples will be collected at previous locations: L10ss-007M (33 mg/kg – maximum previous concentration of total chromium), ss-040M (18 mg/kg) and ss-008M (26 mg/kg). Refer to Section 4.1.3 of the FSP for a discussion about chromium speciation sampling.
Subsurface soil	None collected	None collected	9	Nine boring locations are planned to further define the vertical extent of contamination. These include three in downgradient ditches with chemicals greater than screening criteria (L10ss-027M, ss-036M, and ss-040M), three in previous MI areas where chemicals were greater than screening criteria and CUGs (L10ss-003M, ss-011M, ss-028M, and ss-030M), two in previous MI areas with chemicals greater than screening criteria (L10ss-004M, ss-015M), and one in former MI area L10ss-014M. Samples will be analyzed for TAL metals, explosives and PAHs; 15% RVAAP full suite.
	Geotechnical	None previously collected	1	Two samples shall be collected from one location to provide soil data for modeling.

Table L-3. Summary of Sampling at Load Line 10 (continued)

Medium	Historical Sample Type	Historical Screening Criteria Exceedances	Number of SAP Addendum Sample Locations	Rationale for SAP Addendum Field Activities
Surface water	Discrete	None	1	One surface water and co-located composite wet sediment sample will be collected to characterize current conditions and assess a potential exit pathway from the AOC. The sample will be collected within the main ditch draining to southwest of the AOC. Surface water and the composite wet sediment sample will be analyzed for the RVAAP full suite of parameters.. Potential transport beyond the AOC boundary will be further assessed under the Fuze and Booster Hill sample locations (Section 3.2.5.3 of the FSP).
Wet sediment	MI	None	1	Refer to surface water above.
Groundwater	Discrete	<u>Sb</u> **L10mw-001** <u>Tl</u> **L10mw-001** <u>Explosives</u> L10mw-001 <u>VOCs</u> L10mw-001, 003	0	No additional groundwater sampling is proposed. All six groundwater monitoring wells at Load Line 10 wells are currently being sampled under the FWGWMP. Four quarters of sampling will be completed by April 2010. No additional groundwater sampling is required for completion of the FS.

Bold indicates locations where concentration also exceeded the CUG (H=1.0, Target Risk=10^{-5}) for the identified chemical.

Table L-4. Coordinates for Proposed Sampling Locations at Load Line 10

Sample Location ID	Coordinate Point	Sample Type	Easting	Northing
L10sb-066	NA	Grab	2355317.9046	555728.8161
L10sb-067	NA	Grab	2355489.1345	555805.0170
L10sb-068	NA	Grab	2355509.3446	555814.7901
L10sb-069	NA	Grab	2355473.6551	555713.5410
L10sb-070	NA	Grab	2355678.8494	555739.2118
L10sb-071	NA	Grab	2355535.5818	555384.5008
L10sb-072	NA	Grab	2355469.3094	555346.4930
L10sb-073	NA	Grab	2355397.0080	555418.2359
L10sb-074	NA	Grab	2355367.9806	555134.7083
L10sb-075	NA	Grab	2356078.8121	555274.5882
L10sd-094	NA	Composite	2355374.8540	554838.4348
L10ss-076	NA	Grab	2355563.3587	555659.2497
L10ss-077	NA	Grab	2355487.6770	555546.7158
L10ss-078	NA	Grab	2355342.4499	555112.9486
L10ss-079M	64	MI	2355451.2085	555549.4573
	65	MI	2355488.6176	555509.6951
	66	MI	2355478.3080	555499.6908
	67	MI	2355450.8202	555528.2356
	68	MI	2355261.0819	555365.9552
	69	MI	2355281.7284	555365.0354
	70	MI	2355308.1389	555334.5615
	71	MI	2355297.3570	555324.0989
L10ss-080M	40	MI	2355225.0367	555864.9989
	41	MI	2355169.9480	555813.3530
	42	MI	2355224.6801	555844.1036
	43	MI	2355191.4663	555812.9655
	44	MI	2355292.7090	555797.0713
	45	MI	2355284.3602	555788.7225
	46	MI	2355444.2792	555644.9291
	47	MI	2355400.0646	555602.7899
	48	MI	2355455.1813	555633.9859
	49	MI	2355399.6983	555581.8654
L10ss-081M	50	MI	2355618.0994	555867.0326
	51	MI	2355564.6500	555819.5220
	52	MI	2355616.5978	555845.6285
	53	MI	2355585.5819	555818.0588
	54	MI	2355642.4387	555751.1798
	55	MI	2355631.0104	555741.4641
	56	MI	2355730.3289	555734.8851
	57	MI	2355719.2797	555724.7231
	58	MI	2355820.7305	555644.0688
	59	MI	2355799.1277	555644.5088
	60	MI	2355763.8840	555620.7959

Table L-4. Coordinates for Proposed Sampling Locations at Load Line 10 (continued)

Sample Location ID	Coordinate Point	Sample Type	Easting	Northing
L10ss-081M (continued)	61	MI	2355768.4935	555616.1438
	62	MI	2355753.2286	555610.2383
	63	MI	2355768.0444	555595.2854
L10ss-082M	2	MI	2355410.4150	556205.3672
	3	MI	2355714.4450	556204.1590
	7	MI	2355415.5261	555961.7659
	8	MI	2355551.1804	555936.9390
	9	MI	2355662.6692	555850.4357
	10	MI	2355832.3761	555676.2901
	11	MI	2356068.4581	555846.3631
L10ss-083M	10	MI	2355832.3761	555676.2901
	11	MI	2356068.4581	555846.3631
	12	MI	2356103.9460	555810.4960
	15	MI	2355844.4824	555609.2033
	20	MI	2355771.8448	555357.0777
	26	MI	2355874.1978	555222.6291
	27	MI	2356169.1090	555054.3120
L10ss-084M	23	MI	2355505.5343	555080.1763
	24	MI	2355622.7175	555065.3599
	25	MI	2355811.4653	555135.1962
	26	MI	2355874.1978	555222.6291
	27	MI	2356169.1090	555054.3120
	29	MI	2355432.1318	554827.3555
	30	MI	2355939.9820	554826.0030
L10ss-085M	17	MI	2355181.2045	555392.3470
	21	MI	2354970.5739	555182.7102
	22	MI	2355374.8037	555167.2331
	23	MI	2355505.5343	555080.1763
	28	MI	2355232.2030	554827.8880
	29	MI	2355432.1318	554827.3555
L10ss-086M086M	4	MI	2354803.8620	555892.5034
	5	MI	2355046.6384	555695.3547
	13	MI	2354721.7050	555811.0510
	16	MI	2354720.9750	555521.2170
	17	MI	2355181.2045	555392.3470
	21	MI	2354970.5739	555182.7102
L10ss-087M	1	MI	2355120.5940	556206.5190
	2	MI	2355410.4150	556205.3672
	4	MI	2354803.8620	555892.5034
	5	MI	2355046.6384	555695.3547
	6	MI	2355201.8732	555855.9863
	7	MI	2355415.5261	555961.7659
L10ss-088M	5	MI	2355046.6384	555695.3547

Table L-4. Coordinates for Proposed Sampling Locations at Load Line 10 (continued)

Sample Location ID	Coordinate Point	Sample Type	Easting	Northing
L10ss-088M (continued)	6	MI	2355201.8732	555855.9863
	17	MI	2355181.2045	555392.3470
	18	MI	2355404.1139	555604.4338
L10ss-089M	6	MI	2355201.8732	555855.9863
	7	MI	2355415.5261	555961.7659
	8	MI	2355551.1804	555936.9390
	9	MI	2355662.6692	555850.4357
	14	MI	2355461.4803	555666.0292
	18	MI	2355404.1139	555604.4338
L10ss-090M	14	MI	2355461.4803	555666.0292
	17	MI	2355181.2045	555392.3470
	18	MI	2355404.1139	555604.4338
	19	MI	2355675.9942	555451.8594
	22	MI	2355374.8037	555167.2331
L10ss-091M	9	MI	2355662.6692	555850.4357
	10	MI	2355832.3761	555676.2901
	14	MI	2355461.4803	555666.0292
	15	MI	2355844.4824	555609.2033
	19	MI	2355675.9942	555451.8594
	20	MI	2355771.8448	555357.0777
L10ss-092M	19	MI	2355675.9942	555451.8594
	20	MI	2355771.8448	555357.0777
	22	MI	2355374.8037	555167.2331
	23	MI	2355505.5343	555080.1763
	24	MI	2355622.7175	555065.3599
	25	MI	2355811.4653	555135.1962
	26	MI	2355874.1978	555222.6291
L10ss-093M	31	MI	2356119.0630	555004.4447
	32	MI	2356135.6856	555021.0079
	33	MI	2356122.7814	555168.2186
	34	MI	2356087.0038	555336.9164
	35	MI	2356040.0457	555521.2551
	36	MI	2356022.1569	555520.1379
	37	MI	2356060.1706	555374.9014
	38	MI	2356098.1843	555208.4379
	39	MI	2356108.2508	555147.8116
L10sw-094	NA	Grab	2355374.8540	554838.4348

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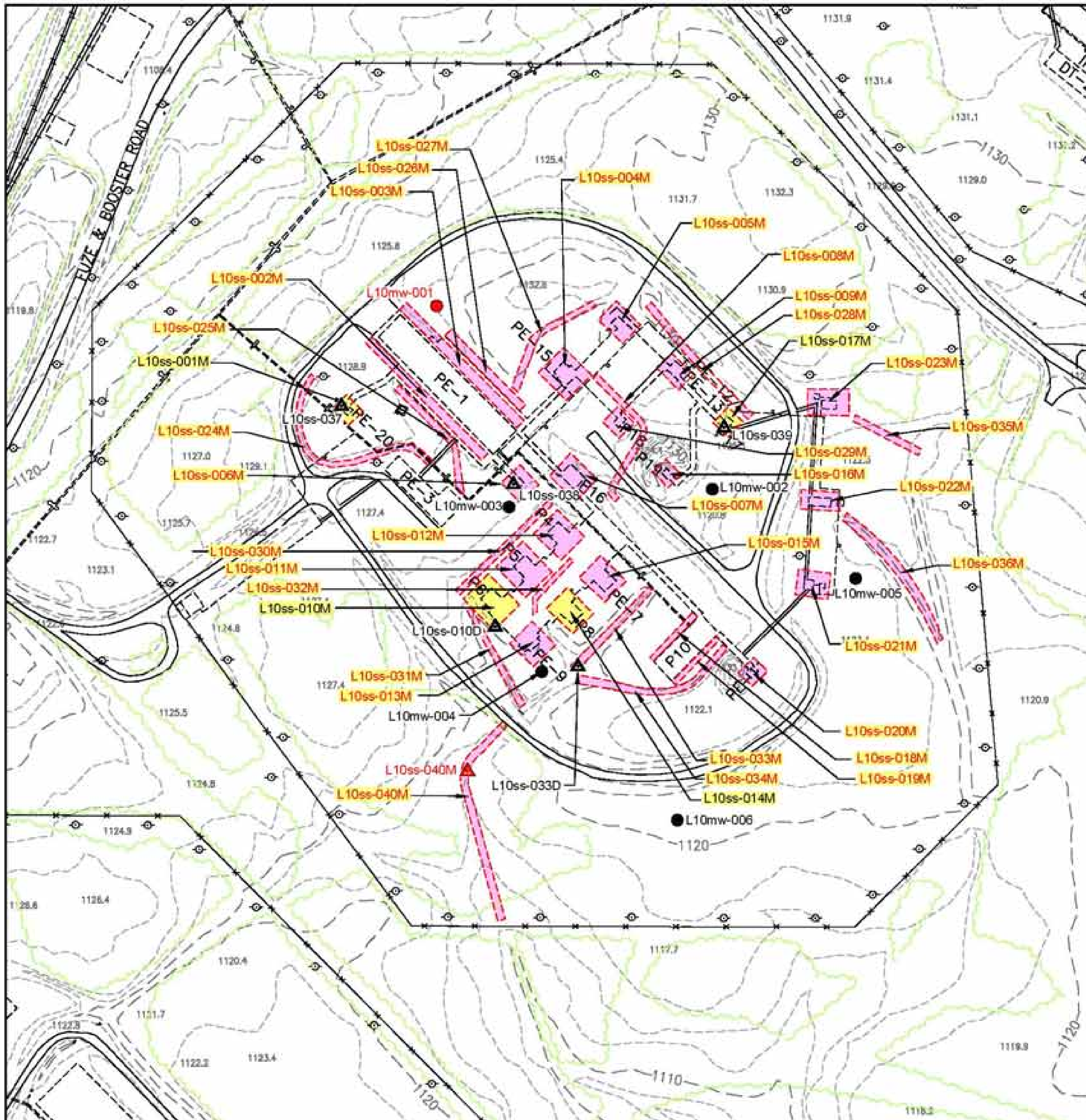


Surface Soil (0-1ft) - mg/kg			
Location	Constituent	Result	Qual
L10ss-002M	Aluminum	22000.00	
L10ss-003M	Chromium	21.00	
L10ss-003M	Lead	430.00	
L10ss-004M	Chromium	18.00	
L10ss-005M	Chromium	23.00	
L10ss-006M	Chromium	22.00	
L10ss-007M	Chromium	33.00	
L10ss-008M	Chromium	26.00	
L10ss-009M	Chromium	19.00	
L10ss-011M	Arsenic	18.00	
L10ss-011M	Chromium	19.00	
L10ss-012M	Chromium	19.00	
L10ss-013M	Chromium	23.00	
L10ss-015M	Chromium	29.00	
L10ss-016M	Chromium	22.00	
L10ss-018M	Chromium	21.00	
L10ss-019M	Chromium	27.00	
L10ss-020M	Chromium	19.00	
L10ss-021M	Chromium	22.00	
L10ss-022M	Chromium	19.00	
L10ss-023M	Chromium	24.00	
L10ss-024M	Chromium	19.00	
L10ss-024M	Cobalt	11.00	
L10ss-025M	Chromium	18.00	
L10ss-026M	Chromium	18.00	
L10ss-027M	Chromium	20.00	
L10ss-027M	Cobalt	13.00	
L10ss-028M	Arsenic	16.00	
L10ss-028M	Chromium	19.00	
L10ss-029M	Chromium	18.00	
L10ss-030M	Arsenic	16.00	
L10ss-030M	Chromium	20.00	
L10ss-031M	Chromium	19.00	
L10ss-032M	Chromium	18.00	
L10ss-033M	Chromium	24.00	
L10ss-033M	Cobalt	11.00	
L10ss-034M	Chromium	24.00	
L10ss-034M	Cobalt	11.00	
L10ss-035M	Cobalt	11.00	
L10ss-036M	Chromium	23.00	
L10ss-040M	Chromium	18.00	

Groundwater - mg/L			
Location	Constituent	Result	Qual
L10mw-001	Antimony	0.0044	
L10mw-001	Thallium	0.0015	

LEGEND:

DEMOLISHED BUILDING
ASPHALT ROAD
GRAVEL ROAD
RAILROAD TRACKS
FENCE LINE
SURFACE WATER
VEGETATION
GROUND CONTOUR (10-FT)
GROUND CONTOUR (2-FT)
UTILITY POLE
DEMOLISHED STEAM LINE

PREVIOUS SAMPLE LOCATIONS

GROUNDWATER WELL
SURFACE WATER
WET SEDIMENT
SURFACE SOIL
SOIL BORING
MI SAMPLING AREA

LOCATIONS WHERE METALS EXCEEDED CRITERIA

GROUNDWATER WELL
SURFACE WATER
WET SEDIMENT
SURFACE SOIL
SOIL BORING
MI SAMPLING AREA

OHIO STATE PLANE (NAD 83)

0 100 200 400

SCALE: 1" = 200'

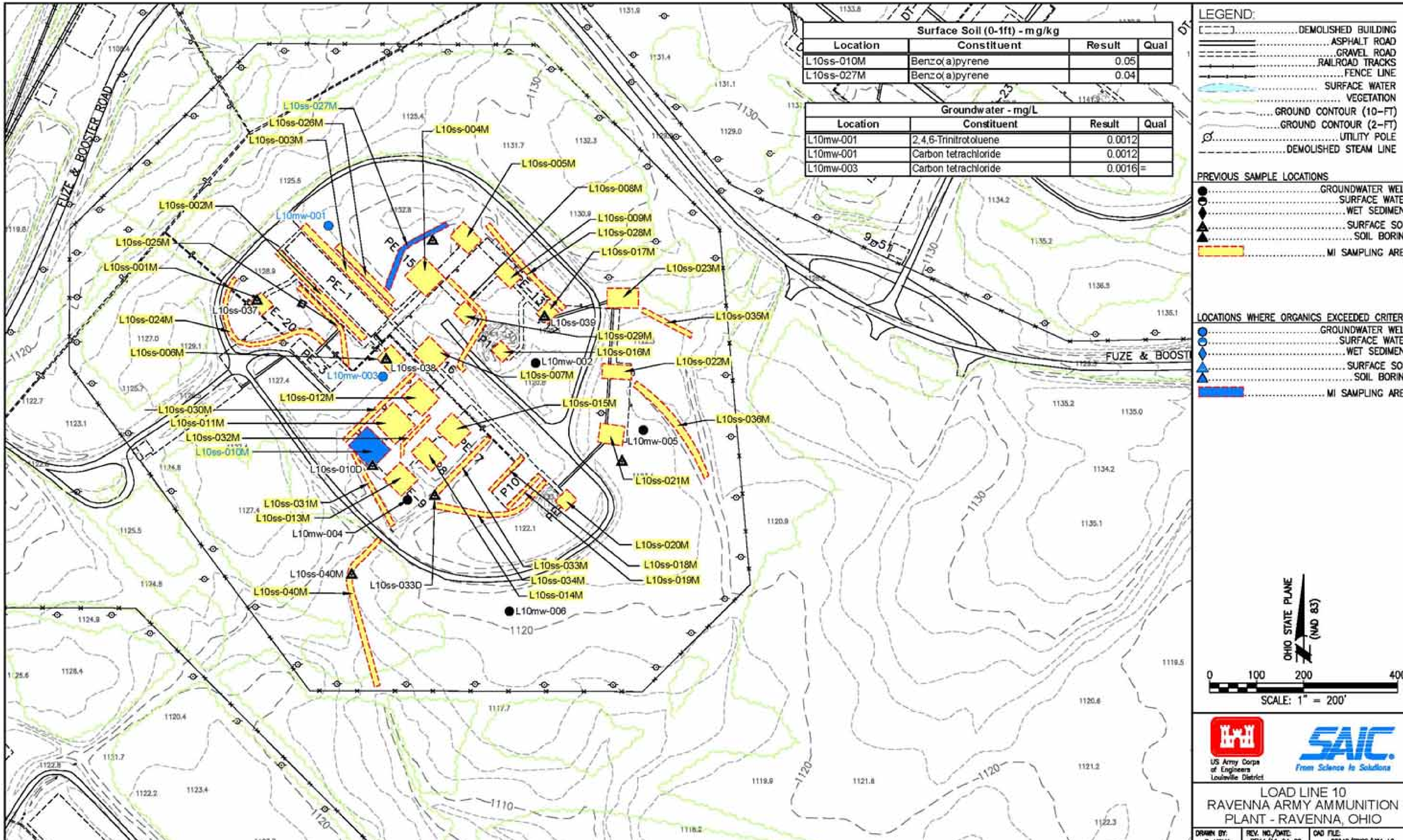
US Army Corps of Engineers Louisville District

SAIC. From Science to Solutions

LOAD LINE 10
RAVENNA ARMY AMMUNITION PLANT - RAVENNA, OHIO

DRAWN BY: P. HOLM | REV. NO./DATE: REV.1/11-24-09 | CAD FILE: 08042/DWGS/H01_L1

Figure L-1. Historical Sampling and Metal Exceedance Locations at Load Line 10



Surface Soil (0-1ft) - mg/kg			
Location	Constituent	Result	Qual
L10ss-010M	Benzo(a)pyrene	0.05	
L10ss-027M	Benzo(a)pyrene	0.04	

Groundwater - mg/L			
Location	Constituent	Result	Qual
L10mw-001	2,4,6-Trinitrotoluene	0.0012	
L10mw-001	Carbon tetrachloride	0.0012	
L10mw-003	Carbon tetrachloride	0.0016	=

Figure L-2. Historical Sampling and Organic Exceedance Locations at Load Line 10

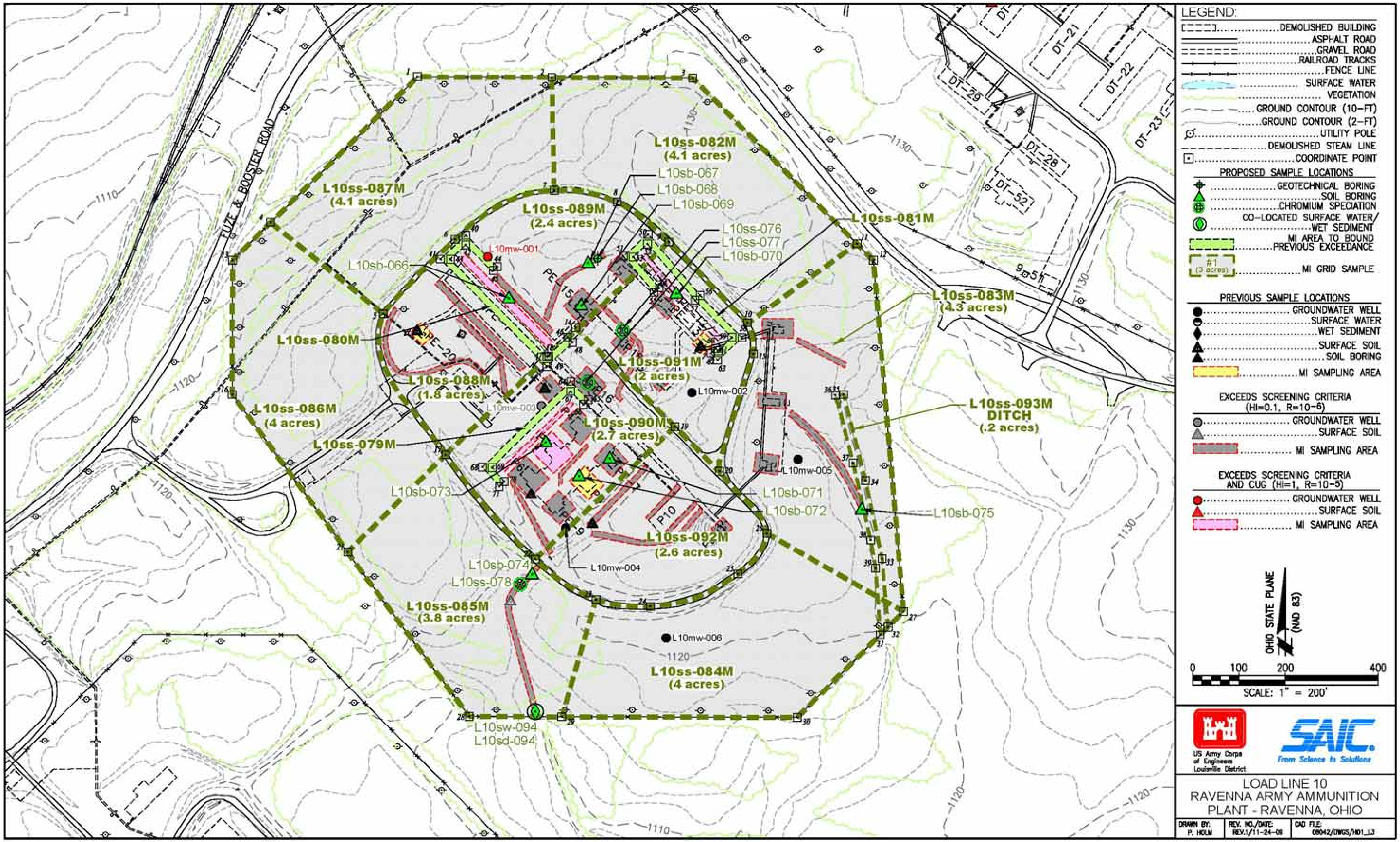


Figure L-3. Historical Exceedances and Proposed Locations at Load Line 10

APPENDIX M

Load Line 11 (RVAAP-44)

M.0 LOAD LINE 11 (RVAAP-44)

M.1 AOC DESCRIPTION

Load Line 11 is approximately 40 acres in size and was utilized primarily for the production of artillery primers and fuzes (Figure M-1). From 1941 to 1945, Load Line 11 operated at full capacity to produce primers for artillery projectiles. After being placed on standby status in 1945, the load line was reactivated twice, once during the 1951 to 1957 time frame to produce primers, and then again from 1969 to 1971 to produce fuzes in support of the Southeast Asia Conflict (MKM 2005). An interim remedial action at the AOC was conducted in 2001, consisting of removal of lead/asbestos-lined sumps, lead-contaminated sediment, and solvent-contaminated soil; additionally, some of the sewer lines were permanently plugged with grout. The buildings, including slabs and foundations, have since been demolished.

M.2 PREVIOUS INVESTIGATIONS

Since 1978, various investigations and assessments have been conducted at RVAAP that included Load Line 11. The USACHPPM conducted two RRSEs at RVAAP in 1996 and 1998. In the most recent report Load Line 11 was scored as a "High" risk site due groundwater, sediment, and soil as potential media of contaminant migration potentially impacting human and ecological receptors (USACHPPM 1998).

In June 2000 through March 2001, as part of a Phase I RI, the following field activities were conducted at Load Line 11:

- Collection of 30 surface soil (0 to 1 ft) samples (four of these were sub-floor borings);
- Collection of 27 subsurface soil (1 to 3 ft) samples;
- Collection of 46 at-depth subsurface soil samples, including ten for monitoring wells, three for geotechnical samples, eight for sewer soil, and five for sump soil;
- Collection of 21 ditch wet sediment (0 to 1 ft) samples;
- Collection of five sewer sediment samples;
- Collection of three sump sediment samples;
- Collection of four surface water samples;
- Collection of six sewer water samples;
- Collection of five sump water samples;
- Installation and sampling of ten shallow groundwater monitoring wells; and
- Collection of 50 confirmation samples (five from sumps, 34 from ditches, six from hot spots, and five from test pits).

During the Phase I RI field activities in 2001, contaminated soil and infrastructure was indentified resulting in an interim removal action. The Phase I RI concluded that there were contaminants above screening criteria (e.g., USEPA Region 9 PRGs and RVAAP background values) in all environmental media sampled. Findings of the Phase I RI indicated the need for an interim removal action to remove contaminated soil and infrastructure from the AOC; this action was completed in 2001. The majority of the exceedances and greater number of analyte detections occurred in the production areas of Load Line 11 (MKM 2005).

For this SAP Addendum, all sample results were compared to the preliminary RVAAP facility-wide screening criteria (Section 3.2.2 of the FSP). Table M-1 lists the chemicals that exceeded screening criteria in each medium, as well as the maximum and minimum concentration detected.

Figures M-1 and M-2 illustrate the type and location of historical samples and identify samples that exceeded screening criteria for metals and organics, respectively.

Table M-1. Chemicals Exceeding Screening Criteria at Load Line 11

Medium	Analyte	Units	Frequency of Detection	Minimum Detect	Maximum Detect	Average Result[a]	Screening Criteria[b]
Surface Soil	Aluminum	mg/kg	79/79	3970	23800	11800	17700
	Arsenic	mg/kg	76/79	5.30	30.20	13.30	15.4
	Chromium	mg/kg	79/79	6.20	28.40	15.20	17.4
	Cobalt	mg/kg	79/79	3.80	33.80	8.72	10.4
	Manganese	mg/kg	79/79	63.90	2080	554	1450
	Thallium	mg/kg	19/79	0.13	2.90	0.16	0.61
	Benz(a)anthracene	mg/kg	6/15	0.07	0.27	0.18	0.22
	Benzo(a)pyrene	mg/kg	6/15	0.07	0.34	0.17	0.022
	Benzo(b)fluoranthene	mg/kg	2/15	0.16	0.39	0.21	0.22
	Indeno(1,2,3-cd)pyrene	mg/kg	1/15	0.27	0.27	0.20	0.22
Subsurface Soil	Aluminum	mg/kg	101/101	4720	24500	10600	19500
	Arsenic	mg/kg	93/101	4.30	44.10	13.70	19.8
	Barium	mg/kg	101/101	19.20	4190	94.50	350
	Cobalt	mg/kg	101/101	3.30	24.70	8.53	23.2
	Thallium	mg/kg	23/101	0.14	2.50	0.14	0.91
	PCB-1254	mg/kg	6/34	0.023	0.79	0.048	0.12
	Benzo(a)pyrene	mg/kg	3/50	0.12	0.20	0.20	0.022
Wet Sediment	Aluminum	mg/kg	8/8	4300	21400	11800	13900
	Arsenic	mg/kg	8/8	9	39.4	17.4	19.5
	Barium	mg/kg	8/8	48	389	132	350
	Chromium	mg/kg	8/8	7.1	26.2	16.8	18.1
	Manganese	mg/kg	8/8	129	8280	1920	1950
Surface Water	Antimony	mg/L	2/5	0.0047	0.0059	0.0030	0.0049
	Manganese	mg/L	5/5	0.0139	1.1400	0.2670	0.63

Table M-1. Chemicals Exceeding Screening Criteria at Load Line 11 (continued)

Medium	Analyte	Units	Frequency of Detection	Minimum Detect	Maximum Detect	Average Result[a]	Screening Criteria[b]
Surface Water	Bis(2-ethylhexyl)phthalate	mg/L	2/5	0.0090	0.0120	0.0072	0.0035
	Trichloroethene	mg/L	2/5	0.0006	0.0020	0.0007	0.00016
Groundwater	Aluminum	mg/L	4/32	0.0205	1.43	0.141	1.0
	Arsenic	mg/L	13/32	0.00200	0.0231	0.00848	0.0117 (unconsolidated)
	Cadmium	mg/L	9/32	0.00018	0.0125	0.00244	0.00046
	Zinc	mg/L	19/32	0.0037	0.623	0.05360	0.31
	2,4,6-Trinitrotoluene	mg/L	2/32	0.00018	0.00058	0.00008	0.00052
	Heptachlor	mg/L	2/32	0.000024	0.000087	0.00002	0.000014
	beta-BHC	mg/L	4/32	0.000013	0.000210	0.00002	0.000047
	Bis(2-ethylhexyl)phthalate	mg/L	4/33	0.00090	0.0300	0.00472	0.0009
	Trichloroethene	mg/L	2/33	0.00200	0.0030	0.00055	0.000031

[a]Average result equals the sum of the concentrations divided by the number of samples; the average includes non-detects at half the reporting limit and field duplicate samples. This can result in an average less than the range of detected values.
[b]Screening criteria are based on HI=0.1 and Target Risk=10^{-6}.

Previous remedial investigations and removal action at Load Line 11 have resulted in the collection of surface and subsurface soil samples throughout the AOC. Soil samples have been collected at following depth intervals: 0 to 1 ft, 1 to 3 ft, 4 to 6 ft, 5 to 7 ft, 6 to 8 ft, 7 to 9 ft, 8 to 10ft, 10 to 12 ft, and 11 to 13 ft. Table M-2 summarizes the historical surface soil (including dry sediment) and subsurface soil sampling conducted at Load Line 11 and indicates whether samples exceeded screening criteria.

Table M-2. Load Line 11 Historical Soil Sampling Summary

Sample Location	Sample Number	Depth of Sample (ft bgs)	Analysis Performed						
			Metals	**Explosives**	**VOCs**	**Pesticides/ PCBs**	**SVOCs**	**Anions**	**TPH**
LL11cs-001	LL11cs-001-0001-SO	5.0- 6.0	N	N	--	--	--	N	--
LL11cs-002	LL11cs-002-0001-FD	5.0- 6.0	N	N	N	**Y**	**Y**	N	--
	LL11cs-002-0001-SO	5.0- 6.0	N	N	N	N	N	N	--
LL11cs-003	LL11cs-003-0001-SO	5.0- 6.0	N	N	--	--	--	N	--
LL11cs-004	LL11cs-004-0001-SO	5.0- 6.0	N	N	N	N	N	N	--
LL11cs-005	LL11cs-005-0001-SO	5.0- 6.0	N	N	N	N	N	N	--
LL11cs-006	LL11cs-006-0001-SD	0.0- 1.0	Cr	--	N	--	--	--	--
LL11cs-007	LL11cs-007-0001-SO	1.0- 2.0	N	--	N	--	--	--	--
LL11cs-008	LL11cs-008-0001-SO	1.0- 2.0	N	--	N	--	--	--	--
LL11cs-009	LL11cs-009-0001-SO	1.0- 2.0	N	--	N	--	--	--	--
LL11cs-010	LL11cs-010-0001-SD	0.0- 1.0	**Y**	--	N	--	--	--	--
LL11cs-011	LL11cs-011-0001-FD	0.0- 1.0	**Y**	--	N	--	--	--	--
	LL11cs-011-0001-SD	0.0- 1.0	**Y**	--	N	--	--	--	--
LL11cs-012	LL11cs-012-0001-SO	1.0- 2.0	N	--	N	--	--	--	--
LL11cs-013	LL11cs-013-0001-SO	1.0- 2.0	**Y**	--	N	--	--	--	--
LL11cs-014	LL11cs-014-0001-SO	1.0- 2.0	N	--	N	--	--	--	--
LL11cs-015	LL11cs-015-0001-SD	0.0- 1.0	Cr	--	N	--	--	--	--
LL11cs-016	LL11cs-016-0001-SD	0.0- 1.0	--	--	N	N	**Y**	--	--
LL11cs-017	LL11cs-017-0001-FD	1.0- 2.0	--	--	N	N	N	--	--
	LL11cs-017-0001-SO	1.0- 2.0	--	--	N	N	N	--	--
LL11cs-018	LL11cs-018-0001-SO	1.0- 2.0	--	--	N	N	N	--	--
LL11cs-019	LL11cs-019-0001-SO	1.0- 2.0	--	--	N	N	**Y**	--	--
LL11cs-020	LL11cs-020-0001-SO	0.0- 1.0	--	--	N	N	**Y**	--	--
LL11cs-021	LL11cs-021-0001-SD	0.0- 1.0	N	--	--	--	--	--	--
LL11cs-022	LL11cs-022-0001-SO	1.0- 2.0	N	--	--	--	--	--	--
LL11cs-023	LL11cs-023-0001-SO	1.0- 2.0	N	--	--	--	--	--	--
LL11cs-024	LL11cs-024-0001-SO	1.0- 2.0	N	--	--	--	--	--	--
LL11cs-025	LL11cs-025-0001-SD	0.0- 1.0	**Y**	--	--	--	--	--	--
LL11cs-026	LL11cs-026-0001-SD	1.0- 2.0	N	--	--	--	--	--	--
LL11cs-027	LL11cs-027-0001-SO	1.0- 2.0	N	--	--	--	--	--	--
LL11cs-028	LL11cs-028-0001-SO	1.0- 2.0	N	--	--	--	--	--	--
LL11cs-029	LL11cs-029-0001-SO	1.0- 2.0	N	--	--	--	--	--	--
LL11cs-030	LL11cs-030-0001-SD	0.0- 1.0	Cr	--	--	--	--	--	--
LL11cs-031	LL11cs-031-0001-FD	0.0- 1.0	**Y**	--	--	--	--	--	--
	LL11cs-031-0001-SD	0.0- 1.0	N	--	--	--	--	--	--
LL11cs-032	LL11cs-032-0001-SO	1.0- 2.0	N	--	--	--	--	--	--
LL11cs-033	LL11cs-033-0001-SO	1.0- 2.0	N	--	--	--	--	--	--
LL11cs-034	LL11cs-034-0001-SO	1.0- 2.0	N	--	--	--	--	--	--
LL11cs-035	LL11cs-035-0001-SO	1.0- 2.0	N	--	--	--	--	--	--
LL11cs-036	LL11cs-036-0001-SO	1.0- 2.0	**Y**	--	--	--	--	--	--
LL11cs-037	LL11cs-037-0001-SO	1.0- 2.0	N	--	--	--	--	--	--
LL11cs-038	LL11cs-038-0001-SO	1.0- 2.0	N	--	--	--	--	--	--
LL11cs-039	LL11cs-039-0001-SD	0.0- 1.0	**Y**	--	--	--	--	--	--
LL11cs-040	LL11cs-040-0001-FD	3.0- 7.0	N	N	N	N	N	N	N
	LL11cs-040-0001-SO	3.0- 7.0	N	N	N	N	N	N	N

Table M-2. Load Line 11 Historical Soil Sampling Summary (continued)

Sample Location	Sample Number	Depth of Sample (ft bgs)	Analysis Performed						
			Metals	Explosives	VOCs	Pesticides/ PCBs	SVOCs	Anions	TPH
LL11cs-041	LL11cs-041-0001-SO	3.0- 7.0	N	N	N	N	N	N	N
LL11cs-042	LL11cs-042-0001-SO	3.0- 7.0	N	N	N	N	N	N	N
LL11cs-043	LL11cs-043-0001-SO	3.0- 7.0	N	N	N	N	**Y**	N	N
LL11cs-044	LL11cs-044-0001-SO	7.0- 8.0	N	N	N	N	N	N	N
LL11cs-045	LL11cs-045-0001-FD	7.0- 8.0	**Y**	N	N	N	N	N	N
	LL11cs-045-0001-SO	7.0- 8.0	**Y**	N	N	N	N	N	N
LL11cs-046	LL11cs-046-0001-SO	3.0- 4.0	N	N	N	N	N	N	N
LL11cs-047	LL11cs-047-0001-SO	3.0- 4.0	N	N	N	N	N	N	N
LL11cs-048	LL11cs-048-0001-SO	3.0- 4.0	N	N	N	N	N	N	N
LL11cs-049	LL11cs-049-0001-SO	3.0- 4.0	N	N	N	N	N	N	N
LL11cs-050	LL11cs-050-0001-SO	3.0- 4.0	**Y**	N	--	N	N	N	N
LL11sb-001	LL11sb-001-0001-FD	0.0- 1.0	N	N	N	N	**Y**	N	--
	LL11sb-001-0001-SO	0.0- 1.0	**Y**	N	N	N	N	N	--
LL11ss-001	LL11ss-001-0001-FD	0.0- 1.0	N	N	N	N	**Y**	N	--
	LL11ss-001-0001-SO	0.0- 1.0	N	N	N	N	**Y**	N	--
	LL11ss-001-0002-SO	1.0- 3.0	N	N	--	--	--	N	--
LL11ss-002	LL11ss-002-0001-SO	0.0- 1.0	N	N	--	--	--	N	--
	LL11ss-002-0002-SO	1.0- 3.0	**Y**	N	--	--	--	N	--
LL11sb-002	LL11sb-002-0001-SO	0.0- 1.0	N	N	--	--	--	N	--
	LL11sb-002-0002-SO	6.0- 8.0	N	N	--	--	--	N	--
LL11sb-003	LL11sb-003-0001-SO	0.0- 1.0	N	N	--	--	--	N	--
LL11ss-003	LL11ss-003-0001-SO	0.0- 1.0	N	N	--	--	--	N	--
	LL11ss-003-0002-SO	1.0- 3.0	**Y**	N	--	--	--	N	--
LL11ss-004	LL11ss-004-0001-FD	0.0- 1.0	N	N	--	--	--	N	--
	LL11ss-004-0001-SO	0.0- 1.0	**Y**	N	--	--	--	N	--
	LL11ss-004-0002-SO	1.0- 3.0	N	N	--	--	--	N	--
LL11sb-004	LL11sb-004-0001-SO	0.0- 1.0	**Y**	N	--	--	--	N	--
	LL11sb-004-0002-SO	10.0-12.0	N	N	--	--	--	N	--
LL11ss-005	LL11ss-005-0001-SO	0.0- 1.0	**Y**	N	--	--	--	N	--
LL11sb-005	LL11sb-005-0001-SO	0.0- 1.0	N	N	N	N	N	N	--
	LL11sb-005-0002-SO	6.0- 8.0	N	N	--	--	--	N	--
LL11ss-006	LL11ss-006-0001-SO	0.0- 1.0	Cr	N	--	--	--	N	--
LL11sb-006	LL11sb-006-0001-SO	0.0- 1.0	**Y**	N	--	--	--	N	--
	LL11sb-006-0002-SO	2.0- 4.0	N	N	--	--	--	N	--
LL11sb-007	LL11sb-007-0001-SO	0.0- 1.0	**Y**	N	--	--	--	N	--
LL11ss-007	LL11ss-007-0002-SO	1.0- 3.0	N	N	--	--	--	N	--
LL11ss-008	LL11ss-008-0001-SO	0.0- 1.0	**Y**	N	--	--	--	N	--
	LL11ss-008-0002-SO	1.0- 3.0	N	N	--	--	--	N	--
LL11sb-008	LL11sb-008-0001-SO	0.0- 1.0	N	N	--	--	--	N	--
	LL11sb-008-0002-FD	12.0-13.0	N	N	--	--	--	N	--
	LL11sb-008-0002-SO	12.0-13.0	N	N	--	--	--	N	--
LL11ss-009	LL11ss-009-0001-SO	0.0- 1.0	N	N	N	N	N	N	--
	LL11ss-009-0002-SO	1.0- 3.0	N	N	--	--	--	N	--

Table M-2. Load Line 11 Historical Soil Sampling Summary (continued)

Sample Location	Sample Number	Depth of Sample (ft bgs)	Analysis Performed						
			Metals	Explosives	VOCs	Pesticides/ PCBs	SVOCs	Anions	TPH
LL11sb-009	LL11sb-009-0001-SO	0.0- 1.0	**Y**	N	--	--	--	N	--
	LL11sb-009-0002-SO	4.0- 6.0	**Y**	N	--	--	--	N	--
LL11sb-010	LL11sb-010-0001-SO	0.0- 1.0	N	N	--	--	--	N	--
LL11ss-010	LL11ss-010-0001-FD	0.0- 1.0	N	N	--	--	--	N	--
	LL11ss-010-0001-SO	0.0- 1.0	N	N	--	--	--	N	--
	LL11ss-010-0002-SO	1.0- 3.0	N	N	N	N	N	N	--
LL11ss-011	LL11ss-011-0001-SO	0.0- 1.0	N	N	--	--	--	N	--
LL11sb-011	LL11sb-011-0001-SO	4.0- 6.0	N	N	--	--	--	N	--
LL11ss-012	LL11ss-012-0001-SO	0.0- 1.0	**Y**	N	N	N	N	N	--
LL11sb-012	LL11sb-012-0001-FD	8.0-10.0	N	N	N	N	N	N	--
	LL11sb-012-0001-SO	8.0-10.0	N	N	N	N	N	N	--
LL11ss-013	LL11ss-013-0001-SO	0.0- 1.0	**Y**	N	--	--	--	N	--
	LL11ss-013-0002-SO	1.0- 3.0	N	N	N	N	N	N	--
LL11sb-013	LL11sb-013-0001-SO	8.0-10.0	N	N	--	--	--	N	--
LL11ss-014	LL11ss-014-0001-SO	0.0- 1.0	N	N	--	--	--	N	--
	LL11ss-014-0002-SO	1.0- 3.0	N	N	--	--	--	N	--
LL11sb-014	LL11sb-014-0001-SO	11.0-13.0	N	N	--	--	--	N	--
LL11ss-015	LL11ss-015-0001-SO	0.0- 1.0	N	N	--	--	--	N	--
	LL11ss-015-0002-SO	1.0- 3.0	N	N	--	--	--	N	--
LL11sb-015	LL11sb-015-0001-SO	10.0-12.0	N	N	--	--	--	N	--
LL11ss-016	LL11ss-016-0001-SO	0.0- 1.0	N	N	--	--	--	N	--
	LL11ss-016-0002-FD	1.0- 3.0	N	N	N	**Y**	N	N	--
	LL11ss-016-0002-SO	1.0- 3.0	N	N	N	**Y**	N	N	--
LL11sb-016	LL11sb-016-0001-SO	8.5-11.5	N	N	--	--	--	N	--
LL11ss-017	LL11ss-017-0001-SO	0.0- 1.0	**Y**	N	--	--	--	N	--
	LL11ss-017-0002-SO	1.0- 3.0	N	N	--	--	--	N	--
LL11sb-017	LL11sb-017-0001-SO	4.0- 6.0	N	N	--	--	--	N	--
LL11ss-018	LL11ss-018-0001-SO	0.0- 1.0	**Y**	N	--	--	--	N	--
	LL11ss-018-0002-SO	1.0- 3.0	N	N	--	--	--	N	--
LL11sb-018	LL11sb-018-0001-SO	4.0- 6.0	N	N	--	--	--	N	--
LL11sb-019	LL11sb-019-0001-FD	0.0- 1.0	**Y**	N	N	N	N	N	--
	LL11sb-019-0001-SO	0.0- 1.0	N	N	N	N	N	N	--
	LL11sb-019-0002-SO	6.0- 8.0	N	N	--	--	--	N	--
LL11ss-019	LL11ss-019-0001-SO	0.0- 1.0	**Y**	N	--	--	--	N	--
	LL11ss-019-0002-SO	1.0- 3.0	N	N	--	--	--	N	--
LL11ss-020	LL11ss-020-0001-SO	0.0- 1.0	N	N	N	N	N	N	--
	LL11ss-020-0002-SO	1.0- 3.0	N	N	--	--	--	N	--
LL11sb-020	LL11sb-020-0001-SO	0.0- 1.0	N	N	--	--	--	N	--
	LL11sb-020-0002-SO	6.0- 8.0	N	N	--	--	--	N	--
LL11ss-021	LL11ss-021-0001-SO	0.0- 1.0	N	N	--	--	--	N	--
	LL11ss-021-0002-SO	1.0- 3.0	N	N	--	--	--	N	--
LL11sb-021	LL11sb-021-0001-SO	0.0- 1.0	N	N	--	--	--	N	--
	LL11sb-021-0002-SO	6.0- 8.0	N	N	--	--	--	N	--
LL11ss-022	LL11ss-022-0001-SO	0.0- 1.0	**Y**	N	--	--	--	N	--
	LL11ss-022-0002-SO	1.0- 3.0	N	N	--	--	--	N	--

Table M-2. Load Line 11 Historical Soil Sampling Summary (continued)

Sample Location	Sample Number	Depth of Sample (ft bgs)	Analysis Performed						
			Metals	Explosives	VOCs	Pesticides/ PCBs	SVOCs	Anions	TPH
LL11sb-022	LL11sb-022-0001-SO	0.0- 1.0	N	N	--	--	--	N	--
	LL11sb-022-0002-SO	6.0- 8.0	**Y**	N	--	--	--	N	--
LL11ss-023	LL11ss-023-0001-SO	0.0- 1.0	N	N	--	--	--	N	--
	LL11ss-023-0002-FD	0.0- 1.0	**Y**	N	--	--	--	N	--
	LL11ss-023-0002-SO	1.0- 3.0	N	N	--	--	--	N	--
LL11sb-023	LL11sb-023-0001-SO	0.0- 1.0	N	N	--	--	--	N	--
	LL11sb-023-0002-SO	6.0- 8.0	N	N	--	--	--	N	--
LL11ss-024	LL11ss-024-0001-SO	0.0- 1.0	**Y**	N	--	--	--	N	--
	LL11ss-024-0002-SO	1.0- 3.0	N	N	--	--	--	N	--
LL11sb-024	LL11sb-024-0001-SO	7.0- 9.0	--	--	N	--	N	--	--
LL11ss-025	LL11ss-025-0001-SO	0.0- 1.0	N	N	--	--	--	N	--
	LL11ss-025-0002-SO	1.0- 3.0	N	N	--	--	--	N	--
LL11sb-025	LL11sb-025-0001-SO	5.0- 7.0	--	--	N	--	N	--	--
LL11ss-026	LL11ss-026-0001-SO	0.0- 1.0	**Y**	N	--	--	--	N	--
	LL11ss-026-0002-SO	1.0- 3.0	N	N	--	--	--	N	--
LL11sb-026	LL11sb-026-0001-SO	4.0- 6.0	--	--	N	--	N	--	--
LL11ss-027	LL11ss-027-0001-SO	0.0- 1.0	**Y**	N	--	--	--	N	--
	LL11ss-027-0002-SO	1.0- 3.0	N	N	--	--	--	N	--
LL11sb-027	LL11sb-027-0001-FD	6.0- 8.0	--	--	N	--	N	--	--
	LL11sb-027-0001-SO	6.0- 8.0	--	--	N	--	N	--	--
LL11ss-028	LL11ss-028-0001-SO	0.0- 1.0	N	N	--	--	--	N	--
	LL11ss-028-0002-SO	1.0- 3.0	**Y**	N	--	--	--	N	--
LL11sb-028	LL11sb-028-0001-SO	4.0- 6.0	--	--	N	--	N	--	--
LL11ss-029	LL11ss-029-0001-FD	0.0- 1.0	**Y**	N	N	--	--	N	--
	LL11ss-029-0001-SO	0.0- 1.0	**Y**	N	N	--	--	N	--
	LL11ss-029-0002-SO	1.0- 3.0	N	N	--	--	--	N	--
LL11sb-029	LL11sb-029-0001-SO	6.0- 8.0	--	--	N	--	N	--	--
LL11ss-030	LL11ss-030-0001-SO	0.0- 1.0	Cr	N	--	--	--	N	--
	LL11ss-030-0002-FD	1.0- 3.0	N	N	--	--	--	N	--
	LL11ss-030-0002-SO	1.0- 3.0	N	N	--	--	--	N	--
LL11sb-030	LL11sb-030-0001-SO	8.0-10.0	--	--	N	--	N	--	--
LL11ss-031	LL11ss-031-0001-SO	0.0- 1.0	**Y**	N	--	--	--	N	--
	LL11ss-031-0002-SO	1.0- 3.0	**Y**	N	--	--	--	N	--
LL11sb-031	LL11sb-031-0001-SO	4.0- 6.0	N	N	N	N	N	N	--
	LL11sb-031A-0001-SO	6.0- 8.0	N	--	N	--	N	--	N
LL11sb-032	LL11sb-032-0001-SO	4.0- 6.0	N	N	N	N	N	N	--
LL11sb-033	LL11sb-033-0001-SO	6.0- 8.0	--	--	N	--	N	--	--
LL11sb-034	LL11sb-034-0001-SO	2.0- 4.0	--	--	N	--	N	--	--
LL11sb-035	LL11sb-035-0001-FD	4.0- 6.0	N	N	N	N	N	N	--
LL11sb-035	LL11sb-035-0001-SO	4.0- 6.0	N	N	N	N	N	N	--
LL11sb-036	LL11sb-036-0001-SO	4.0- 6.0	--	--	N	--	N	--	--
LL11sb-037	LL11sb-037-0001-SO	6.0- 8.0	N	N	N	N	N	N	N
LL11sb-038	LL11sb-038-0001-SO	6.0- 8.0	N	N	N	N	N	N	N
LL11sb-039	LL11sb-039-0001-SO	6.0- 8.0	**Y**	N	N	N	N	N	N
LL11sb-040	LL11sb-040-0001-SO	6.0- 8.0	**Y**	N	N	N	N	N	N

Table M-2. Load Line 11 Historical Soil Sampling Summary (continued)

Sample Location	Sample Number	Depth of Sample (ft bgs)	Analysis Performed						
			Metals	Explosives	VOCs	Pesticides/ PCBs	SVOCs	Anions	TPH
LL11sb-041	LL11sb-041-0001-SO	6.0- 8.0	N	N	N	N	N	N	--
LL11sb-042	LL11sb-042-0001-SO	6.0- 8.0	**Y**	N	N	N	N	N	--
LL11sb-043	LL11sb-043-0001-SO	6.0- 8.0	**Y**	N	N	N	N	N	--
LL11sd-013	LL11sd-013-0001-FD	0.0- 1.0	**Y**	N	--	--	--	N	--
	LL11sd-013-0001-SD	0.0- 1.0	**Y**	N	--	--	--	N	--
LL11sd-014	LL11sd-014-0001-SD	0.0- 1.0	**Y**	N	--	--	--	N	--
LL11sd-015	LL11sd-015-0001-SD	0.0- 1.0	N	N	--	--	--	N	--
LL11sd-016	LL11sd-016-0001-SD	0.0- 1.0	Cr	N	--	--	--	N	--
LL11sd-019	LL11sd-019-0001-SD	0.0- 1.0	**Y**	N	--	--	--	N	--
LL11sd-020	LL11sd-020-0001-SD	0.0- 1.0	N	N	--	--	--	N	--
LL11sd-022	LL11sd-022-0001-SD	0.0- 1.0	N	N	--	--	--	N	--
LL11sd-023	LL11sd-023-0001-SD	0.0- 1.0	N	N	--	--	--	N	--
LL11sd-025	LL11sd-025-0001-SD	0.0- 1.0	**Y**	N	--	--	--	N	--
LL11sd-026	LL11sd-026-0001-SD	0.0- 1.0	N	N	--	--	--	N	--
LL11sd-029	LL11sd-029-0001-FD	0.0- 1.0	Cr	N	N	N	N	N	--
	LL11sd-029-0001-SD	0.0- 1.0	**Y**	N	N	N	N	N	--
LL11sd-031	LL11sd-031-0001-SD	0.0- 1.0	**Y**	N	--	--	--	N	--
LL11sd-032	LL11sd-032-0001-SD	0.0- 1.0	**Y**	N	N	N	**Y**	N	--
LL11sd-033	LL11sd-033-0001-SD	0.0- 1.0	N	N	--	--	--	N	--

Y = Analyte(s) greater than screening criteria.
Cr = Only chromium greater than screening criteria.
N = Non-detect or less than screening criteria.
-- = Analysis was not performed.
TPH = total petroleum hydrocarbons.
Only PAHs were detected above screening criteria in the SVOC analysis.

M.3 PROPOSED SAP ADDENDUM CHARACTERIZATION ACTIVITIES

The objective of this SAP Addendum for Load Line 11 is to define the nature and extent of chemicals at concentrations greater than the screening criteria. To accomplish this further sampling and analysis of metals, PCBs, and PAHs in soil; metals, SVOCs and VOCs in surface water; and metals in wet sediment will be conducted. In addition, current concentrations of chemicals in groundwater will be evaluated.

Table M-3 summarizes the chemicals that exceeded screening criteria and CUGs for each medium, the types and quantities of samples to be collected during the implementation of this SAP Addendum, and the rationale behind the proposed samples. All historical soil and wet sediment sampling at this AOC has been conducted using discrete sample methods; therefore, this addendum proposes discrete samples so that consistent sample types can be used in nature and extent evaluation and future risk management decisions. The general approach for investigation activities is presented in Section 3.2 of the FSP. Figure M-3 illustrates the locations of the samples to be collected as well as previous screening criteria and CUG exceedances.

Table M-4 presents the coordinates for the proposed sampling locations for this AOC. The locations may be altered during implementation of this SAP Addendum for a variety of reasons (e.g., soil boring refusal and MEC avoidance). The final coordinates of the sample locations (including elevations) will be presented in the RI Report.

Table M-3. Summary of Sampling at Load Line 11

Medium	Historical Sample Type	Historical Screening Criteria Exceedances	Number of SAP Addendum Sample Locations	Rationale for SAP Addendum Field Activities
Surface soil	Discrete	Al LL11cs-011, 025, 031, LL11sb-004 As **LL11sb-001, 004, 006, 009, LL11ss-004, 005, 008, 012**, **022, 024, 027, 031**, **LL11sd-013, 019**, **025, 029, 031, 032**, **LL11cs-011** Co LL11ss-017, 019, 023, 026, 029 LL11sd-013, 014, 016, 025, 029, 032 LL11sb-007, LL11cs-010, 025, 039 Mn **LL11ss-013, 018, 029, LL11sd-014** Tl LL11sb-019 SVOCs LL11cs-016, **020,** LL11sb-001, LL11sd-032, LL11ss-001	9	Previous investigations have characterized and bound many surface soil locations where chemical concentrations were greater than screening criteria, and most concentrations greater than CUGs appear to be confined within ditches. A total of nine surface soil samples are planned. Surface soil samples were placed near (up- or downgradient of) discrete locations where chemicals were greater than multiple screening criterion or CUGs and were not previously bound, in ditches downgradient from operational areas not previously investigated, and near former facilities not previously investigated. Excavations of dry/wet sediment have occurred at locations LL11sd-013, sd-018, sd-019, sd-026, sd-027 and sd-032 (where chemicals were greater than CUGs) to a depth of 2 ft bgs during a removal action at the AOC. Samples will be analyzed for TAL metals, explosives, PCBs, and PAHs, with 10% RVAAP full suite.
	Chromium speciation	Cr LL11cs-006, 011, 015, 025, 030, 031 LL11sb-004, 009 LL11sd-013, 025, 029, 031, 032 LL11ss-006, 023, 024, 030	3	Discrete surface soil samples will be collected at existing locations: LL11cs-011 (28.4 mg/kg – previous maximum concentration of total chromium), LL11sb-004 (20.7 mg/kg) and LL11sd-025 (17.5 mg/kg).

Table M-3. Summary of Sampling at Load Line 11 (continued)

Medium	Historical Sample Type	Historical Screening Criteria Exceedances	Number of SAP Addendum Sample Locations	Rationale for SAP Addendum Field Activities
Subsurface soil	Discrete	Al LL11cs-013 As **LL11ss-002, 003, 028, 031**; **LL11cs-045**, **050**; **LL11sb-009**, **022**, **039**, **040**, **042**, **043** Ba **LL11cs-050** Co LL11cs-036 Ti LL11cs-050 Pesticide/PCB LL11cs-002, LL11ss-016 SVOCs LL11cs-002, 019, 043	10	Ten boring locations are planned to define the vertical extent of contamination. Borings are placed near previous surface and subsurface locations with chemicals greater than CUGs that were not bound by previous samples. At locations such as LL11sb-001, LL11cs-045, LL11ss-012, and LL11ss-031, where a surface soil sample (0-1 ft) results exceeded a CUG and there was no subsurface soil data (or the subsurface sample also exceeded a chemical CUG), a boring was placed at or down gradient of the sample location to define the vertical (and in some cases the lateral) extent. There are three areas where multiple sample locations in close proximity exceeded a chemical CUG, in the surface and/or subsurface soil samples. These groupings include the following: 1) LL11sb-040, LL11cs-050, LL11sb-039; 2) LL11sb-043 and LL11sb-044; and 3) LL11ss-003 and LL11ss-005. These location groupings are being further evaluated by the placement one boring in the vicinity or within representative soil. One sample location, LL11ss-028 had no surface soil chemicals detected above screening criteria; however, the subsurface soil interval (1-3 ft) had an exceedance of a CUG. A boring is placed downgradient of this location to define the vertical extent. There are five locations where a chemical exceeded a CUG that have been adequately characterized by previous sampling activities. These sample locations include: LL11sd-014 (down gradient sample location LL11sb-002 had no chemical above screening criteria at the 0-1 ft and 6-8 ft interval), LL11sd-025 (sample LL11sd-024 had no chemical above a CUG), LL11sb-009/MW-009 (confirmation samples LL11cs-026 through LL11cs-030 collected after excavation activities indicate no chemicals greater than CUGs, one confirmation sample did exceed one screening criteria), and LL11sb-022 and LL11sb-042 (subsurface soil exceeded a chemical CUG, confirmation sample location LL11cs-004 collected after sump excavation had no subsurface chemical above a CUG). Sample location LLss-002 had no surface soils greater than screening criteria and one chemical slightly exceeded the background concentration. No further investigation is planned. The following locations had surface soil sample results greater than CUGs with a subsurface soil sample (1-3 ft or 2-4 ft) that did not exceed CUGs and therefore no

Table M-3. Summary of Sampling at Load Line 11 (continued)

Medium	Historical Sample Type	Historical Screening Criteria Exceedances	Number of SAP Addendum Sample Locations	Rationale for SAP Addendum Field Activities
				further subsurface investigation is necessary: LL11ss-027, LL11ss-018, LL11ss-013, LL11ss-022, LL11ss-029, LL11ss-008, LL11ss-004, LL11cs-011, and LL11cs-020 (LL11cs-19). Additionally, after excavation activities confirmation sampling indicated no subsurface soil CUG chemical exceedances at LL11sd-019 (LL11cs-037), LL11 sd-032 (LL11cs-016 through LL11cs-019), and LL11sd-013 (LL11cs-021 through LL11cs-025). Surface soil samples were placed to define the lateral extent if no surface soil data was available adjacent to the sampling location. Samples will be analyzed for TAL metals, explosives, PCBs, and PAHs, with 10% RVAAP full suite.
	Geotechnical	None collected.	1	Two samples shall be collected from one location to provide soil data for modeling.
Surface water	Discrete	<u>Antimony</u> LL11sw-015 <u>Mn</u> LL11sw-013 <u>SVOCs</u> LL11sw-013, 015 <u>VOCs</u> LL11sw-012	3	Two surface water and co-located composite wet sediment samples will be collected to characterize current conditions at the AOC. One sample will be collected at or near the previous wet sediment sample sd-017 that had metals at concentrations greater than CUGs. One sample is placed down gradient of sample location LL11sd-030. Surface water samples will be analyzed for the RVAAP full suite. Composite wet sediment samples will be analyzed for explosives, TAL metals, SVOCs and VOCs, with 10% (one sample) for RVAAP full suite. One surface water and co-located composite wet sediment sample will be collected near Newton Falls Road to assess the potential transport beyond the AOC boundary. This sample is being collected as part of the Fuze and Booster Hill sample locations (Section 3.2.5.3 of the FSP).
Wet sediment	Discrete	<u>Al</u> LL11sd-024, 030 <u>As</u> **LL11sd-017**, **018** <u>Ba</u> LL11sd-018 <u>Cr</u> LL11sd-024, 027, 030 <u>Mn</u> **LL11sd-017**, **018**	3	Refer to surface water above. Note: As discussed in surface soil, sample location sd-018 was excavated to 2 ft bgs during prior removal actions.

Table M-3. Summary of Sampling at Load Line 11 (continued)

Medium	Historical Sample Type	Historical Screening Criteria Exceedances	Number of SAP Addendum Sample Locations	Rationale for SAP Addendum Field Activities
Groundwater	Discrete	Al LL11mw-002 As **LL11mw-007** Cd **LL11mw-002** Zn LL11mw-002 Explosives LL11mw-004 Pesticide/PCB LL11mw-002 SVOCs **LL11mw-002**, **007** VOC **LL11mw-008**, **009**	0	No additional groundwater sampling is planned. All monitoring wells were recently or are currently being sampled under the FWGWMP. Four quarters of sampling were completed in October 2008 at monitoring wells LL11mw-002 and LL11mw-007. Monitoring wells LL11mw-001, -003, -004, -005, -006, -008, -009, and -010 were included in the FWGWMP in January 2009 and four quarters of sampling was completed in October 2009.

Bold indicates locations where concentration also exceeded the CUG (HI=1.0, Target Risk=10^{-5}) for the identified chemical.

Table M-4. Coordinates for Proposed Sampling Locations at Load Line 11

Sample Location ID	Sample Type	Easting	Northing
LL11sb-060	Grab	2352839.0029	557549.5720
LL11sb-061	Grab	2352718.7739	557899.7885
LL11sb-062	Grab	2352689.5754	558162.4509
LL11sb-063	Grab	2352668.6769	558163.4142
LL11sb-063	Grab	2352361.3258	557781.8238
LL11sb-064	Grab	2352530.9676	558223.8434
LL11sb-065	Grab	2351867.0397	557475.7402
LL11sb-066	Grab	2351664.1276	557856.8662
LL11sb-067	Grab	2352819.886	558449.0197
LL11sb-068	Grab	2352812.758	558552.3077
LL11sb-069	Grab	2353600.9294	557992.3609
LL11sd-082	Composite	2352459.1104	558883.8415
LL11sd-083	Composite	2352749.7665	558187.4164
LL11sd-084	Composite	2351985.0721	557646.6356
LL11ss-070	Grab	2353254.2576	558064.1354
LL11ss-071	Grab	2352908.9565	557992.8388
LL11ss-072	Grab	2352718.7739	558184.7686
LL11ss-073	Grab	2352371.8274	557911.8057
LL11ss-074	Grab	2352443.7353	557679.2993
LL11ss-075	Grab	2352146.3208	557739.9881
LL11ss-076	Grab	2352100.5493	557999.5861
LL11ss-077	Grab	2352057.0781	558306.9880
LL11ss-078	Grab	2352423.5160	558227.3019
LL11ss-079	Grab	2352565.2624	558487.2924
LL11ss-080	Grab	2353014.1011	558576.6579
LL11ss-081	Grab	2353472.5110	558515.4334
LL11sw-082	Grab	2352459.1104	558883.8415
LL11sw-083	Grab	2352749.7665	558187.4164
LL11sw-084	Grab	2351985.0721	557646.6356

Surface Water - mg/L			
Location	Constituent	Result	Qual
LL11sw-013	Manganese	1.14	=
LL11sw-015	Antimony	0.0059	=

Wet Sediment - mg/kg			
Location	Constituent	Result	Qual
LL11sd-017	Arsenic	21.10	=
LL11sd-017	Manganese	2020.00	=
LL11sd-018	Arsenic	39.40	=
LL11sd-018	Barium	389.00	=
LL11sd-018	Manganese	8280.00	=
LL11sd-024	Aluminum	15400.00	=
LL11sd-024	Chromium	21.00	=
LL11sd-027	Chromium	20.70	=
LL11sd-030	Aluminum	21400.00	=
LL11sd-030	Chromium	26.20	=

Groundwater - mg/L			
Location	Constituent	Result	Qual
LL11mw-002	Aluminum	1.43	J
LL11mw-002	Cadmium	0.0125	=
LL11mw-002	Zinc	0.623	J
LL11mw-007	Arsenic	0.0231	

Subsurface Soil (1-13ft) - mg/kg			
Location	Constituent	Result	Qual
LL11cs-013	Aluminum	24500.00	=
LL11cs-036	Cobalt	24.70	=
LL11cs-045	Arsenic	44.10	=
LL11cs-050	Arsenic	33.60	=
LL11cs-050	Barium	4190.00	=
LL11cs-050	Thallium	2.50	=
LL11sb-009	Arsenic	22.90	=
LL11sb-022	Arsenic	25.80	=
LL11sb-039	Arsenic	22.30	=
LL11sb-040	Arsenic	23.40	=
LL11sb-042	Arsenic	20.60	=
LL11sb-043	Arsenic	22.40	=
LL11ss-002	Arsenic	20.00	=
LL11ss-003	Arsenic	22.60	=
LL11ss-028	Arsenic	20.10	=
LL11ss-031	Arsenic	21.70	=

Surface Soil (0-1ft) - mg/kg			
Location	Constituent	Result	Qual
LL11cs-006	Chromium	20.40	=
LL11cs-010	Cobalt	10.60	=
LL11cs-011	Aluminum	23600.00	=
LL11cs-011	Arsenic	22.60	=
LL11cs-011	Chromium	28.40	=
LL11cs-015	Chromium	20.50	=
LL11cs-025	Aluminum	23800.00	=
LL11cs-025	Chromium	26.30	=
LL11cs-025	Cobalt	16.60	=
LL11cs-030	Chromium	18.10	=
LL11cs-031	Aluminum	21000.00	=
LL11cs-031	Chromium	27.10	=
LL11cs-039	Cobalt	10.70	=
LL11sb-001	Arsenic	24.80	=
LL11sb-004	Aluminum	18500.00	=
LL11sb-004	Arsenic	18.10	=
LL11sb-004	Chromium	20.70	=
LL11sb-006	Arsenic	17.80	=
LL11sb-007	Cobalt	11.00	=
LL11sb-009	Arsenic	15.50	=
LL11sb-009	Chromium	18.80	=
LL11sb-019	Thallium	2.90	=
LL11sd-013	Arsenic	30.00	=
LL11sd-013	Chromium	21.70	=
LL11sd-013	Cobalt	14.30	=
LL11sd-014	Manganese	1930.00	=
LL11sd-014	Cobalt	13.90	=
LL11sd-016	Cobalt	11.80	=
LL11sd-019	Arsenic	23.70	=
LL11sd-025	Arsenic	21.00	=
LL11sd-025	Chromium	17.50	=
LL11sd-025	Cobalt	33.80	=
LL11sd-029	Arsenic	18.20	=
LL11sd-029	Chromium	20.90	=
LL11sd-029	Cobalt	11.10	=
LL11sd-031	Arsenic	21.10	=
LL11sd-031	Chromium	19.90	=
LL11sd-032	Arsenic	17.20	=
LL11sd-032	Chromium	18.30	=
LL11sd-032	Cobalt	11.50	=
LL11ss-004	Arsenic	20.20	=
LL11ss-005	Arsenic	24.00	=
LL11ss-006	Chromium	18.70	=
LL11ss-008	Arsenic	17.90	=
LL11ss-012	Arsenic	24.20	=
LL11ss-013	Manganese	1500.00	=
LL11ss-017	Cobalt	11.20	=
LL11ss-018	Manganese	1540.00	=
LL11ss-019	Cobalt	10.80	=
LL11ss-022	Arsenic	30.20	=
LL11ss-023	Chromium	19.10	=
LL11ss-023	Cobalt	10.50	=
LL11ss-024	Arsenic	16.00	=
LL11ss-024	Chromium	19.40	=
LL11ss-026	Cobalt	10.50	=
LL11ss-027	Arsenic	18.80	=
LL11ss-029	Cobalt	14.00	=
LL11ss-029	Manganese	2080.00	=
LL11ss-030	Chromium	19.00	=
LL11ss-031	Arsenic	17.90	=

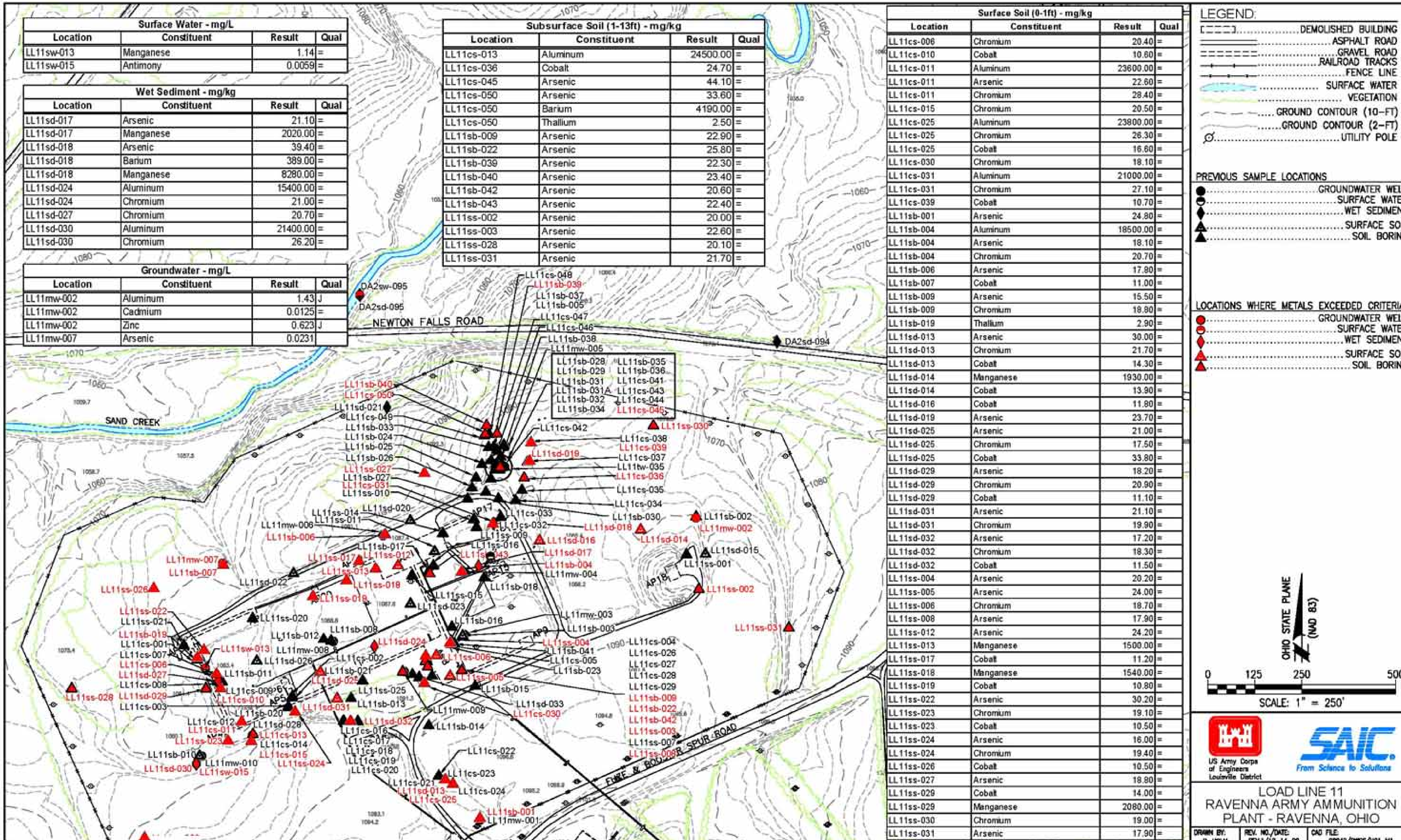
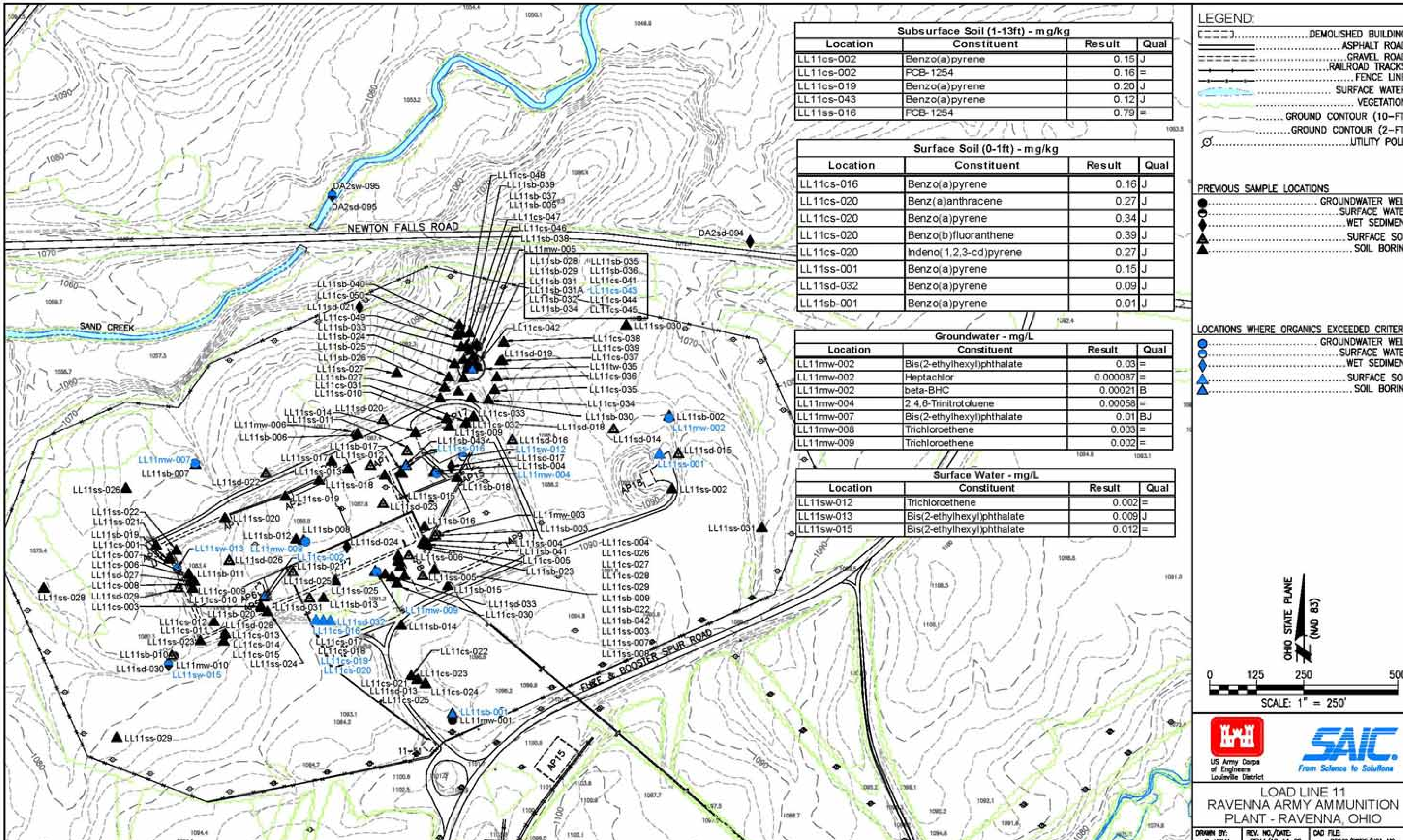


Figure M-1. Historical Sampling and Metal Exceedance Locations at Load Line 11



Subsurface Soil (1-13ft) - mg/kg

Location	Constituent	Result	Qual
LL11cs-002	Benzo(a)pyrene	0.15	J
LL11cs-002	PCB-1254	0.16	=
LL11cs-019	Benzo(a)pyrene	0.20	J
LL11cs-043	Benzo(a)pyrene	0.12	J
LL11ss-016	PCB-1254	0.79	=

Surface Soil (0-1ft) - mg/kg

Location	Constituent	Result	Qual
LL11cs-016	Benzo(a)pyrene	0.16	J
LL11cs-020	Benz(a)anthracene	0.27	J
LL11cs-020	Benzo(a)pyrene	0.34	J
LL11cs-020	Benzo(b)fluoranthene	0.39	J
LL11cs-020	Indeno(1,2,3-cd)pyrene	0.27	J
LL11ss-001	Benzo(a)pyrene	0.15	J
LL11sd-032	Benzo(a)pyrene	0.09	J
LL11sb-001	Benzo(a)pyrene	0.01	J

Groundwater - mg/L

Location	Constituent	Result	Qual
LL11mw-002	Bis(2-ethylhexyl)phthalate	0.03	=
LL11mw-002	Heptachlor	0.000087	=
LL11mw-002	beta-BHC	0.00021	B
LL11mw-004	2,4,6-Trinitrotoluene	0.00058	=
LL11mw-007	Bis(2-ethylhexyl)phthalate	0.01	BJ
LL11mw-008	Trichloroethene	0.003	=
LL11mw-009	Trichloroethene	0.002	=

Surface Water - mg/L

Location	Constituent	Result	Qual
LL11sw-012	Trichloroethene	0.002	=
LL11sw-013	Bis(2-ethylhexyl)phthalate	0.009	J
LL11sw-015	Bis(2-ethylhexyl)phthalate	0.012	=

Figure M-2. Historical Sampling and Organic Exceedance Locations at Load Line 11

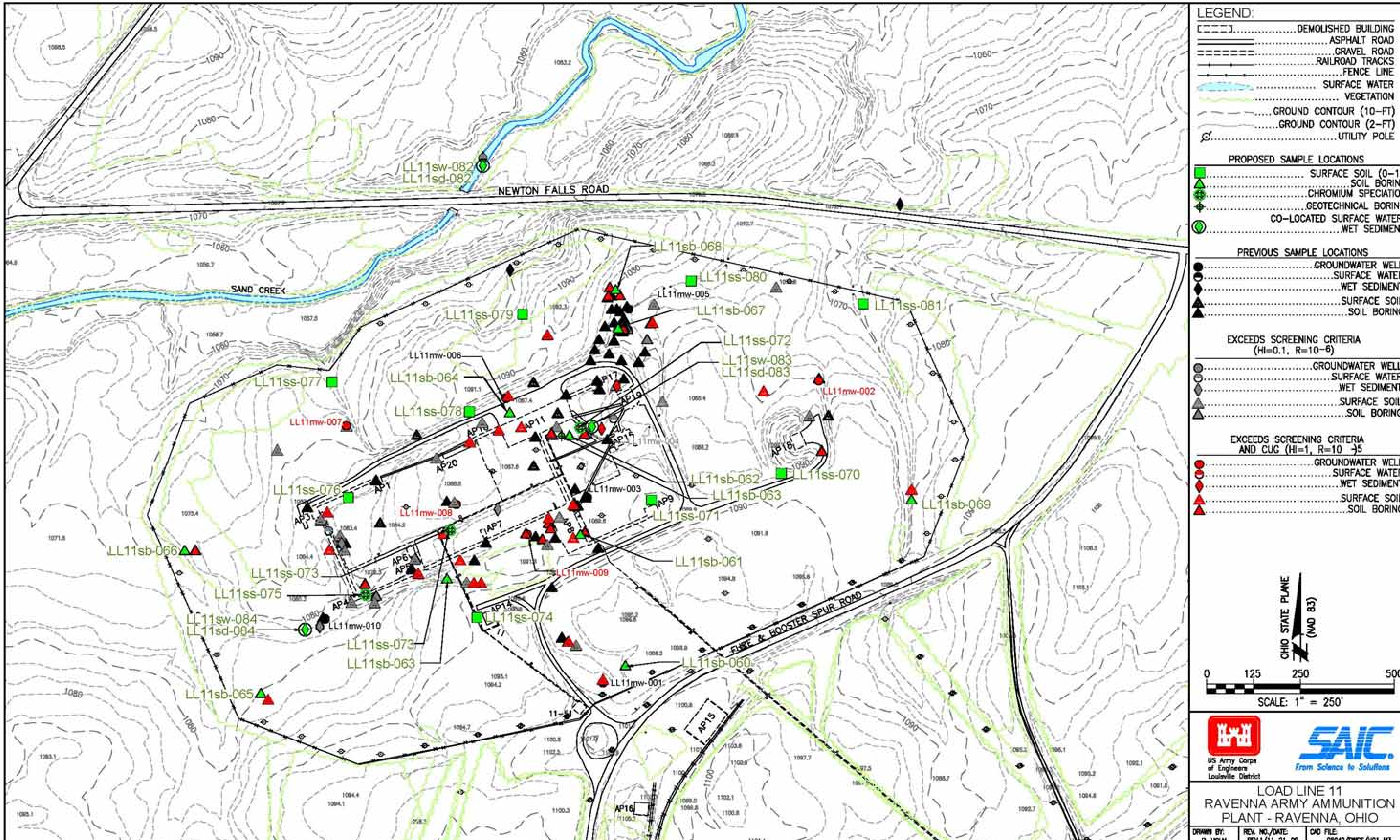


Figure M-3. Historical Exceedances and Proposed Sampling Locations at Load Line 11

APPENDIX N

Wet Storage Area (RVAAP-45)

N.0 WET STORAGE AREA (RVAAP-45)

N.1 AOC DESCRIPTION

The Wet Storage Area is a 36-acre AOC used from 1941 to 1945 to store primary explosives including lead azide, mercury fulminate, and tetryl (Figure N-1). The highly explosive and shock sensitive materials were stored in water-filled drums within each of six separate igloos. Four of the igloos (WS-1, WS-1A, WS-2, and WS-2A) located in the western portion of the AOC were decontaminated and demolished in 2004. The two remaining igloos (WS-3 and WS-3A) are located in the eastern portion of the AOC (MKM 2007a).

N.2 PREVIOUS INVESTIGATIONS

Since 1978, various assessments and investigations have been conducted at RVAAP that included sampling at the Wet Storage Area. In the 1998 RRSE, conducted by USACHPPM, the Wet Storage Area was scored as a "Medium" priority site. This report indicated that surface soil was a potential medium for contaminant migration (USACHPPM 1998).

From October 2004 to May 2005 as part of the Final Characterization of 14 AOCs at RVAAP, 18 MI surface soil (0 to 1 ft) samples were collected at the Wet Storage Area. The sample locations were sequentially numbered from WSAss-001M to WSAss-017M and the last location was numbered WSAss-020M. Location identifiers WSAss-018M and WSAss-019M were not used. Additionally, the boundaries for sample location WSAss-020M were not reported. Figure N-1 identifies sample locations and types of sample collected from previous investigations. The results of this investigation concluded that concentrations of contaminants for inorganics and SVOCs were above screening criteria (USEPA Region 9 PRGs and RVAAP background values) (MKM 2007a).

For this SAP Addendum, all sample results were compared to the preliminary RVAAP facility-wide screening criteria (Section 3.2.2 of the FSP). Table N-1 lists the chemicals that exceeded screening criteria in each medium, as well as the maximum and minimum concentration detected.

Figures N-1 and N-2 illustrate the type and location of historical samples and identify samples that exceeded screening criteria for metals and organics, respectively.

Table N-1. Chemicals Exceeding Screening Criteria at Wet Storage Area

Medium	Analyte	Units	Frequency of Detection	Minimum Detect	Maximum Detect	Average Result[a]	Screening Criteria[b]
Surface Soil	Arsenic	mg/kg	22/22	11	21	15.7	15.4
	Chromium	mg/kg	22/22	16	26	20.90	17.4
	Cobalt	mg/kg	22/22	6.60	14	10.70	10.4
	Benz(a)anthracene	mg/kg	1/2	8.2	8.2	4.11	0.22
	Benzo(a)pyrene	mg/kg	2/2	0.012	5.5	2.76	0.022

Table N-1. Chemicals Exceeding Screening Criteria at Wet Storage Area (continued)

Medium	Analyte	Units	Frequency of Detection	Minimum Detect	Maximum Detect	Average Result[a]	Screening Criteria[b]
Surface Soil	Benzo(b)fluoranthene	mg/kg	2/2	0.019	7.3	3.66	0.22
	Benzo(k)fluoranthene	mg/kg	1/2	3.20	3.20	1.61	2.2
	Dibenz(a,h)anthracene	mg/kg	1/2	0.94	0.94	0.479	0.022
	Indeno(1,2,3-cd)pyrene	mg/kg	1/2	3.4	3.4	1.71	0.22
Subsurface Soil	Not sampled	--	--	--	--	--	--
Wet Sediment	Not sampled	--	--	--	--	--	--
Surface Water	Not sampled	--	--	--	--	--	--
Groundwater	Not sampled	--	--	--	--	--	--

-- Not applicable.
[a]Average result equals the sum of the concentrations divided by the number of samples; the average includes non-detects at half the reporting limit and field duplicate samples. This can result in an average less than the range of detected values.
[b]Screening criteria are based on HI=0.1 and Target Risk=10^{-6}.

During previous investigations surface soil samples have been collected at Wet Storage Area at the 0-1 ft interval. Table N-2 summarizes the historical surface soil sampling conducted at Wet Storage Area and indicates whether sample results exceeded screening criteria.

Table N-2. Wet Storage Area Historical Soil Sampling Summary

Sample Location	Sample Number	Depth of Sample (ft bgs)	Analysis Performed				
			Metals	Explosives	VOCs	Pesticides/ PCBs	SVOCs
WSAss-001M	WSAss-001M-SO	0.0- 1.0	**Y**	N	--	--	--
WSAss-002M	WSAss-002M-SO	0.0- 1.0	**Y**	N	--	--	--
WSAss-003M	WSAss-003M-SO	0.0- 1.0	**Y**	N	--	--	--
WSAss-004D	WSAss-004D-SO	0.0- 1.0	--	--	N	--	--
WSAss-004M	WSAss-004M-SO	0.0- 1.0	Cr	N	--	N	**Y**
WSAss-005M	WSAss-005M-DUP	0.0- 1.0	**Y**	N	--	--	--
	WSAss-005M-SO	0.0- 1.0	**Y**	N	--	--	--
WSAss-006M	WSAss-006M-SO	0.0- 1.0	**Y**	N	--	--	--
WSAss-007M	WSAss-007M-SO	0.0- 1.0	**Y**	N	--	--	--
WSAss-008M	WSAss-008M-SO	0.0- 1.0	**Y**	N	--	--	--
WSAss-009M	WSAss-009M-SO	0.0- 1.0	**Y**	N	--	--	--
WSAss-010M	WSAss-010M-SO	0.0- 1.0	N	N	--	--	--
WSAss-011D	WSAss-011D-SO	0.0- 1.0	--	--	N	--	--
WSAss-011M	WSAss-011M-SO	0.0- 1.0	Cr	N	--	N	N
WSAss-012M	WSAss-012M-SO	0.0- 1.0	Cr	N	--	--	--
WSAss-013M	WSAss-013M-SO	0.0- 1.0	**Y**	N	--	--	--
WSAss-014M	WSAss-014M-DUP	0.0- 1.0	**Y**	N	--	--	--
	WSAss-014M-SO	0.0- 1.0	**Y**	N	--	--	--
WSAss-015M	WSAss-015M-SO	0.0- 1.0	Cr	N	--	--	--

Table N-2. Wet Storage Area Historical Soil Sampling Summary (continued)

Sample Location	Sample Number	Depth of Sample (ft bgs)	Analysis Performed				
			Metals	Explosives	VOCs	Pesticides/ PCBs	SVOCs
WSAss-016M	WSAss-016M-QA	0.0- 1.0	**Y**	N	--	--	--
	WSAss-016M-SO	0.0- 1.0	**Y**	N	--	--	--
WSAss-017M	WSAss-017M-SO	0.0- 1.0	Cr	N	--	--	--
WSAss-020M	WSAss-020M-DUP	0.0- 1.0	**Y**	N	--	--	--
	WSAss-020M-SO	0.0- 1.0	**Y**	N	--	--	--

Y = Analyte(s) greater than screening criteria.
Cr = Only chromium greater than screening criterion.
N = Non-detect or less than screening criteria.
-- = Analysis not performed.
Only PAHs were detected above screening criteria in the SVOC analysis.

N.3 PROPOSED SAP ADDENDUM CHARACTERIZATION ACTIVITIES

The objective of this SAP Addendum for the Wet Storage Area is to define nature and extent of chemicals at concentrations greater than the screening criteria. To accomplish this further sampling and analysis of metals and PAHs in soil will be conducted and the adjacent surface water and wet sediment will be characterized. Based on AOC characteristics and the operational constraints during its use (e.g., material maintained under control in igloos), the existing and planned sample coverage to define nature and extent is adequate so that there will be no substantial uncharacterized portions of the AOC. Therefore, MI samples for non-operational areas based on an AOC-wide grid are not planned for the Wet Storage Area.

Table N-3 summarizes the chemicals that exceeded screening criteria and CUGs for each medium, the types and quantities of samples to be collected during the implementation of this SAP Addendum, and the rationale behind the proposed samples. The general approach for investigation activities is presented in Section 3.2 of the FSP. Figure N-3 illustrates the locations of the samples to be collected as well as previous screening criteria and CUG exceedances.

Table N-4 presents the coordinates for the proposed sampling locations for this AOC. The locations may be altered during implementation of this SAP Addendum for a variety of reasons (e.g., soil boring refusal and MEC avoidance). The final coordinates of the sample locations (including elevations) will be presented in the RI Report.

Table N-3. Summary of Sampling at Wet Storage Area

Medium	Historical Sample Type	Historical Screening Criteria Exceedances	Number of SAP Addendum Sample Locations	Rationale for SAP Addendum Field Activities
Surface soil	MI	As **WSAss-001M**, **002M**, **003M**, **005M**, **007M**, **009M**, **013M**, **014M**, **016M**, **020M** Co WSAss-002M, 003M, 005M, 006M, 007M, 008M, 009M, 014M, 020M SVOCs **WSAss-004M**.	4	Four boundary MI sample areas are planned around former MI areas where chemicals were detected greater than screening criteria and CUGs to further define the lateral extent of contamination. In some cases, one new MI area was used to bound multiple former MI areas and potential sources. Samples will be analyzed for TAL metals, explosives, and PAHs; 15% RVAAP full suite. NOTE: Boundary of area ss-020M was not published by MKM.
	Chromium speciation	Cr WSAss-001M, 002M, 003M, 004M, 005M, 006M, 007M, 008M, 009M, 011M, 012M, 013M, 014M, 015M, 016M, 017M, 020M	3	Discrete surface soil samples will be collected at previous locations WSAss-003M (26 mg/kg – maximum previous total chromium concentration), ss-009M (18 mg/kg) and ss-001M (22 mg/kg). Refer to Section 4.1.3 of the FSP for a discussion about chromium speciation sampling.
Subsurface soil	None collected	N/A	8	A total of eight boring locations are placed to further define the vertical extent of contamination. These include seven in previous MI areas (WSAss-002M, ss-004M, ss-005M, ss-007M, ss-013M, ss-014M and ss-020M) where chemicals were detected greater than CUGs and one in previous MI area WSAss-006M where chemicals were greater than screening criteria. Samples will be analyzed for TAL metals, explosives, and PAHs; 15% RVAAP full suite.
	Geotechnical (none previously collected)	N/A	1	Two samples shall be collected from one location to provide soil data for modeling.

Table N-3. Summary of Sampling at Wet Storage Area (continued)

Medium	Historical Sample Type	Historical Screening Criteria Exceedances	Number of SAP Addendum Sample Locations	Rationale for SAP Addendum Field Activities
Surface water	None collected	N/A	4	Four surface water and co-located composite wet sediment samples will be collected to characterize current conditions and assess potential entrance and exit pathways from the AOC. Two samples are planned on the tributary that runs on the west side of the AOC: one at the ingress of tributary onto the AOC and one approximately 100 feet from the point of confluence with Sand Creek. Two samples are planned along Sand Creek: one west of the point of confluence within the small tributary, and one east of the bridge on George Road. Surface water samples will be analyzed for the RVAAP full suite. Composite wet sediment samples will be analyzed for explosives, TAL metals, and SVOCs. The RVAAP full suite of parameters will be analyzed for 15% (i.e., one) of the composite wet sediment samples.
Wet sediment	None collected	N/A	4	Refer to surface water above.
Groundwater	None collected	N/A	N/A	There are currently no groundwater wells at this AOC. Potential leaching of soil contaminants to groundwater will be evaluated through SESOIL modeling. No groundwater sampling is planned as part of this SAP Addendum. If SESOIL modeling indicates potential soil source leaching, monitoring wells will be installed under a separate addendum.

Bold indicates locations where concentration also exceeded the CUG (HI=1.0, Target Risk=10^{-5}) for the identified chemical.

Table N-4. Coordinates for Proposed Sampling Locations at Wet Storage Area

Sample Location ID	Coordinate Point	Sample Type	Easting	Northing
WSAss-033M	1	MI	2356851.0000	559585.0000
	2	MI	2357084.0000	559585.0000
	3	MI	2356866.0000	559570.0000
	4	MI	2357069.0000	559570.0000
	5	MI	2356866.0000	559201.0000
	6	MI	2357069.0000	559201.0000
	7	MI	2356851.0000	559186.0000
	8	MI	2357084.0000	559186.0000
WSAss-034M	9	MI	2357404.2260	559498.8785
	10	MI	2357549.0485	559498.8785
	11	MI	2357419.2260	559480.8083
	12	MI	2357534.0485	559483.8785
	13	MI	2357404.2260	559367.6547
	14	MI	2357419.2260	559375.2022
	15	MI	2357419.2260	559351.1302
	16	MI	2357534.0485	559351.1302
	17	MI	2357404.2260	559336.1302
	18	MI	2357549.0485	559336.1302
WSAss-036M	19	MI	2356807.0000	559160.0000
	20	MI	2357082.0000	559160.0000
	21	MI	2356822.0000	559145.0000
	22	MI	2357067.0000	559145.0000
	23	MI	2356822.0000	558868.0000
	24	MI	2357067.0000	558868.0000
	25	MI	2356807.0000	558853.0000
	26	MI	2357082.0000	558853.0000
WSAss-035M	27	MI	2357652.9017	559212.7246
	28	MI	2357665.9528	559203.4689
	29	MI	2357561.2815	559083.5352
	30	MI	2357572.4582	559071.6364
	31	MI	2357532.8997	559065.9655
	32	MI	2357541.3214	559052.3612
WSAsb-021	N/A	Grab	2357474.3577	559003.3550
WSAsb-022	N/A	Grab	2357500.8575	559458.0730
WSAsb-023	N/A	Grab	2357031.0000	559473.0000
WSAsb-024	N/A	Grab	2357002.5820	559261.5794
WSAsb-025	N/A	Grab	2357003.3241	559243.5618
WSAsb-026	N/A	Grab	2357047.4700	559131.6900
WSAsb-027	N/A	Grab	2357003.0000	559019.0000
WSAsb-028	N/A	Grab	2357007.9308	558916.3195
WSAsb-029	N/A	Grab	2356862.9269	559097.8346
WSAsd-037	N/A	Composite	2356623.1648	559084.1212
WSAsd-038	N/A	Composite	2356599.7496	559673.4210

Table N-4. Coordinates for Proposed Sampling Locations at Wet Storage Area (continued)

Sample Location ID	Coordinate Point	Sample Type	Easting	Northing
WSAsd-039	N/A	Composite	2356558.3227	559848.2285
WSAsd-040	N/A	Composite	2357826.7448	560328.6348
WSAss-030	N/A	Grab	2357001.0186	559433.4342
WSAss-031	N/A	Grab	2357012.3991	559338.2981
WSAss-032	N/A	Grab	2357005.1335	559084.7267
WSAsw-037	N/A	Grab	2356623.1648	559084.1212
WSAsw-038	N/A	Grab	2356599.7496	559673.4210
WSAsw-039	N/A	Grab	2356558.3227	559848.2285
WSAsw-040	N/A	Grab	2357826.7448	560328.6348

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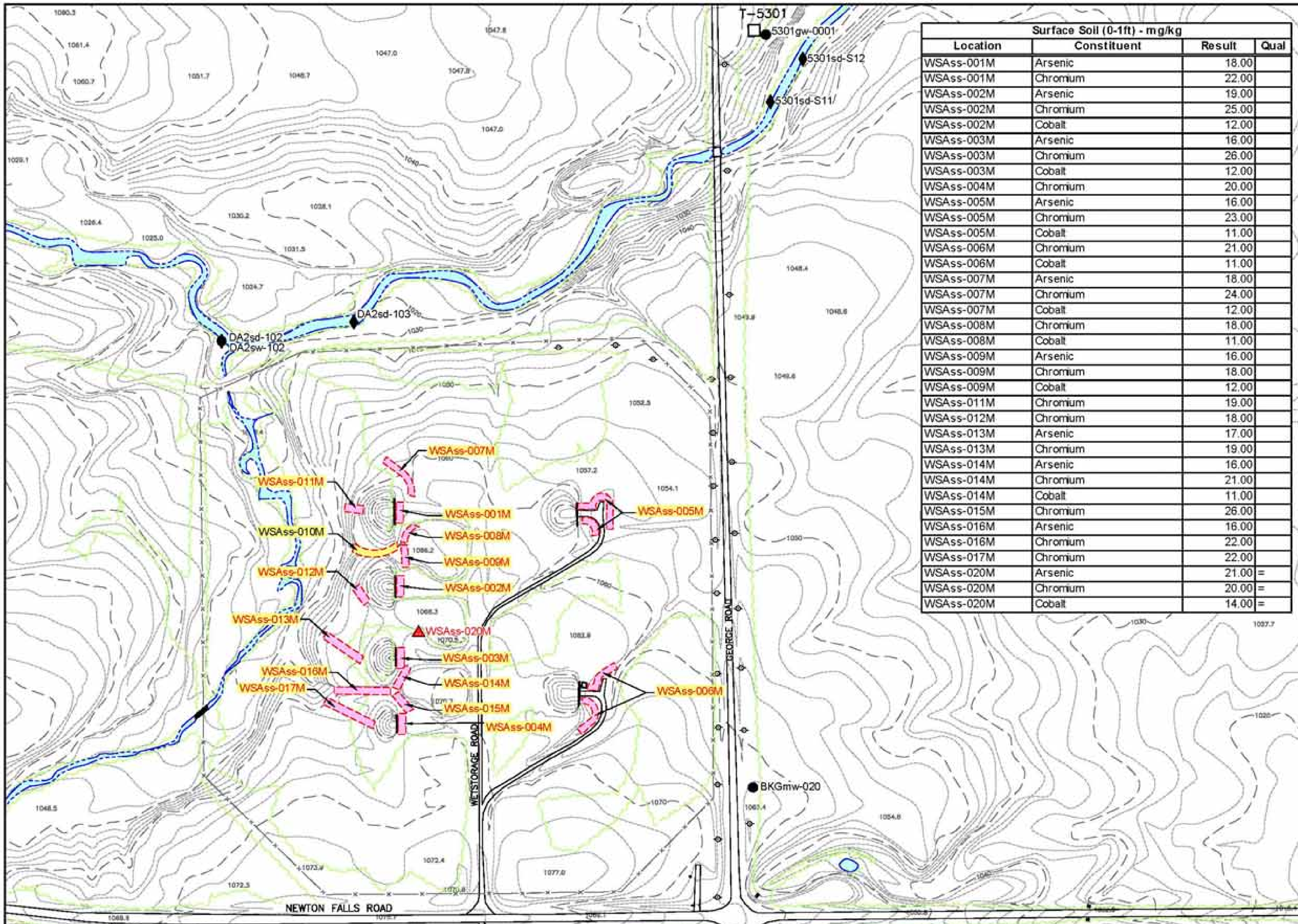


Surface Soil (0-1ft) - mg/kg			
Location	**Constituent**	**Result**	**Qual**
WSAss-001M	Arsenic	18.00	
WSAss-001M	Chromium	22.00	
WSAss-002M	Arsenic	19.00	
WSAss-002M	Chromium	25.00	
WSAss-002M	Cobalt	12.00	
WSAss-003M	Arsenic	16.00	
WSAss-003M	Chromium	26.00	
WSAss-003M	Cobalt	12.00	
WSAss-004M	Chromium	20.00	
WSAss-005M	Arsenic	16.00	
WSAss-005M	Chromium	23.00	
WSAss-005M	Cobalt	11.00	
WSAss-006M	Chromium	21.00	
WSAss-006M	Cobalt	11.00	
WSAss-007M	Arsenic	18.00	
WSAss-007M	Chromium	24.00	
WSAss-007M	Cobalt	12.00	
WSAss-008M	Chromium	18.00	
WSAss-008M	Cobalt	11.00	
WSAss-009M	Arsenic	16.00	
WSAss-009M	Chromium	18.00	
WSAss-009M	Cobalt	12.00	
WSAss-011M	Chromium	19.00	
WSAss-012M	Chromium	18.00	
WSAss-013M	Arsenic	17.00	
WSAss-013M	Chromium	19.00	
WSAss-014M	Arsenic	16.00	
WSAss-014M	Chromium	21.00	
WSAss-014M	Cobalt	11.00	
WSAss-015M	Chromium	26.00	
WSAss-016M	Arsenic	16.00	
WSAss-016M	Chromium	22.00	
WSAss-017M	Chromium	22.00	
WSAss-020M	Arsenic	21.00	=
WSAss-020M	Chromium	20.00	=
WSAss-020M	Cobalt	14.00	=

LEGEND:

- DEMOLISHED BUILDING
- ASPHALT ROAD
- GRAVEL ROAD
- RAILROAD TRACKS
- FENCE LINE
- SURFACE WATER
- VEGETATION
- GROUND CONTOUR (10-FT)
- GROUND CONTOUR (2-FT)
- UTILITY POLE

PREVIOUS SAMPLE LOCATIONS

- GROUNDWATER WELL
- SURFACE WATER
- WET SEDIMENT
- SURFACE SOIL
- SOIL BORING
- MI SAMPLING AREA

LOCATIONS WHERE METALS EXCEEDED CRITERIA

- GROUNDWATER WELL
- SURFACE WATER
- WET SEDIMENT
- SURFACE SOIL
- SOIL BORING
- MI SAMPLING AREA

OHIO STATE PLANE (NAD 83)

0 125 250 500

SCALE: 1" = 250'

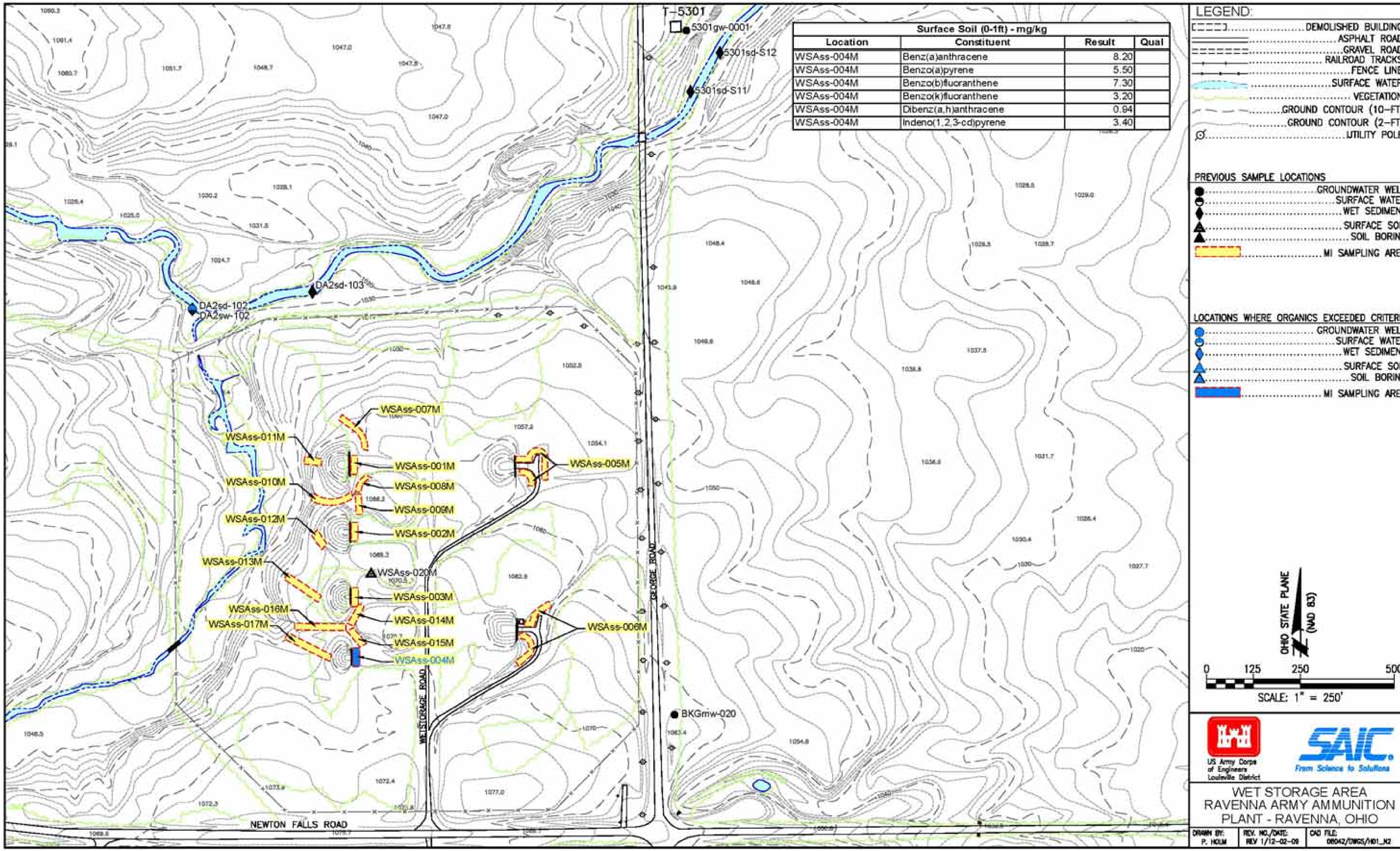
US Army Corps of Engineers Louisville District

SAIC. From Science to Solutions

WET STORAGE AREA
RAVENNA ARMY AMMUNITION PLANT - RAVENNA, OHIO

DRAWN BY:	REV. NO./DATE:	CAD FILE:
P. HOLM	REV 1/12-02-09	08042/DWGS/H01_N1

Figure N-1. Historical Sampling and Metal Exceedance Locations at Wet Storage Area



Surface Soil (0-1ft) - mg/kg			
Location	**Constituent**	**Result**	**Qual**
WSAss-004M	Benz(a)anthracene	8.20	
WSAss-004M	Benzo(a)pyrene	5.50	
WSAss-004M	Benzo(b)fluoranthene	7.30	
WSAss-004M	Benzo(k)fluoranthene	3.20	
WSAss-004M	Dibenz(a,h)anthracene	0.94	
WSAss-004M	Indeno(1,2,3-cd)pyrene	3.40	

Figure N-2. Historical Sampling and Organic Exceedance Locations at Wet Storage Area

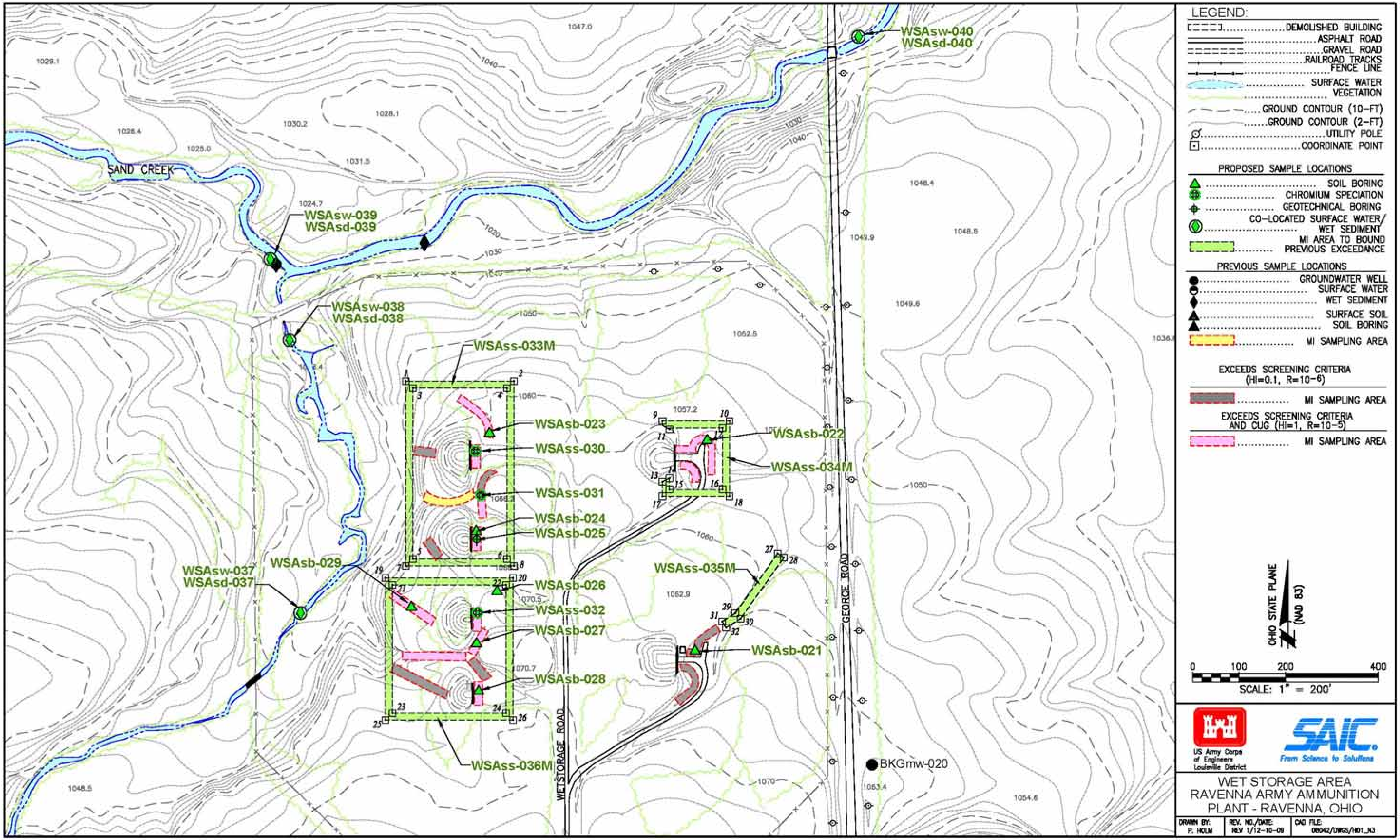


Figure N-3. Historical Exceedances and Proposed Sampling Locations at Wet Storage Area

APPENDIX O

Buildings F-15 and F-16 (RVAAP-46)

O.0 BUILDINGS F-15 AND F-16 (RVAAP-46)

O.1 AOC DESCRIPTION

Buildings F-15 and F-16 are located west of Block D and east of Slagle Road (Figure O-1). The buildings were used during World War II, the Korean War, and the Vietnam War to test miscellaneous explosives and propellants. The number of tests conducted, quantities of materials tested and exact dates of testing are unknown. The buildings have been demolished and the building footers (approximately 60 ft by 120 ft) remain.

O.2 PREVIOUS INVESTIGATIONS

Since 1978, various assessments and investigations have been conducted at RVAAP that included Building F-15 and F-16. In the 1998 RRSE, conducted by USACHPPM, Buildings F-15 and F-16 were scored as a "High" priority AOC. This report indicated that surface soil and sediment were potential media for contaminant migration which could potentially impact human and/or ecological receptors (USACHPPM 1998).

From October 2004 through February 2005 as part of the Final Characterization of 14 AOCs at RVAAP the following field activities were conducted:

- Collection of 18 MI surface soil (0 to 1 ft) samples;
- Collection of two MI wet sediment samples; and
- Collection of two surface water samples.

The results of this investigation concluded that concentrations for inorganics and one SVOC were above screening criteria (e.g., USEPA Region 9 PRGs and RVAAP background values) (MKM 2007a).

For this SAP Addendum, all sample results were compared to the preliminary RVAAP facility-wide screening criteria (Section 3.2.2 of the FSP). Table O-1 lists the chemicals that exceeded screening criteria in each medium, as well as the maximum and minimum concentration detected.

Figures O-1 and O-2 illustrate the type and location of historical samples and identify samples that exceeded screening criteria for metals and organics, respectively.

Table O-1. Chemicals Exceeding Screening Criteria at Buildings F-15 and F-16

Medium	Analyte	Units	Frequency of Detection	Minimum Detect	Maximum Detect	Average Result[a]	Screening Criteria[b]
Surface Soil	Arsenic	mg/kg	19/19	9.4	20	12.1	15.4
	Chromium	mg/kg	19/19	19.00	55.00	25.50	17.4
	Cobalt	mg/kg	19/19	4.60	12.00	9.43	10.4
	Benzo(a)pyrene	mg/kg	2/2	0.03	0.11	0.07	0.022
Subsurface Soil	Not sampled	--	--	--	--	--	--
Wet Sediment	Chromium	mg/kg	3/3	17	20	18.1	18.1
Surface Water	Arsenic	mg/L	1/3	0.0068	0.0068	0.0029	0.0032
	Manganese	mg/L	3/3	0.072	4.600	1.58	0.63
Groundwater	Not sampled	--	--	--	--	--	--

-- Not applicable.
[a]Average result equals the sum of the concentrations divided by the number of samples; the average includes non-detects at half the reporting limit and field duplicate samples. This can result in an average less than the range of detected values.
[b]Screening criteria are based on HI=0.1 and Target Risk=10^{-6}.

During previous investigations, surface soil samples have been collected at the 0-0.5 ft, 0-1 ft intervals at Buildings F-15 and F-16. Table O-2 summarizes the historical surface soil sampling conducted at Buildings F-15 and F-16, and indicates whether sample results exceeded screening criteria.

Table O-2. Buildings F-15 and F-16 Historical Soil Sampling Summary

Sample Location	Sample Number	Depth of Sample (ft bgs)	Analysis Performed				
			Metals	Explosives	VOCs	Pesticides/ PCBs	SVOCs
F15ss-001M	F15ss-001M-SO	0.0- 1.0	**Y**	N	--	--	--
F15ss-002M	F15ss-002M-SO	0.0- 1.0	**Y**	N	--	--	--
F15ss-003M	F15ss-003M-SO	0.0- 1.0	Cr	N	--	--	--
F15ss-004M	F15ss-004M-SO	0.0- 1.0	**Y**	N	--	--	--
F15ss-005M	F15ss-005M-SO	0.0- 1.0	**Y**	N	--	--	--
F15ss-006D	F15ss-006D-SO	0.0- 1.0	--	--	N	--	--
F15ss-006M	F15ss-006M-SO	0.0- 1.0	**Y**	N	--	N	**Y**
F15ss-007M	F15ss-007M-SO	0.0- 1.0	Cr	N	--	--	--
F15ss-008M	F15ss-008M-SO	0.0- 1.0	**Y**	N	--	--	--
F15ss-009M	F15ss-009M-DUP	0.0- 0.5	Cr	N	--	--	--
	F15ss-009M-SO	0.0- 0.5	Cr	N	--	--	--
F15ss-010M	F15ss-010M-SO	0.0- 1.0	**Y**	N	--	--	--
F15ss-011M	F15ss-011M-SO	0.0- 1.0	**Y**	N	--	--	--
F16ss-001M	F16ss-001M-SO	0.0- 0.5	**Y**	N	--	--	--
F16ss-002M	F16ss-002M-SO	0.0- 0.5	Cr	N	--	--	--
F16ss-003M	F16ss-003M-SO	0.0- 0.5	Cr	N	--	--	--
F16ss-004M	F16ss-004M-SO	0.0- 1.0	**Y**	N	--	--	--
F16ss-005D	F16ss-005D-SO	0.0- 0.5	--	--	N	--	--

Table O-2. Buildings F-15 and F-16 Historical Soil Sampling Summary (continued)

Sample Location	Sample Number	Depth of Sample (ft bgs)	Analysis Performed				
			Metals	Explosives	VOCs	Pesticides/ PCBs	SVOCs
F16ss-005M	F16ss-005M-SO	0.0- 0.5	Cr	N	--	N	**Y**
F16ss-006M	F16ss-006M-SO	0.0- 1.0	**Y**	N	--	--	--
F16ss-007M	F16ss-007M-SO	0.0- 0.5	Cr	N	--	--	--

Y = Analyte(s) greater than screening criteria.
Cr = Only chromium greater than screening criterion.
N = Non-detect or less than screening criteria.
-- = Analysis not performed.
Only PAHs were detected above screening criteria in the SVOC analysis.

O.3 PROPOSED SAP ADDENDUM CHARACTERIZATION ACTIVITIES

The objective of this SAP Addendum for Buildings F-15 and F-16 is to define the nature and extent of chemicals at concentrations greater than the screening criteria. To accomplish this further sampling and analysis of metals and PAHs in soil will be conducted.

Table O-3 summarizes the chemicals that exceeded screening criteria and CUGs for each medium, the types and quantities of samples to be collected during the implementation of this SAP Addendum, and the rationale behind the proposed samples. The general approach for investigation activities is presented in Section 3.2 of the FSP. Figure O-3 illustrates the locations of the samples to be collected as well as previous screening criteria and CUG exceedances.

Table O-4 presents the coordinates for the proposed sampling locations for this AOC. The locations may be altered during implementation of this SAP Addendum for a variety of reasons (e.g., soil boring refusal and MEC avoidance). The final coordinates of the sample locations (including elevations) will be presented in the RI Report.

Table O-3. Summary of Sampling at Buildings F-15 and F-16

Medium	Historical Sample Type	Historical Screening Criteria Exceedances	Number of SAP Addendum Sample Locations	Rationale for SAP Addendum Field Activities
Surface soil	MI	As **F15ss-005M, 011M, F16ss-004M** Co F15ss-001M, 002M, 004M, 005M, 006M, 008M, 010M F16ss-001M, 006M SVOCs F15ss-006M, F16ss-005M	7	A total of seven MI areas are planned to further define surface soils above screening criteria and CUGs. Two boundary MI areas are established around former MI areas where chemicals were detected above CUGs to further define the lateral extent of chemicals. Three MI areas are placed in ditches downgradient of locations where chemicals were greater than screening criteria and CUGs, since operational areas of the AOC consist primarily of paved surfaces. Two MI areas are established over the former building footprints Samples will be analyzed for TAL metals, explosives, and PAHs; 15% RVAAP full suite.
	Chromium speciation	Cr F15ss-001M. 002M, 003M, 004M, 005M, 006M, 007M, 008M, 009M, 010M, 011M, F16ss-001M, 002M, 003M, 004M, 005M, 006M, 007M	3	Discrete surface soil samples will be collected at previous locations F16ss-007M (55 mg/kg – maximum previous concentration of total chromium), F15ss-008M (19 mg/kg) and F16ss-005M (38 mg/kg). Refer to Section 4.1.3 of the FSP for a discussion about chromium speciation sampling.
Subsurface soil	none collected	N/A	5	A total of five boring locations are placed to further define the vertical extent of contamination. These include three in previous MI areas where arsenic was detected greater than the CUG (locations F15ss-005M, F15ss-011M and F16ss-004M) and two in MI areas (F15ss-006M and F16ss-007M) where chemicals were detected above screening criteria but less than CUGs. Samples will be analyzed for TAL metals, explosives, and PAHs; 15% RVAAP full suite.
	Geotechnical	N/A	1	Two samples shall be collected from one location to provide soil data for modeling.

Table O-3. Summary of Sampling at Buildings F-15 and F-16 (continued)

Medium	Historical Sample Type	Historical Screening Criteria Exceedances	Number of SAP Addendum Sample Locations	Rationale for SAP Addendum Field Activities
Surface water	Discrete	As F16sw-001 Mn F16sw-001	0	No further investigation is planned F16sw-001, which is isolated and does not connect to flowing surface waters. Surface water downgradient of Building F-16 (F16sw-002) did not exceed screening criteria.
Wet sediment	MI	Cr F16sd-001M	0	No further investigation is planned. Refer to surface water discussion.
Groundwater	none collected	N/A	0	Currently there are no groundwater wells at this AOC. Potential leaching of soil contaminants to groundwater will be evaluated through SESOIL modeling. No groundwater sampling is planned as part of this SAP Addendum. If SESOIL modeling indicates potential soil source leaching, monitoring wells will be installed under a separate addendum

Bold indicates locations where concentration also exceeded the CUG (HI=1.0, Target Risk=10^{-5}) for the identified chemical.

Table O-4. Coordinates for Proposed Sampling Locations at Buildings F-15 and F-16

Sample Location ID	Coordinate Point	Sample Type	Easting	Northing
F15ss-036M	1	MI	2349212.0387	564172.0923
	2	MI	2349228.0365	564172.3563
	3	MI	2349215.9167	563937.1243
	4	MI	2349231.9145	563937.3883
	5	MI	2349256.4427	563913.7902
	6	MI	2349326.4256	563915.3404
	7	MI	2349256.7971	563897.7942
	8	MI	2349326.7799	563899.3443
F15ss-035M	9	MI	2349216.2464	563711.5052
	10	MI	2349361.2402	563712.8451
	11	MI	2349216.3942	563695.5059
	12	MI	2349361.3880	563696.8458
F15ss-037M	13	MI	2349460.0028	563593.9353
	14	MI	2349571.4763	563593.9353
	15	MI	2349475.0028	563578.9353
	16	MI	2349556.4763	563578.9353
	17	MI	2349475.0028	563522.1864
	18	MI	2349556.4763	563522.1864
	19	MI	2349460.0028	563507.1864
	20	MI	2349571.4763	563507.1864
F15ss-038M	37	MI	2349437.1380	563839.7100
	38	MI	2349499.9510	563839.7100
	39	MI	2349437.1380	563696.7720
	40	MI	2349499.3741	563696.9699
F16ss-026M	21	MI	2349274.6970	562649.9734
	22	MI	2349412.9175	562649.9734
	23	MI	2349289.6970	562634.9734
	24	MI	2349397.9175	562634.9734
	25	MI	2349412.9175	562626.8208
	26	MI	2349512.9175	562626.8208
	27	MI	2349397.9175	562611.8208
	28	MI	2349512.9175	562611.8208
	29	MI	2349289.6970	562575.7535
	30	MI	2349370.9165	562575.7535
	31	MI	2349274.6970	562560.7535
	32	MI	2349370.9165	562560.7535
F16ss-027M	33	MI	2349254.5806	562280.8628
	34	MI	2349380.0520	562366.6841
	35	MI	2349255.2335	562263.1362
	36	MI	2349380.0520	562348.5109
F16ss-028M	41	MI	2349462.1812	562567.8193
	42	MI	2349525.2914	562567.8193
	43	MI	2349462.1812	562387.5409
	44	MI	2349525.2914	562387.5409
F15sb-031	N/A	Grab	2349515.7214	563547.4527

Table O-4. Coordinates for Proposed Sampling Locations at Buildings F-15 and F-16 (continued)

Sample Location ID	Coordinate Point	Sample Type	Easting	Northing
F15sb-032	N/A	Grab	2349425.9102	563576.1152
F15sb-033	N/A	Grab	2349426.0000	563910.0000
F15ss-034	N/A	Grab	2349371.196	563834.2915
F16sb-021	N/A	Grab	2349385.5868	562537.0270
F16sb-022	N/A	Grab	2349385.0000	562591.0000
F16sb-023	N/A	Grab	2349438.3125	562611.8208
F16ss-024	N/A	Grab	2349438.3126	562581.0728
F16ss-025	N/A	Grab	2349405.3858	562442.7063

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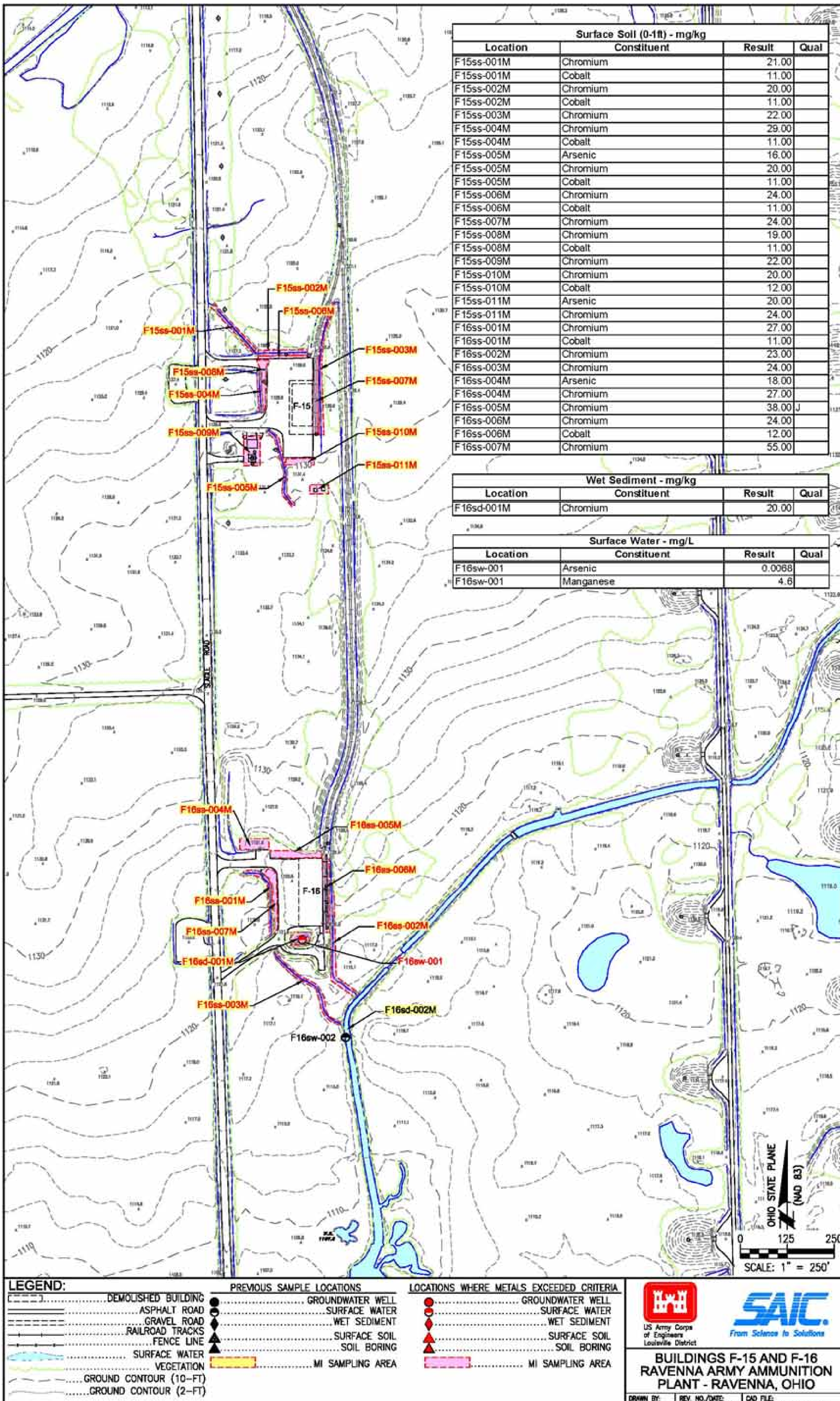


Surface Soil (0-1ft) - mg/kg

Location	Constituent	Result	Qual
F15ss-001M	Chromium	21.00	
F15ss-001M	Cobalt	11.00	
F15ss-002M	Chromium	20.00	
F15ss-002M	Cobalt	11.00	
F15ss-003M	Chromium	22.00	
F15ss-004M	Chromium	29.00	
F15ss-004M	Cobalt	11.00	
F15ss-005M	Arsenic	16.00	
F15ss-005M	Chromium	20.00	
F15ss-005M	Cobalt	11.00	
F15ss-006M	Chromium	24.00	
F15ss-006M	Cobalt	11.00	
F15ss-007M	Chromium	24.00	
F15ss-008M	Chromium	19.00	
F15ss-008M	Cobalt	11.00	
F15ss-009M	Chromium	22.00	
F15ss-010M	Chromium	20.00	
F15ss-010M	Cobalt	12.00	
F15ss-011M	Arsenic	20.00	
F15ss-011M	Chromium	24.00	
F16ss-001M	Chromium	27.00	
F16ss-001M	Cobalt	11.00	
F16ss-002M	Chromium	23.00	
F16ss-003M	Chromium	24.00	
F16ss-004M	Arsenic	18.00	
F16ss-004M	Chromium	27.00	
F16ss-005M	Chromium	38.00	J
F16ss-006M	Chromium	24.00	
F16ss-006M	Cobalt	12.00	
F16ss-007M	Chromium	55.00	

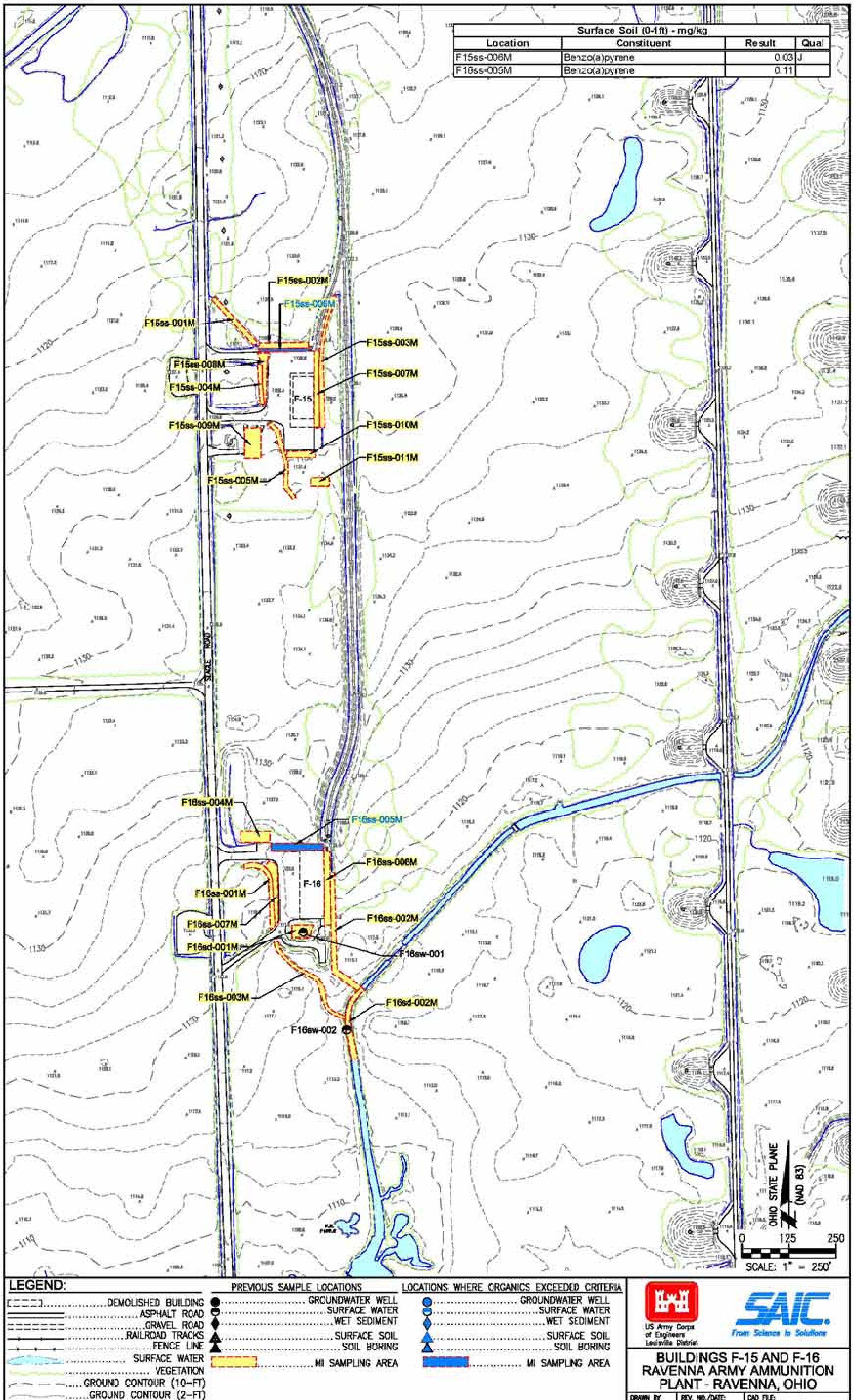
Wet Sediment - mg/kg

Location	Constituent	Result	Qual
F16sd-001M	Chromium	20.00	

Surface Water - mg/L

Location	Constituent	Result	Qual
F16sw-001	Arsenic	0.0068	
F16sw-001	Manganese	4.6	

Figure O-1. Historical Sampling and Metal Exceedance Locations at Building F-15 and F-16



Surface Soil (0-1ft) - mg/kg			
Location	Constituent	Result	Qual
F15ss-006M	Benzo(a)pyrene	0.03	J
F16ss-005M	Benzo(a)pyrene	0.11	

Figure O-2. Historical Sampling and Organic Exceedance Locations at Buildings F-15 and F-16

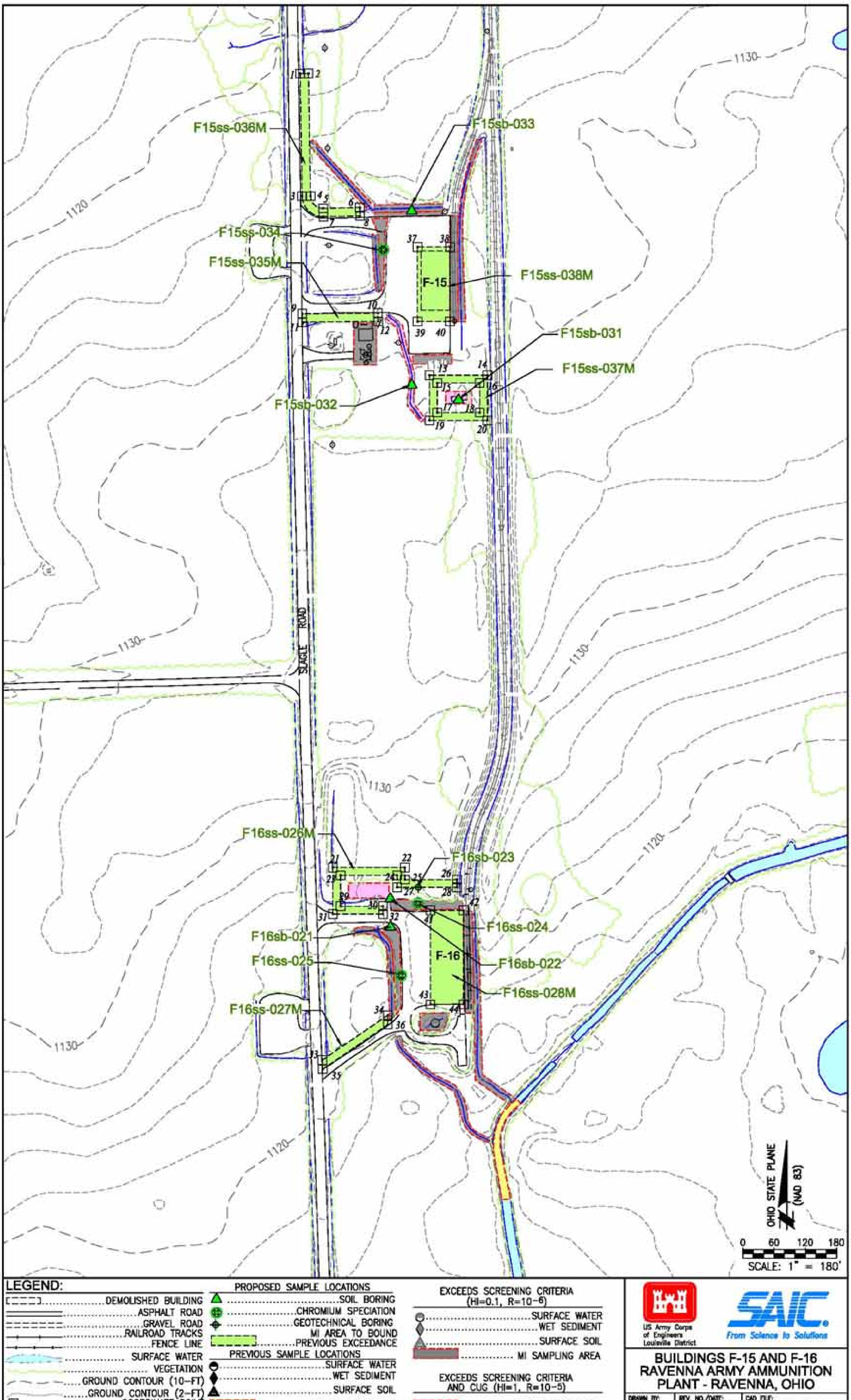


Figure O-3. Historical Exceedances and Proposed Sampling Locations at Locations at Building F-15 and F-16

APPENDIX P

Anchor Test Area (RVAAP-48)

P.0 ANCHOR TEST AREA (RVAAP-48)

P.1 AOC DESCRIPTION

Although operational information is relatively limited about Anchor Test Area (Figure P-1), the AOC was used for research, development, and testing of explosively-driven soil anchoring devices. The dates of use for the AOC are unknown, although it is believed activities did not occur until sometime after 1961. The Anchor Test Area encompasses approximately 1 acre and includes several dirt mounds with a nearby sand pit (approximately 6 ft by 30 ft). There is metal debris in the area.

P.2 PREVIOUS INVESTIGATIONS

In the 1978 USATHAMA Installation Risk Assessment, the Anchor Test Area was identified as being contaminated with explosive wastes. During the 1998 RRSE, conducted by USACHPPM, the Anchor Test Area was scored as a "medium" priority site. This report indicated that groundwater and surface soil were potential media for contaminant migration potentially impacting human receptors (USACHPPM 1998).

From August 2004 to February 2005, as part of the Final Characterization of 14 AOCs at RVAAP, five MI surface soil (0 to 1 ft) samples and two composite subsurface samples were collected and analyzed. Figure P-1 identifies sample locations and types of samples collected from previous investigations. The results of this investigation concluded that concentrations for arsenic in one sample and manganese in one sample were above screening criteria (USEPA Region 9 PRG and RVAAP background values) (MKM 2007a).

For this SAP Addendum, all sample results were compared to the preliminary RVAAP facility-wide screening criteria (Section 3.2.2 of the FSP). Table P-1 lists the chemicals that exceeded screening criteria in soil, as well as the maximum and minimum concentration detected.

Figure P-1 illustrates the type and location of historical samples and identifies samples that exceeded screening criteria for metals. There were no screening criteria exceedances for organics.

Table P-1. Chemicals Exceeding Screening Criteria at Anchor Test Area

Media	Analyte	Units	Frequency of Detection	Minimum Detect	Maximum Detect	Average Result[a]	Screening Criteria[b]
Surface Soil	Arsenic	mg/kg	6/6	7.5	54	16.2	15.4
	Chromium	mg/kg	6/6	16	36	22	17.4
	Manganese	mg/kg	6/6	330	1500	912	1450
Subsurface Soil	Chromium	mg/kg	2/2	26	28	27	27.2
Wet Sediment	Not sampled	--	--	--	--	--	--
Surface Water	Not sampled	--	--	--	--	--	--
Groundwater	Not sampled	--	--	--	--	--	--

-- Not applicable.

[a]Average result equals the sum of the concentrations divided by the number of samples; the average includes non-detects at half the reporting limit and field duplicate samples. This can result in an average less than the range of detected values.

[b]Screening criteria are based on HI=0.1 and Target Risk=10^{-6}.

During previous investigations, surface (0-1 ft) and subsurface (1-3 ft and 3-5 ft) soil samples have been collected at Anchor Test Area. Table P-2 summarizes the historical surface and subsurface soil sampling conducted at Anchor Test Area, and indicates whether sample results exceeded screening criteria.

Table P-2. Anchor Test Area Historical Soil Sampling Summary

Sample Location	Sample Number	Depth of Sample (ft bgs)	Analysis Performed				
			Metals	Explosives	VOCs	Pesticides/ PCBs	SVOCs
ATAss-001M	ATAss-001M-DUP	0.0- 1.0	**Y**	N	--	--	--
	ATAss-001M-SO	0.0- 1.0	**Y**	N	--	--	--
ATAsb-001M	ATAsb-001M-SO	1.0- 3.0	Cr	N	--	--	--
ATAss-002M	ATAss-002M-SO	0.0- 1.0	Cr	N	--	--	--
ATAsb-002M	ATAsb-002M-SO	3.0- 5.0	N	N	--	--	--
ATAss-003D	ATAss-003D-SO	0.0- 1.0	--	--	N	--	--
ATAss-003M	ATAss-003M-SO	0.0- 1.0	Cr	N	--	N	N
ATAss-004M	ATAss-004M-SO	0.0- 1.0	N	N	--	--	--
ATAss-005M	ATAss-005M-SO	0.0- 1.0	**Y**	N	--	--	--

Y = Analyte(s) greater than screening criteria.
Cr = Only chromium greater than screening criterion.
N = Non-detect or less than screening criteria.
-- = Analysis not performed.

P.3 Proposed SAP Addendum Characterization Activities

The objective of this SAP Addendum for the Anchor Test Area is to define the nature and extent of chemicals at concentrations greater than the screening criteria. To accomplish this further sampling and analysis of metals in soil will be conducted.

Table P-3 summarizes the chemicals that exceeded screening criteria and CUGs for each medium, the types and quantities of samples to be collected during the implementation of this SAP Addendum, and the rationale behind the proposed samples. The general approach for investigation activities is presented in Section 3.2 of the FSP. Figure P-2 illustrates the locations of the samples to be collected as well as previous screening criteria and CUG exceedances.

Table P-4 presents the coordinates for the proposed sampling locations for this AOC. The locations may be altered during implementation of this SAP Addendum for a variety of reasons (e.g., soil boring refusal and MEC avoidance). The final coordinates of the sample locations (including elevations) will be presented in the RI Report.

Table P-3. Summary of Sampling at Anchor Test Area

Medium	Historical Sample Type	Historical Screening Criteria Exceedances	Number of SAP Addendum Sample Locations	Rationale for SAP Addendum Field Activities
Surface soil	MI	As **ATAss-005M** Mn **ATAss-001M**	2	Two MI areas are established around the previous MI areas where chemicals exceeded screening criteria and CUGs to further define the lateral extent of contamination. These include one boundary MI area around ATAss-005M and one MI area downgradient of ATAss-001M, ss-002M, and ss-003M. Samples will be analyzed for TAL metals and explosives; 15% RVAAP full suite.
	Chromium speciation	Cr ATAss-001M, 002M, 003M, 005M	3	Discrete surface soil samples will be collected at previous locations ATAss-002M (36 mg/kg-max), ss-003M (19 mg/kg) and ss-001M (28 mg/kg). Refer to Section 4.1.3 of the FSP for a discussion about chromium speciation sampling.
Subsurface soil	Composite	Cr ATAsb-001M	5	A total of five boring locations are placed to further define the vertical extent of contamination. These include two in previous MI areas with chemicals greater than CUGs (locations ATAss-005M and ATAss-001M), one in former MI area ATAss-004 with chemicals less than screening criteria, and two in new proposed MI areas. Samples will be analyzed for TAL metals and explosives; 15% RVAAP full suite.
	Geotechnical	N/A	1	Two samples shall be collected from one location to provide soil data for modeling.
Surface water	N/A	N/A	0	No sampling will be conducted because no perennial surface water occurs on the AOC.
Wet sediment	N/A	N/A	0	See surface water comment
Groundwater	N/A	N/A	0	No groundwater wells currently exist at this AOC. Potential leaching of soil contaminants to groundwater will be evaluated through SESOIL modeling. No groundwater sampling is planned as part of this SAP Addendum. If SESOIL modeling indicates potential soil source leaching, monitoring wells will be installed under a separate addendum.

Bold indicates locations where concentration also exceeded the CUG (HI=1.0, Target Risk=10^{-5}) for the identified chemical.

Table P-4. Coordinates for Proposed Sampling Locations at Anchor Test Area

Sample Location ID	Coordinate Point	Sample Type	Easting	Northing
ATAsb-006	N/A	Grab	2361580.6308	556046.4403
ATAsb-007	N/A	Grab	2361609.1200	556047.1826
ATAsb-008	N/A	Grab	2361579.9657	556017.6856
ATAsb-009	N/A	Grab	2361578.8439	555983.0435
ATAsb-010	N/A	Grab	2361481.007	556031.6006
ATAsb-011	N/A	Grab	2361513.1138	556064.2249
ATAss-012	N/A	Grab	2361565.1651	556025.3313
ATAss-013	N/A	Grab	2361579.9657	556025.3313
ATAss-014	N/A	Grab	2361594.7661	556025.3313
ATAss-015M	9	MI	2361556.5550	555990.2023
	10	MI	2361604.5550	555990.2023
	11	MI	2361556.5550	555975.2023
	12	MI	2361604.5550	555975.2023
ATAss-016M	1	MI	2361476.0673	556101.9546
	2	MI	2361551.0675	556101.9546
	3	MI	2361491.0673	556086.9546
	4	MI	2361536.0675	556086.9546
	5	MI	2361491.0673	556041.9544
	6	MI	2361536.0675	556041.9544
	7	MI	2361476.0673	556026.9544
	8	MI	2361551.0675	556026.9544

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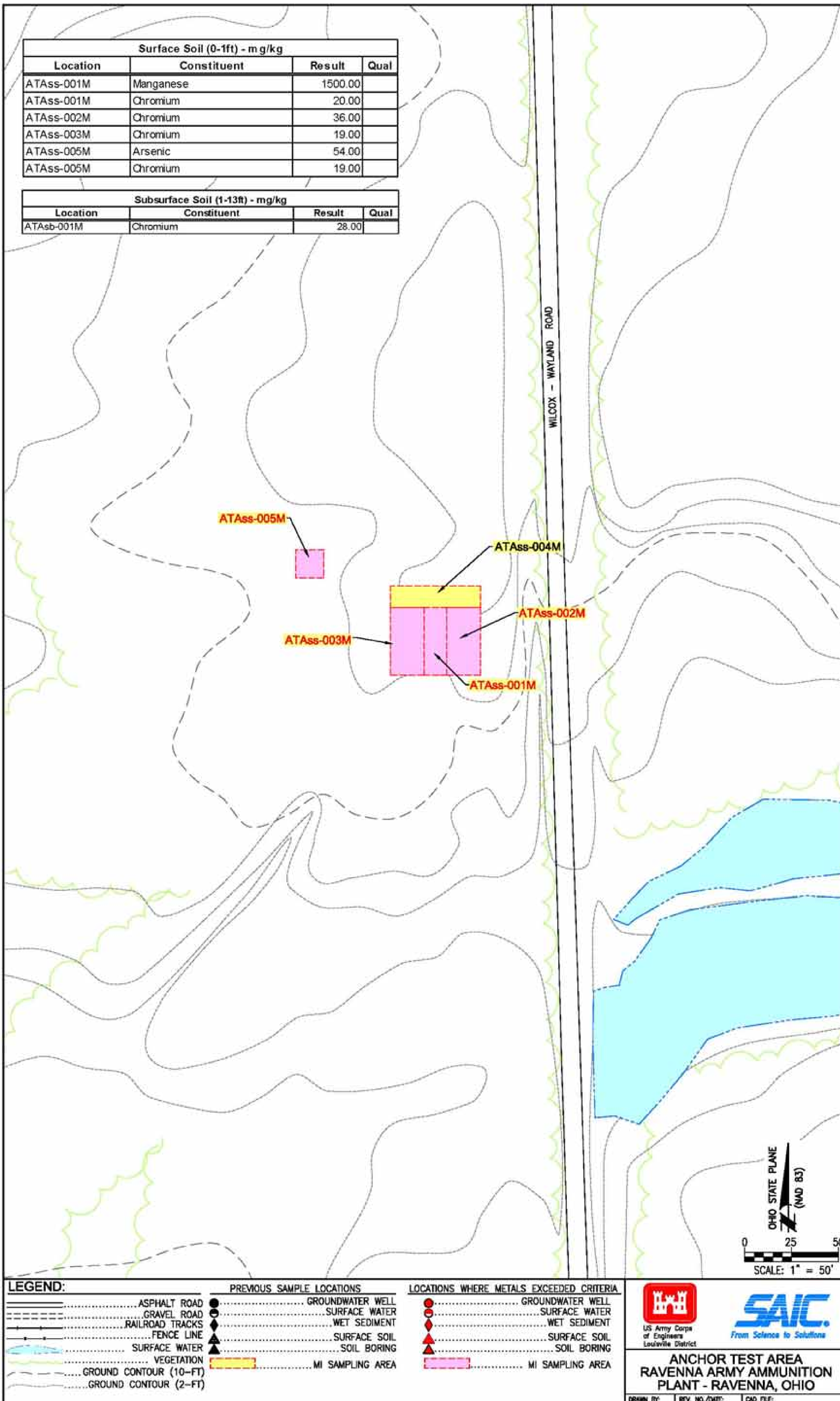

Surface Soil (0-1ft) - mg/kg			
Location	Constituent	Result	Qual
ATAss-001M	Manganese	1500.00	
ATAss-001M	Chromium	20.00	
ATAss-002M	Chromium	36.00	
ATAss-003M	Chromium	19.00	
ATAss-005M	Arsenic	54.00	
ATAss-005M	Chromium	19.00	

Subsurface Soil (1-13ft) - mg/kg			
Location	Constituent	Result	Qual
ATAsb-001M	Chromium	28.00	

Figure P-1. Historical Sampling and Metal Exceedance Locations at Anchor Test Area

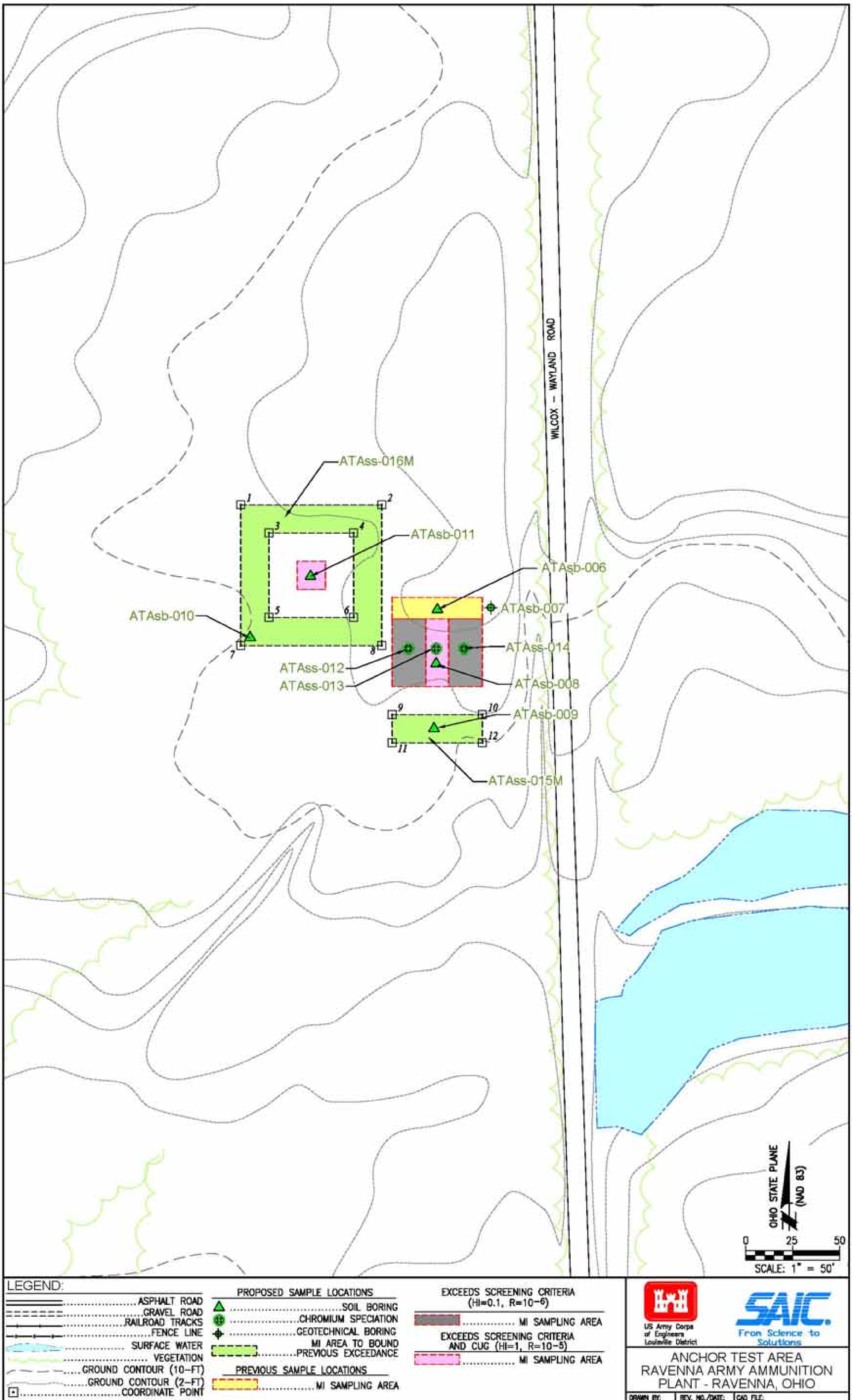

Figure P-2. Historical Exceedances and Proposed Sampling Locations at Anchor Test Area

APPENDIX Q

Atlas Scrap Yard (RVAAP-50)

Q.0 ATLAS SCRAP YARD (RVAAP-50)

Q.1 AOC DESCRIPTION

This AOC is a former construction camp built to house workers during the construction of RVAAP (Figure Q-1). Following demolition of the facilities after World War II, the area was used as a storage area/scrap yard for non-explosive scrap materials, Munitions and Explosives of Concern (MEC) scrap, and wooden ammunition boxes. The RVAAP-50-R-01 munitions response site (MRS) encompasses approximately 66 acres within the IRP AOC boundary. An MEC removal action was completed in 2003, wherein removal of above-grade MEC and ammunition boxes was completed. Currently the area is covered by thick grass and miscellaneous non-explosive scrap material including pipes, railroad ballast, railroad ties, concrete rubble, and chipped ammunition boxes.

Q.2 PREVIOUS INVESTIGATIONS

Since 1978, various investigations have been conducted at RVAAP that included Atlas Scrap Yard. During the 1998 RRSE conducted by USACHPPM, the Atlas Scrap Yard was scored as a “Medium” priority site. This report indicated that groundwater and surface soil were potential media for contaminant migration potentially impacting human receptors (USACHPPM 1998).

From August 2004 to May 2005 as part of the Final Characterization of 14 AOCs at RVAAP the following field activities were conducted at Atlas Scrap Yard:

- Collection of 33 multi-increment surface soil (0 to 1 ft) samples;
- Installation and sampling of ten shallow groundwater monitoring wells;
- Collection of 15 sanitary sewer water samples; and
- Collection of seven sediment samples from sanitary sewers.

The results of this investigation concluded that concentrations for metals and SVOCs were above screening criteria (e.g., USEPA Region 9 PRGs and RVAAP background values) (MKM 2007a).

For this SAP Addendum, all sample results were compared to the preliminary RVAAP facility-wide screening criteria (Section 3.2.2 of the FSP). Table Q-1 lists the chemicals that exceeded screening criteria in each medium, as well as the maximum and minimum concentration detected.

Figures Q-1 and Q-2 illustrate the type and location of historical samples and identify samples that exceeded screening criteria for metals and organics, respectively.

Table Q-1. Chemicals Exceeding Screening Criteria at the Atlas Scrap Yard

Medium	Analyte	Units	Frequency of Detection	Minimum Detect	Maximum Detect	Average Result[a]	Screening Criteria[b]
Surface Soil	Aluminum	mg/kg	40/40	8100	24000	14400	17700
	Arsenic	mg/kg	40/40	4.80	41	10.90	15.4
	Cadmium	mg/kg	32/40	0.09	9.50	0.69	6.4
	Chromium	mg/kg	40/40	12	64	21.30	17.4
	Cobalt	mg/kg	40/40	2	19	6.96	10.4
	Lead	mg/kg	40/40	14	1200	69	400
	Manganese	mg/kg	40/40	95	3500	890	1450
	Benz(a)anthracene	mg/kg	5/5	0.073	2.90	0.88	0.22
	Benzo(a)pyrene	mg/kg	5/5	0.10	3.20	1.02	0.022
	Benzo(b)fluoranthene	mg/kg	5/5	0.12	5.20	1.49	0.22
	Dibenz(a,h)anthracene	mg/kg	4/5	0.052	0.75	0.23	0.022
	Indeno(1,2,3-cd)pyrene	mg/kg	5/5	0.068	1.70	0.60	0.22
Subsurface Soil	Not sampled	--	--	--	--	--	--
Wet Sediment	Not present	--	--	--	--	--	--
Surface Water	Not present	--	--	--	--	--	--
Groundwater	Antimony	mg/L	2/10	0.0028	0.003	0.00358	0.00039
	Arsenic	mg/L	9/10	0.00086	0.0400	0.00908	0.0117 (unconsolidated)
	Bis(2-ethylhexyl) phthalate	mg/L	1/10	0.05800	0.0580	0.01230	0.0009

-- Not applicable.
[a]Average result equals the sum of the concentrations divided by the number of samples; the average includes non-detects at half the reporting limit and field duplicate samples. This can result in an average less than the range of detected values.
[b]Screening criteria are based on HI=0.1 and Target Risk=10^{-6}.

During previous investigations, surface soil samples at Atlas Scrap Yard have been collected at 0-0.5 ft and 0-1 ft intervals. Table Q-2 summarizes the historical surface soil sampling conducted at Atlas Scrap Yard, and indicates whether sample results exceeded screening criteria.

Table Q-2. Atlas Scrap Yard Historical Soil Sampling Summary

Sample Location	Sample Number	Depth of Sample (ft bgs)	Analysis Performed				
			Metals	Explosives	VOCs	Pesticides/ PCBs	SVOCs
ASYss-001M	ASYss-001M-SO	0.0- 1.0	**Y**	N	--	--	--
ASYss-002M	ASYss-002M-SO	0.0- 0.5	Cr	N	--	--	--
ASYss-003M	ASYss-003M-SO	0.0- 1.0	**Y**	N	--	--	--
ASYss-004D	ASYss-004D-SO	0.0- 0.5	--	--	N	--	--

Table Q-2. Atlas Scrap Yard Historical Soil Sampling Summary (continued)

Sample Location	Sample Number	Depth of Sample (ft bgs)	Analysis Performed				
			Metals	Explosives	VOCs	Pesticides/ PCBs	SVOCs
ASYss-004M	ASYss-004M-SO	0.0- 0.5	Cr	N	--	N	**Y**
ASYss-005D	ASYss-005D-SO	0.0- 1.0	--	--	N	--	--
ASYss-005M	ASYss-005M-SO	0.0- 0.5	N	N	--	--	--
ASYss-006M	ASYss-006M-SO	0.0- 1.0	**Y**	N	--	--	--
ASYss-007M	ASYss-007M-DUP	0.0- 1.0	N	N	--	--	--
	ASYss-007M-SO	0.0- 1.0	N	N	--	--	--
ASYss-008M	ASYss-008M-SO	0.0- 1.0	Cr	N	--	--	--
ASYss-009M	ASYss-009M-SO	0.0- 1.0	N	N	--	--	--
ASYss-010M	ASYss-010M-SO	0.0- 1.0	Cr	N	--	--	--
ASYss-011M	ASYss-011M-SO	0.0- 1.0	Cr	N	--	--	**Y**
ASYss-012D	ASYss-012D-QA	0.0- 1.0	--	--	N	--	--
	ASYss-012D-SO	0.0- 1.0	--	--	N	--	--
ASYss-012M	ASYss-012M-QA	0.0- 1.0	N	N	--	--	--
	ASYss-012M-SO	0.0- 1.0	N	N	--	--	--
ASYss-013D	ASYss-013D-SO	0.0- 1.0	--	--	N	--	--
ASYss-013M	ASYss-013M-SO	0.0- 1.0	**Y**	N	--	--	--
ASYss-014M	ASYss-014M-SO	0.0- 1.0	N	N	--	--	--
ASYss-015D	ASYss-015D-SO	0.0- 1.0	--	--	N	--	--
ASYss-015M	ASYss-015M-SO	0.0- 1.0	Cr	N	--	N	**Y**
ASYss-016M	ASYss-016M-SO	0.0- 1.0	Cr	N	--	--	--
ASYss-017M	ASYss-017M-DUP	0.0- 1.0	**Y**	N	--	--	--
	ASYss-017M-SO	0.0- 1.0	**Y**	N	--	--	--
ASYss-018M	ASYss-018M-SO	0.0- 1.0	**Y**	N	--	--	--
ASYss-019M	ASYss-019M-SO	0.0- 1.0	**Y**	N	--	--	--
ASYss-020M	ASYss-020M-SO	0.0- 1.0	Cr	N	--	--	--
ASYss-021M	ASYss-021M-DUP	0.0- 1.0	**Y**	N	--	--	--
	ASYss-021M-SO	0.0- 1.0	**Y**	N	--	--	--
ASYss-022M	ASYss-022M-QA	0.0- 0.5	**Y**	N	--	--	--
	ASYss-022M-SO	0.0- 0.5	**Y**	N	--	--	--
ASYss-023M	ASYss-023M-SO	0.0- 0.5	Cr	N	--	--	--
ASYss-025M	ASYss-025M-SO	0.0- 1.0	Cr	N	--	--	--
ASYss-026M	ASYss-026M-SO	0.0- 1.0	Cr	N	--	--	--
ASYss-027D	ASYss-027D-DUP	0.0- 1.0	--	--	N	--	--
	ASYss-027D-SO	0.0- 1.0	--	--	N	--	--
ASYss-027M	ASYss-027M-DUP	0.0- 1.0	Cr	N	--	N	**Y**
	ASYss-027M-SO	0.0- 1.0	Cr	N	--	N	**Y**
ASYss-028M	ASYss-028M-SO	0.0- 1.0	Cr	N	--	--	--
ASYss-029M	ASYss-029M-SO	0.0- 1.0	Cr	N	--	--	--
ASYss-030M	ASYss-030M-SO	0.0- 1.0	Cr	N	--	--	--
ASYss-031M	ASYss-031M-SO	0.0- 0.5	**Y**	N	--	--	--
ASYss-032M	ASYss-032M-SO	0.0- 1.0	**Y**	N	--	--	--
ASYss-033M	ASYss-033M-SO	0.0- 1.0	Cr	N	--	--	--

Table Q-2. Atlas Scrap Yard Historical Soil Sampling Summary (continued)

Sample Location	Sample Number	Depth of Sample (ft bgs)	Analysis Performed				
			Metals	Explosives	VOCs	Pesticides/ PCBs	SVOCs
ASYss-034M	ASYss-034M-SO	0.0- 0.5	Cr	N	--	--	--
ASYsd-024M	ASYsd-024M-SD	0.0- 0.5	Cr	N	--	--	--

Y = Analyte(s) greater than screening criteria.
Cr = Only chromium greater than screening criterion.
N = Non-detect or less than screening criteria.
-- = Analysis not performed.
Only PAHs were detected above screening criteria in the SVOC analysis.

Q.3 PROPOSED SAP ADDENDUM CHARACTERIZATION ACTIVITIES

The objective of this SAP Addendum for Atlas Scrap Yard is to define the nature and extent of chemicals at concentrations greater than the screening criteria. To accomplish this further sampling and analysis of metals and PAHs in soil will be conducted and current concentrations of chemicals in groundwater will be evaluated. In addition, since previous sample coverage was biased to operational areas and likely contaminant accumulation points (such as ditches and former materials storage locations), portions of Atlas Scrap Yard lack adequate sample coverage. Visual surveys and surface soil MI samples are planned for these areas to complete the characterization of these areas.

Table Q-3 summarizes the chemicals that exceeded screening criteria or CUGs for each medium, the types and quantities of samples to be collected during the implementation of this SAP Addendum, and the rationale behind the proposed samples. The general approach for investigation activities is presented in Section 3.2 of the FSP. Figure Q-3 illustrates the locations of the samples to be collected as well as previous screening criteria and CUG exceedances.

Table Q-4 presents the coordinates for the proposed sampling locations for this AOC. The locations may be altered during implementation of this SAP Addendum for a variety of reasons (e.g., soil boring refusal and MEC avoidance). The final coordinates of the sample locations (including elevations) will be presented in the RI Report.

Table Q-3. Summary of Sampling at Atlas Scrap Yard

Medium	Historical Sample Type	Historical Screening Criteria Exceedances	Number of SAP Addendum Sample Locations	Rationale for SAP Addendum Field Activities
Surface soil	MI	<u>Al</u> ASYss-001M, 003M, 006M, 013M <u>As</u> **ASYss-017M, 018M** <u>Cd</u> ASYss-019M <u>Co</u> ASYss-021M, 022M, 031M, 032M <u>Pb</u> **ASYss-019M** <u>Mn</u> **ASYss-001M, 003M, 006M, 013M, 032M** <u>SVOCs</u> **ASYss-004M**, 011M, **015M, 027M**	35	Nineteen MI areas are established around or within the former MI areas to further define the lateral extent of chemicals that exceeded screening criteria and CUGs within potential source areas. These include ten approximately 1/10-acre MI sub-areas for the purposes of subdividing former MI areas ASYss-001, 003, and 004; and seven boundary MI areas around previous MI areas where chemicals were detected greater than CUGs. Eighteen MI samples areas are planned in an approximately 4-acre grid to characterize those portions of the known operational area of Atlas Scrap Yard where samples have not been previously collected. Samples will be analyzed for TAL metals, explosives, and PAHs, with 15% RVAAP full suite.
	Chromium speciation	<u>Cr</u> ASYsd-024M, ASYss-002M, 003M, 004M, 006M, 008M, 010M, 011M, 013M, 015M, 016M, 017M, 018M, 019M, 020M, 021M, 022M, 023M, 025M, 026M, 027M, 028M, 029M, 030M, 031M, 032M , 033M, 034M	3	Discrete surface soil samples will be collected at former locations ASYss-019M (64 mg/kg – previous maximum concentration of total chromium), ss-031M (18 mg/kg) and ss-013M (34 mg/kg). Previous chromium speciation was limited to the former service station locations (ss-005M and ss-012M). Hexavalent chromium was not detected at either location. Using the detection limit for hexavalent chromium and the total chromium detected, the percent was calculated as less than 4.75% and 7.69%, respectively. Additional chromium speciation is recommended at additional locations due the variety of operations. Refer to Section 4.1.3 of the FSP for a discussion about chromium speciation sampling.

Table Q-3. Summary of Sampling at Atlas Scrap Yard (continued)

Medium	Historical Sample Type	Historical Screening Criteria Exceedances	Number of SAP Addendum Sample Locations	Rationale for SAP Addendum Field Activities
Subsurface soil	None previously collected	N/A	19	A total of 19 borings locations are planned to define the vertical extent of COCs. These include: • Ten in previous MI areas (ASYss-001M, ss-003M, ss-004M, ss-006M, ss-013M, ss-015M, ss-017M, ss-019M, ss-027M and ss-032M) with chemical detections greater than CUGs; • Four in previous MI areas (ASYss-002M, ss-010M, ss-011M and ss-025M) with chemical detections greater than screening criteria; • Three in MI areas (ASYss-005M, ss-009M and ss-012M) with no chemicals greater than screening criteria, and • Two within the east-central portion of the AOC where some historical drawings indicate the former storm sewer system within the AOC terminated in a former drain field comprised of tile drains. Samples will be analyzed for TAL metals, explosives, and PAHs, with 15% RVAAP full suite.
	Geotechnical	None collected.	2	Two samples shall be collected from each of two sample locations to provide soil data for modeling.
Surface water	None Collected	None	0	No further investigation.
Wet sediment	None collected	None	0	No further investigation.
Groundwater	Discrete	Sb ASYmw-004, 007 As **ASYmw-004, 0**10 SVOCs **ASYmw-003**	0	No additional groundwater sampling is proposed. All ten groundwater wells at Atlas Scrap Yard wells are currently being sampled under the FWGWMP. Four quarters of samples will be completed by April 2010. No additional groundwater sampling is required for completion of the FS.

Bold indicates locations where concentration also exceeded the CUG (HI=1.0, Target Risk=10^{-5}) for the identified chemical.

Table Q-4. Coordinates for Proposed Sampling Locations at Atlas Scrap Yard

Sample Location ID	Coordinate Point	Sample Type	Easting	Northing
ASYsb-045	NA	Grab	2366299.5528	558281.8614
ASYsb-046	NA	Grab	2366637.6428	558188.5793
ASYsb-047	NA	Grab	2366839.6620	558078.2416
ASYsb-048	NA	Grab	2366468.4222	558060.0925
ASYsb-049	NA	Grab	2366918.6431	557933.7284
ASYsb-050	NA	Grab	2367184.8556	557806.5429
ASYsb-051	NA	Grab	2366685.3018	557711.8494
ASYsb-052	NA	Grab	2366715.7564	557708.4059
ASYsb-053	NA	Grab	2365891.4339	557475.4707
ASYsb-054	NA	Grab	2366716.5388	557447.2596
ASYsb-055	NA	Grab	2366747.6328	557449.7740
ASYsb-056	NA	Grab	2367390.6037	557611.4974
ASYsb-057	NA	Grab	2367152.3320	557312.0073
ASYsb-058	NA	Grab	2367484.9955	557409.1783
ASYsb-059	NA	Grab	2366559.6894	556995.7799
ASYsb-060	NA	Grab	2366982.2137	557141.3461
ASYsb-061	NA	Grab	2366868.2723	556920.1781
ASYsb-062	NA	Grab	2367056.2831	556975.3470
ASYsb-063	NA	Grab	2367546.7459	557142.8969
ASYsb-064	NA	Grab	2366610.7794	556679.0696
ASYsb-065	NA	Grab	2367303.5580	556427.7447
ASYss-066	NA	Grab	2367011.3239	556515.6065
ASYss-067	NA	Grab	2366582.1690	556677.0264
ASYss-068	NA	Grab	2366571.9511	556954.9140
ASYss-069M	65	MI	2366490.8742	557030.2905
	66	MI	2366580.9176	557066.3078
	67	MI	2366510.9077	557022.1484
	68	MI	2366572.4751	557046.7753
	69	MI	2366562.4747	556906.1226
	70	MI	2366620.1755	556925.3563
	71	MI	2366554.2985	556887.5858
	72	MI	2366639.9178	556916.1256
ASYss-070M	93	MI	2366534.0326	556736.2560
	94	MI	2366616.9295	556736.2560
	95	MI	2366549.0326	556721.2560
	96	MI	2366616.9295	556721.2560
	97	MI	2366639.0327	556706.7310
	98	MI	2366654.0327	556706.7310
	99	MI	2366549.0326	556631.2558
	100	MI	2366639.0327	556631.2558
	101	MI	2366534.0326	556616.2558
	102	MI	2366654.0327	556616.2558
ASYss-071M	73	MI	2366794.6206	556977.3035

Table Q-4. Coordinates for Proposed Sampling Locations at Atlas Scrap Yard (continued)

Sample Location ID	Coordinate Point	Sample Type	Easting	Northing
ASYss-071M (continued)	74	MI	2366875.7894	557021.2699
	75	MI	2366949.4811	557049.3430
	76	MI	2366988.2717	557057.1011
	77	MI	2367170.4422	557053.0290
	78	MI	2366801.7648	556964.1141
	79	MI	2366882.0590	557007.6067
	80	MI	2366953.6508	557034.8799
	81	MI	2366989.5918	557042.0680
	82	MI	2367154.8233	557038.3962
	83	MI	2366837.7325	556851.2035
	84	MI	2366926.2733	556887.2756
	85	MI	2366986.7136	556904.0647
	86	MI	2367014.6537	556919.5869
	87	MI	2367154.8233	556919.5869
	88	MI	2366843.3920	556837.3121
	89	MI	2366931.1266	556873.0558
	90	MI	2366992.4428	556890.0881
	91	MI	2367018.5405	556904.5869
	92	MI	2367169.8233	556904.5869
ASYss-072M	57	MI	2366630.9905	557781.2613
	58	MI	2366775.1380	557781.2613
	59	MI	2366645.9905	557766.2613
	60	MI	2366760.1380	557766.2613
	61	MI	2366645.9905	557650.6533
	62	MI	2366760.1380	557650.6533
	63	MI	2366630.9905	557635.6533
	64	MI	2366775.1380	557635.6533
ASYss-073M	49	MI	2366772.0040	558188.6250
	50	MI	2366912.0537	558188.6250
	51	MI	2366787.0040	558173.6250
	52	MI	2366897.0537	558173.6250
	53	MI	2366787.0040	557989.8336
	54	MI	2366897.0537	557989.8336
	55	MI	2366772.0040	557974.8336
	56	MI	2366912.0537	557974.8336
ASYss-074M	124	MI	2366802.0040	558054.8348
	125	MI	2366872.5060	558054.8348
	126	MI	2366802.0040	558004.8336
	127	MI	2366872.5060	558004.8336
ASYss-075M	122	MI	2366802.0040	558116.1999
	123	MI	2366872.5060	558116.1999
	124	MI	2366802.0040	558054.8348
	125	MI	2366872.5060	558054.8348

Table Q-4. Coordinates for Proposed Sampling Locations at Atlas Scrap Yard (continued)

Sample Location ID	Coordinate Point	Sample Type	Easting	Northing
ASYss-076M	120	MI	2366802.0040	558158.6250
	121	MI	2366872.5060	558158.6250
	122	MI	2366802.0040	558116.1999
	123	MI	2366872.5060	558116.1999
ASYss-077M	41	MI	2366556.4302	558331.1802
	42	MI	2366727.8640	558331.1802
	43	MI	2366571.4302	558316.1802
	44	MI	2366712.8640	558316.1802
	45	MI	2366571.4302	558070.2660
	46	MI	2366712.8640	558070.2660
	47	MI	2366556.4302	558055.2660
	48	MI	2366727.8640	558055.2660
ASYss-078M	116	MI	2366586.4302	558155.3434
	117	MI	2366687.2555	558155.3434
	118	MI	2366586.4302	558085.2660
	119	MI	2366687.2555	558085.2660
ASYss-079M	114	MI	2366586.4302	558223.5266
	115	MI	2366687.2555	558223.5266
	116	MI	2366586.4302	558155.3434
	117	MI	2366687.2555	558155.3434
ASYss-080M	112	MI	2366586.4302	558301.1802
	113	MI	2366687.2555	558301.1802
	114	MI	2366586.4302	558223.5266
	115	MI	2366687.2555	558223.5266
ASYss-081M	33	MI	2366168.1469	558388.7571
	34	MI	2366403.4079	558388.7571
	35	MI	2366183.1469	558373.7571
	36	MI	2366388.4079	558373.7571
	37	MI	2366183.1469	558189.9657
	38	MI	2366388.4079	558189.9657
	39	MI	2366168.1469	558174.9657
	40	MI	2366403.4079	558174.9657
ASYss-082M	103	MI	2366217.2422	558358.7571
	104	MI	2366299.5528	558358.4249
	106	MI	2366217.2422	558281.8614
	107	MI	2366299.5528	558281.8614
ASYss-083M	104	MI	2366299.5528	558358.4249
	105	MI	2366373.4079	558358.7571
	107	MI	2366299.5528	558281.8614
	108	MI	2366373.1739	558281.4077
ASYss-084M	106	MI	2366217.2422	558281.8614
	107	MI	2366299.5528	558281.8614
	109	MI	2366217.2422	558204.9657

Table Q-4. Coordinates for Proposed Sampling Locations at Atlas Scrap Yard (continued)

Sample Location ID	Coordinate Point	Sample Type	Easting	Northing
ASYss-084M	110	MI	2366299.5528	558204.9657
ASYss-085M	107	MI	2366299.5528	558281.8614
	108	MI	2366373.1739	558281.4077
	110	MI	2366299.5528	558204.9657
	111	MI	2366373.4079	558204.9657
ASYss-086M	1	MI	2366135.8005	558507.2240
	2	MI	2366345.9554	558508.7644
	6	MI	2366332.6078	558088.6553
	11	MI	2366111.7449	557750.0866
	12	MI	2366109.1542	557668.5462
	13	MI	2366319.3091	557670.0866
ASYss-087M	12	MI	2366109.1542	557668.5462
	13	MI	2366319.3091	557670.0866
	17	MI	2366305.8616	557246.8329
	22	MI	2366084.9987	556908.2642
	23	MI	2366082.4570	556828.2642
	24	MI	2366292.5630	556828.2642
ASYss-088M	2	MI	2366345.9554	558508.7644
	3	MI	2366766.2652	558511.8453
	6	MI	2366332.6078	558088.6553
	7	MI	2366752.9176	558091.7362
ASYss-089M	6	MI	2366332.6078	558088.6553
	7	MI	2366752.9176	558091.7362
	13	MI	2366319.3091	557670.0866
	14	MI	2366739.5190	557670.0229
ASYss-090M	13	MI	2366319.3091	557670.0866
	14	MI	2366739.5190	557670.0229
	17	MI	2366305.8616	557246.8329
	18	MI	2366726.1714	557249.9138
ASYss-091M	17	MI	2366305.8616	557246.8329
	18	MI	2366726.1714	557249.9138
	24	MI	2366292.5630	556828.2642
	25	MI	2366712.8238	556829.8046
ASYss-092M	24	MI	2366292.5630	556828.2642
	25	MI	2366712.8238	556829.8046
	28	MI	2366281.3123	556474.1554
	29	MI	2366441.5318	556407.8048
	30	MI	2366699.4762	556409.6955
ASYss-093M	3	MI	2366766.2652	558511.8453
	4	MI	2367186.5750	558514.9262
	7	MI	2366752.9176	558091.7362
	8	MI	2367173.2274	558094.8171
ASYss-094M	7	MI	2366752.9176	558091.7362

Table Q-4. Coordinates for Proposed Sampling Locations at Atlas Scrap Yard (continued)

Sample Location ID	Coordinate Point	Sample Type	Easting	Northing
ASYss-094M (continued)	8	MI	2367173.2274	558094.8171
	14	MI	2366739.5190	557670.0229
	15	MI	2367159.8289	557673.1038
ASYss-095M	14	MI	2366739.5190	557670.0229
	15	MI	2367159.8289	557673.1038
	18	MI	2366726.1714	557249.9138
	19	MI	2367146.4813	557252.9946
ASYss-096M	18	MI	2366726.1714	557249.9138
	19	MI	2367146.4813	557252.9946
	25	MI	2366712.8238	556829.8046
	26	MI	2367133.1337	556832.8855
ASYss-097M	25	MI	2366712.8238	556829.8046
	26	MI	2367133.1337	556832.8855
	30	MI	2366699.4762	556409.6955
	31	MI	2367119.7861	556412.7764
ASYss-098M	4	MI	2367186.5750	558514.9262
	5	MI	2367584.7070	558496.3645
	8	MI	2367173.2274	558094.8171
	9	MI	2367593.5372	558097.8979
ASYss-099M	8	MI	2367173.2274	558094.8171
	9	MI	2367593.5372	558097.8979
	15	MI	2367159.8289	557673.1038
	16	MI	2367580.1387	557676.1846
ASYss-100M	15	MI	2367159.8289	557673.1038
	16	MI	2367580.1387	557676.1846
	19	MI	2367146.4813	557252.9946
	20	MI	2367566.7911	557256.0755
ASYss-101M	19	MI	2367146.4813	557252.9946
	20	MI	2367566.7911	557256.0755
	26	MI	2367133.1337	556832.8855
	27	MI	2367553.4435	556835.9664
ASYss-102M	26	MI	2367133.1337	556832.8855
	27	MI	2367553.4435	556835.9664
	31	MI	2367119.7861	556412.7764
	32	MI	2367540.0959	556415.8573
ASYss-103M	10	MI	2365901.5900	557748.5462
	11	MI	2366111.7449	557750.0866
	12	MI	2366109.1542	557668.5462
	21	MI	2365874.8928	556908.2642
	22	MI	2366084.9987	556908.2642

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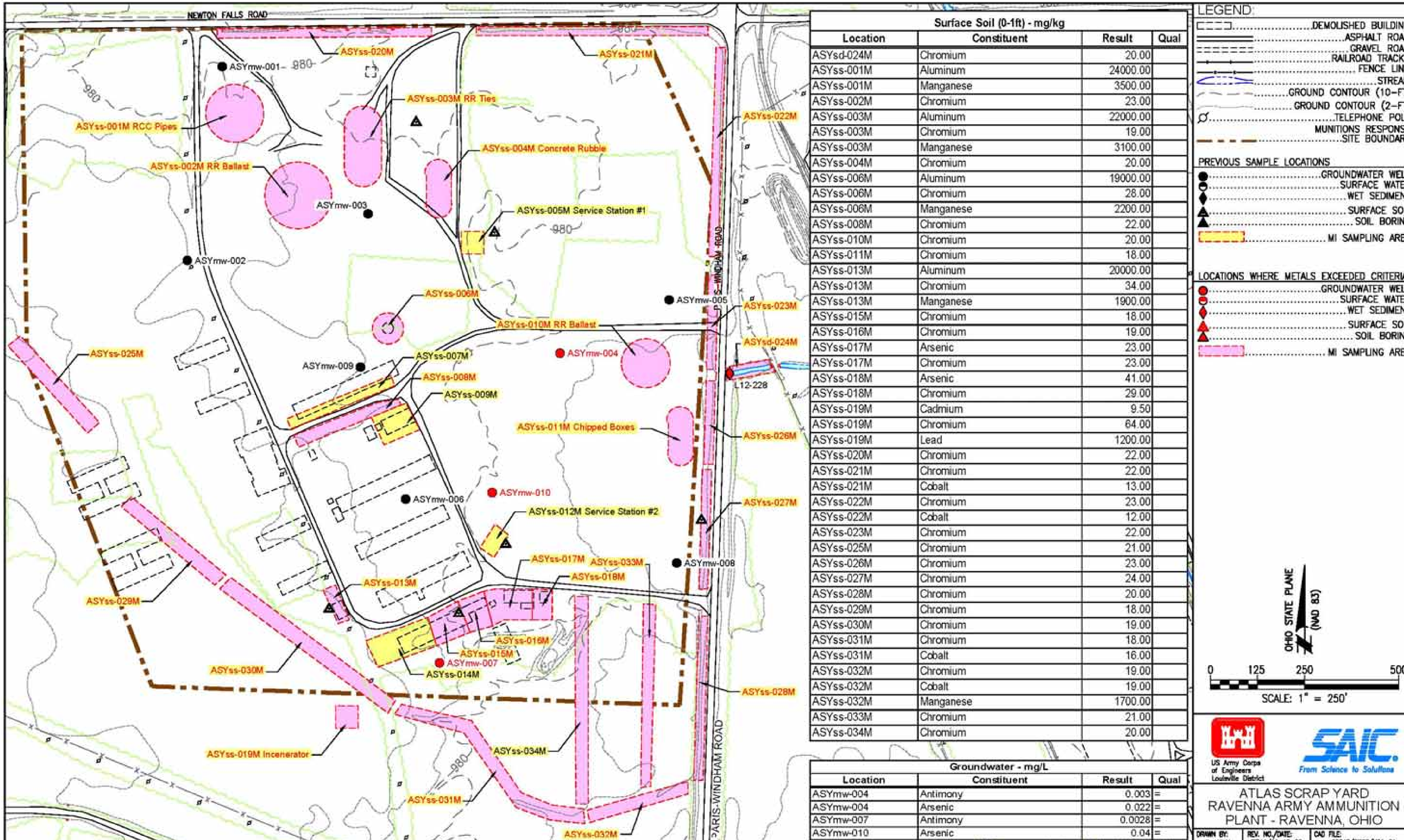


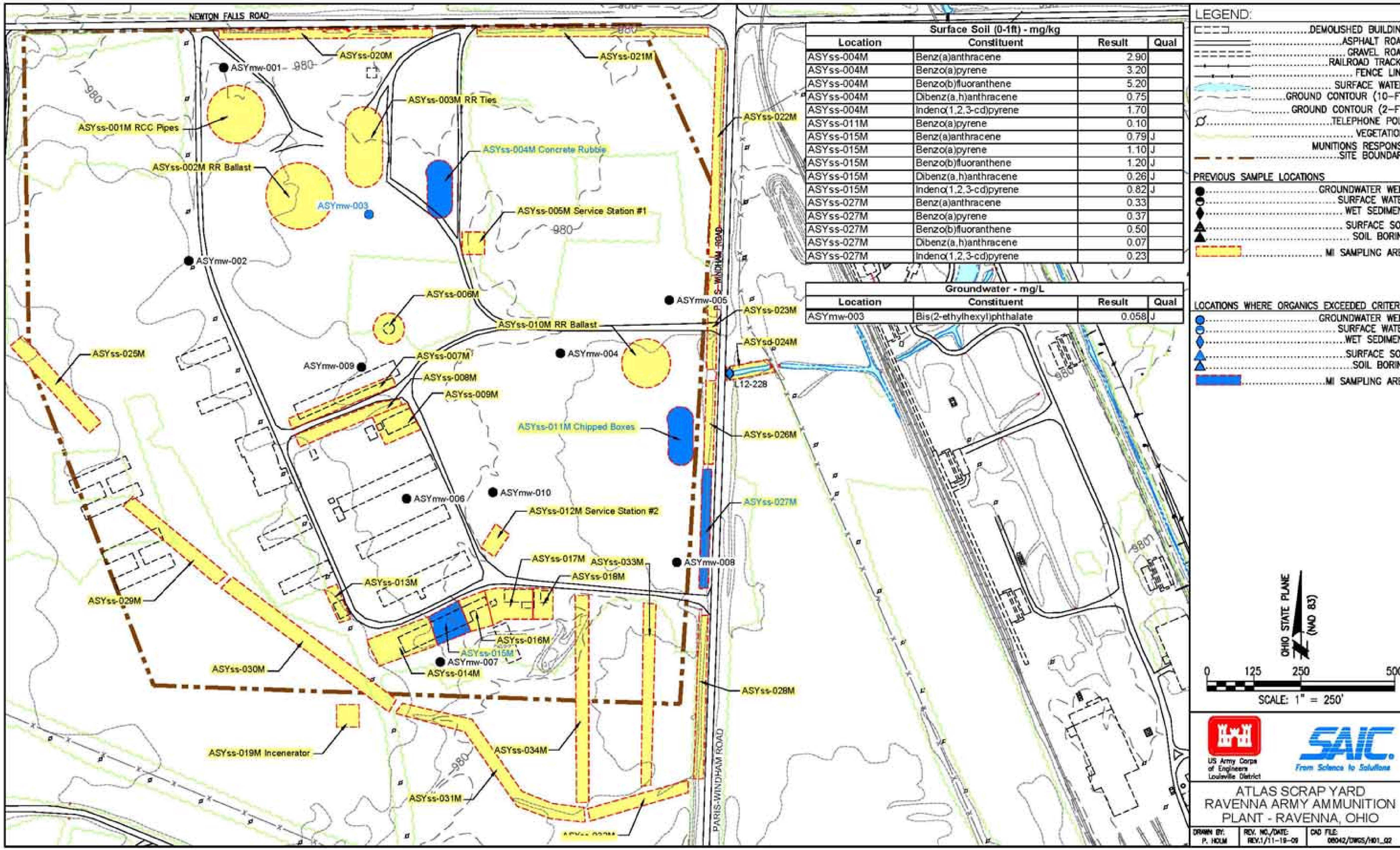
Surface Soil (0-1ft) - mg/kg

Location	Constituent	Result	Qual
ASYsd-024M	Chromium	20.00	
ASYss-001M	Aluminum	24000.00	
ASYss-001M	Manganese	3500.00	
ASYss-002M	Chromium	23.00	
ASYss-003M	Aluminum	22000.00	
ASYss-003M	Chromium	19.00	
ASYss-003M	Manganese	3100.00	
ASYss-004M	Chromium	20.00	
ASYss-006M	Aluminum	19000.00	
ASYss-006M	Chromium	28.00	
ASYss-006M	Manganese	2200.00	
ASYss-008M	Chromium	22.00	
ASYss-010M	Chromium	20.00	
ASYss-011M	Chromium	18.00	
ASYss-013M	Aluminum	20000.00	
ASYss-013M	Chromium	34.00	
ASYss-013M	Manganese	1900.00	
ASYss-015M	Chromium	18.00	
ASYss-016M	Chromium	19.00	
ASYss-017M	Arsenic	23.00	
ASYss-017M	Chromium	23.00	
ASYss-018M	Arsenic	41.00	
ASYss-018M	Chromium	29.00	
ASYss-019M	Cadmium	9.50	
ASYss-019M	Chromium	64.00	
ASYss-019M	Lead	1200.00	
ASYss-020M	Chromium	22.00	
ASYss-021M	Chromium	22.00	
ASYss-021M	Cobalt	13.00	
ASYss-022M	Chromium	23.00	
ASYss-022M	Cobalt	12.00	
ASYss-023M	Chromium	22.00	
ASYss-025M	Chromium	21.00	
ASYss-026M	Chromium	23.00	
ASYss-027M	Chromium	24.00	
ASYss-028M	Chromium	20.00	
ASYss-029M	Chromium	18.00	
ASYss-030M	Chromium	19.00	
ASYss-031M	Chromium	18.00	
ASYss-031M	Cobalt	16.00	
ASYss-032M	Chromium	19.00	
ASYss-032M	Cobalt	19.00	
ASYss-032M	Manganese	1700.00	
ASYss-033M	Chromium	21.00	
ASYss-034M	Chromium	20.00	

Groundwater - mg/L

Location	Constituent	Result	Qual
ASYmw-004	Antimony	0.003	=
ASYmw-004	Arsenic	0.022	=
ASYmw-007	Antimony	0.0028	=
ASYmw-010	Arsenic	0.04	=

Figure Q-1. Historical Sampling and Metal Exceedance Locations at Atlas Scrap Yard



Surface Soil (0-1ft) - mg/kg			
Location	Constituent	Result	Qual
ASYss-004M	Benz(a)anthracene	2.90	
ASYss-004M	Benzo(a)pyrene	3.20	
ASYss-004M	Benzo(b)fluoranthene	5.20	
ASYss-004M	Dibenz(a,h)anthracene	0.75	
ASYss-004M	Indeno(1,2,3-cd)pyrene	1.70	
ASYss-011M	Benzo(a)pyrene	0.10	
ASYss-015M	Benz(a)anthracene	0.79	J
ASYss-015M	Benzo(a)pyrene	1.10	J
ASYss-015M	Benzo(b)fluoranthene	1.20	J
ASYss-015M	Dibenz(a,h)anthracene	0.26	J
ASYss-015M	Indeno(1,2,3-cd)pyrene	0.82	J
ASYss-027M	Benz(a)anthracene	0.33	
ASYss-027M	Benzo(a)pyrene	0.37	
ASYss-027M	Benzo(b)fluoranthene	0.50	
ASYss-027M	Dibenz(a,h)anthracene	0.07	
ASYss-027M	Indeno(1,2,3-cd)pyrene	0.23	

Groundwater - mg/L			
Location	Constituent	Result	Qual
ASYmw-003	Bis(2-ethylhexyl)phthalate	0.058	J

Figure Q-2. Historical Sampling and Organic Exceedance Locations at Atlas Scrap Yard

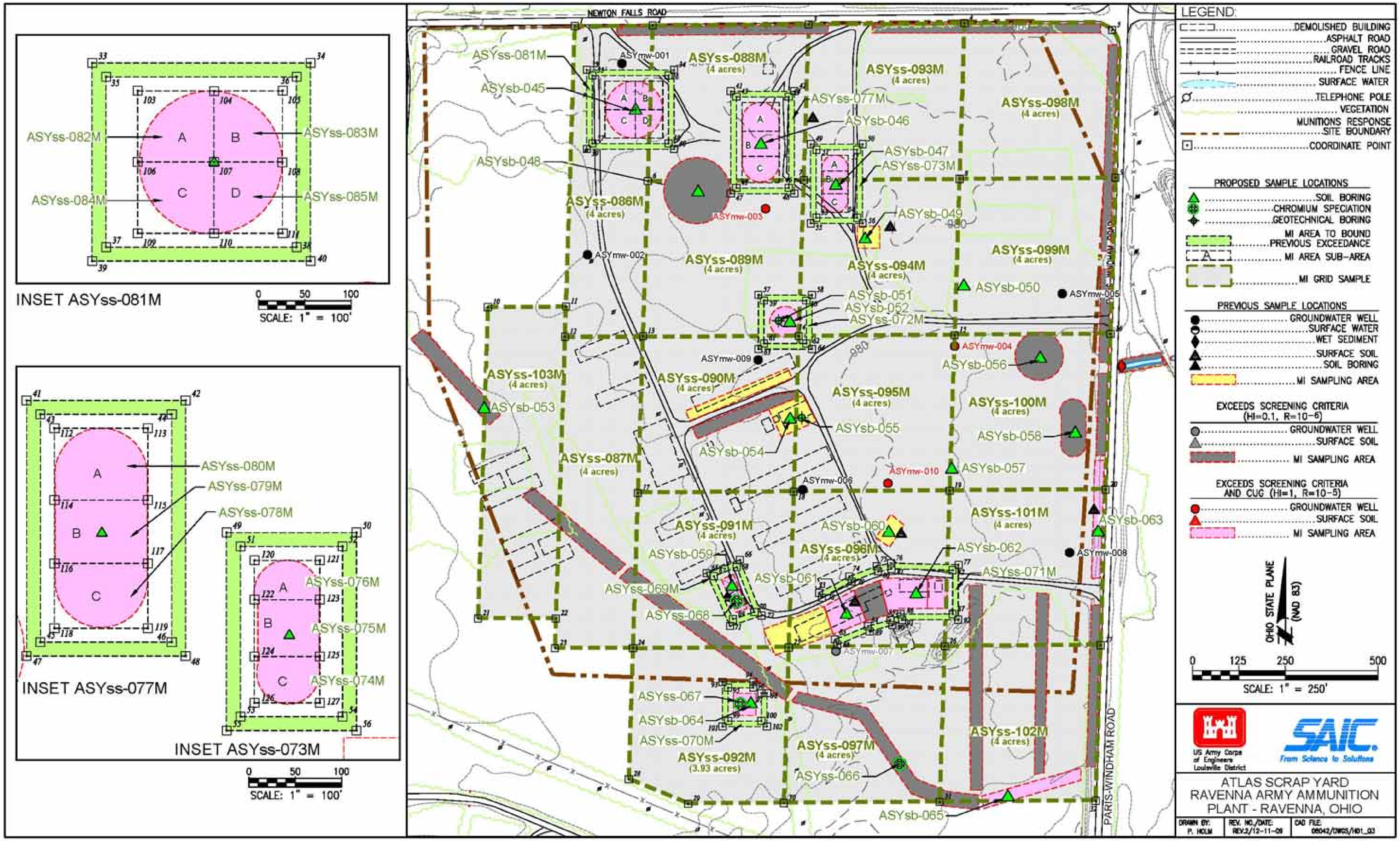


Figure Q-3. Historical Exceedances and Proposed Sampling Locations at Atlas Scrap Yard

Part II

Final

Quality Assurance Project Plan
for the
PBA 2008 Supplemental Investigation Sampling and Analysis Plan
Addendum No. 1

Ravenna Army Ammunition Plant
Ravenna, Ohio

Contract No. W912QR-04-D-0028
Delivery Order No. 0001

Prepared for:
U.S. Army Corps of Engineers
600 Martin Luther King, Jr. Place
Louisville, Kentucky 40202

Prepared by:
SAIC Engineering of Ohio, Inc.
8866 Commons Boulevard, Suite 201
Twinsburg, Ohio 44087

December 23, 2009

TABLE OF CONTENTS

LIST OF TABLES

LIST OF ACRONYMS

ADR	Automated Data Review
A-E	Architect-Engineer
AOC	Area of Concern
ASTM	American Society of Testing and Materials
COC	Chain of Custody
CX	Center of Expertise
DoD	U.S. Department of Defense
DQO	Data Quality Objective
EDD	Electronic Data Deliverable
EDMS	Environmental Data Management System
FSP	Field Sampling Plan
HTRW	Hazardous, Toxic, and Radioactive Waste
ICP	Inductively-coupled Plasma
IDW	Investigation-Derived Waste
LCS	Laboratory Control Samples
MI	Multi-Increment
MS/MSD	Matrix Spike/Matrix Spike Duplicate
MRL	Method Reporting Level
PAH	Polycyclic Aromatic Hydrocarbon
PCB	Polychlorinated Biphenyl
QA	Quality Assurance
QAAP	Quality Assurance Administrative Procedure
QAPP	Quality Assurance Project Plan
QC	Quality Control
QSM	Quality Systems Manual
RI	Remedial Investigation
RVAAP	Ravenna Army Ammunition Plant
SAIC	Science Applications International Corporation
SAP	Sampling and Analysis Plan
SOP	Standard Operating Procedure
SVOC	Semi-volatile Organic Compound
TAL	Target Analyte List
TBD	To Be Determined
USACE	United States Army Corps of Engineers
USEPA	United States Environmental Protection Agency
VOC	Volatile Organic Compound

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1.0 INTRODUCTION

This Quality Assurance Project Plan (QAPP) for the PBA 2008 Supplemental Investigation Sampling and Analysis Plan Addendum (herein referred to as this SAP Addendum) addresses supplemental project-specific information in relation to the final Facility-Wide QAPP for the Ravenna Army Ammunition Plant (RVAAP) (USACE 2001). Each QAPP section is presented documenting adherence to the Facility-Wide QAPP or stipulating project-specific addendum requirements.

Primary analytical direction for these projects will be obtained from the identified USEPA SW-846 Methods; the USACE Shell for Analytical Chemistry Requirements, Appendix I, EM200-1-3 (USACE 2001a); the Department of Defense Quality Systems Manual (QSM) for Environmental Laboratories (DoD 2006); and the Louisville QSM Supplement.

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2.0 PROJECT DESCRIPTION

This QAPP addresses supplemental project-specific information and tiers under the Facility-Wide QAPP for RVAAP (USACE 2001). Each QAPP section documents adherence to the Facility-Wide QAPP or stipulates project-specific requirements.

Primary analytical direction for these projects will be obtained from the identified USEPA SW-846 Methods; the USACE Shell for Analytical Chemistry Requirements, Appendix I, EM200-1-3 (USACE 2001a); the Department of Defense QSM for Environmental Laboratories (DoD 2006); and the Louisville QSM Supplement.

2.1 SITE HISTORY/BACKGROUND INFORMATION

This information is contained in Sections 1.0 and 2.0 of the Field Sampling Plan (FSP) for this SAP Addendum. AOC-specific background and history information is included in Appendices A through Q of the FSP.

2.2 PAST DATA COLLECTION ACTIVITY/CURRENT STATUS

This information is provided for each of the 17 AOCs in Appendices A through Q of the FSP (Part I) of this SAP Addendum.

2.3 PROJECT OBJECTIVES AND SCOPE

This information is contained in Section 3.0 of the FSP of this SAP Addendum.

2.4 SAMPLE NETWORK DESIGN AND RATIONALE

General information regarding the sample network design and rationale is provided in Section 3.2 of the FSP of this SAP Addendum, with information specific to each AOC presented in Appendices A through Q.

2.5 PARAMETERS TO BE TESTED AND FREQUENCY

Sample matrix types, analytical parameters, and analytical methods are discussed in Section 4.5 and in Appendices A through Q (for specific AOCs) of the FSP of this SAP Addendum. These sampling and analysis requirements are summarized in Table 2-1 of this QAPP, in conjunction with anticipated sample numbers, quality assurance (QA) sample frequencies, and field quality control (QC) sample frequencies.

Table 2-1. Sampling and Analytical Requirements

Parameter	Methods	Field Samples[a] Discrete	MI	Total	Field Duplicate Samples[b]	Site Source Water[c]	Sampler Rinsates[d]	Trip Blanks[e]	Total A-E Samples	USACE QA Split Samples[f]	USACE Trip Blanks[e]
Soil – Chemical Analysis											
Metals (TAL)	SW-846, 6010B/6020/ 7471A	554	128	680	74	-	TBD	TBD	754	74	TBD
Semivolatile Organics	SW-846, 8270C/3540C/3541	122	23	145	23	-	TBD	TBD	168	23	TBD
Explosives	SW-846, 8330B	511	128	637	72	-	TBD	TBD	709	72	TBD
Volatile Organics	SW-846, 8260B/5035	99	23	122	21	-	TBD	TBD	143	21	TBD
Pesticides	SW-846, 8081A/3540C	99	23	122	21	-	TBD	TBD	143	21	TBD
PCBs	SW-846, 8082/3540C	139	23	162	25	-	TBD	TBD	187	25	TBD
Nitroguanidine	SW-846, 8330 Mod./8332 Mod.	99	23	122	21	-	TBD	TBD	143	21	TBD
Nitrocellulose	SW-846, 9056A Mod./EPA 353.2 Mod.[g]	99	23	122	21	-	TBD	TBD	143	21	TBD
Polycyclic Aromatic Hydrocarbons	SW-846, 8310	357	106	460	49	-	TBD	TBD	509	49	TBD
Cyanide	SW-846, 9010C/9012A	99	23	122	21	-	TBD	TBD	143	21	TBD
Hexavalent Chromium[h]	SW-846, 7196	43	-	43	-	-	TBD	TBD	43	-	TBD
Asbestos[i]	EPA/600/R-93/116	TBD	TBD	-	TBD	-	TBD	TBD	TBD	TBD	TBD
Soil – Geotechnical Analysis											
Porosity	USACE EM 1110-2-1906 App II	25	-	25	-	-	TBD	TBD	25	-	TBD
Bulk Density	ASTM D5057	25	-	25	-	-	TBD	TBD	25	-	TBD
Moisture Content	ASTM D2216	25	-	25	-	-	TBD	TBD	25	-	TBD
Total Organic Carbon	EPA 415.1 Mod or SW-846, 9060A Mod. or Walkley-Black	25	-	25	-	-	TBD	TBD	25	-	TBD
Grain Size Fraction Analysis	ASTM D422	25	-	25	-	-	TBD	TBD	25	-	TBD
Permeability, K (undisturbed)	ASTMD5084/ 2434	25	-	25	-	-	TBD	TBD	25	-	TBD

Table 2-1. Sampling and Analytical Requirements (continued)

Parameter	Methods	Field Samples[a]			Field Duplicate Samples[b]	Site Source Water[c]	Sampler Rinsates[d]	Trip Blanks[e]	Total A-E Samples	USACE QA Split Samples[f]	USACE Trip Blanks[e]
		Discrete	MI	Total							
Surface Water											
Metals (TAL)	SW-846, 6010B/6020/7470A	36	-	36	11	2	TBD	TBD	49	11	TBD
Semivolatile Organics	SW-846, 8270C/3520C/3510C	36	-	36	11	2	TBD	TBD	49	11	TBD
Explosives	SW-846, 8330B	36	-	36	10	2	TBD	TBD	48	10	TBD
Nitrate	SW-846, 9056A/EPA 353.2	3	-	3	1	2	TBD	TBD	6	1	TBD
Volatile Organics	SW-846, 8260B/5030B	36	-	36	36	2	TBD	TBD	74	36	TBD
Pesticides	SW846, 8081A/3520C/3510C	36	-	36	10	2	TBD	TBD	48	10	TBD
PCBs	SW846, 8082/3520C/3510C	36	-	36	36	2	TBD	TBD	74	36	TBD
Nitroguanidine	SW846, 8330 Mod./8332 Mod.	36	-	36	11	2	TBD	TBD	49	11	TBD
Nitrocellulose	SW-846, 9056A Mod./EPA 353.2 Mod.[g]	36	-	36	10	2	TBD	TBD	48	10	TBD
Polycyclic Aromatic Hydrocarbons	SW-846, 8310	-	-	-	-	-	-	-	-	-	-
Cyanide	SW-846, 9010C/9012A	36	-	36	11	2	TBD	TBD	49	11	TBD
Wet Sediment											
Metals (TAL)	SW-846, 6010B/6020/ 7471A	36	-	36	11	-	TBD	TBD	47	11	TBD
Semivolatile Organics	SW-846, 8270C/3540C/3541	35	-	35	11	-	TBD	TBD	46	11	TBD
Explosives	SW-846, 8330B	36	-	36	11	-	TBD	TBD	47	11	TBD
Volatile Organics	SW-846, 8260B/5035	21	-	21	11	-	TBD	TBD	32	11	TBD
Pesticides	SW-846, 8081A/3540C	19	-	19	11	-	TBD	TBD	30	11	TBD
PCBs	SW-846, 8082/3540C	22	-	22	11	-	TBD	TBD	33	11	TBD
Nitroguanidine	SW-846, 8330 Mod./8332 Mod.	19	-	19	11	-	TBD	TBD	30	11	TBD
Nitrocellulose	SW-846, 9056A Mod./EPA 353.2 Mod.[g]	19	-	19	11	-	TBD	TBD	30	11	TBD

Table 2-1. Sampling and Analytical Requirements (continued)

Parameter	Methods	Field Samples[a]			Field Duplicate Samples[b]	Site Source Water[c]	Sampler Rinsates[d]	Trip Blanks[e]	Total A-E Samples	USACE QA Split Samples[f]	USACE Trip Blanks[e]
		Discrete	MI	Total							
Polycyclic Aromatic Hydrocarbons	SW-846, 8310	-	-	-	-	-	-	-	-	-	-
Cyanide	SW-846, 9010C/9012A	19	-	19	11	-	TBD	TBD	30	11	TBD
Hexavalent Chromium[h]	SW-846, 7196A/3060A	1	-	1	-	-	TBD	TBD	1	-	TBD
Groundwater											
Metals (TAL)	SW-846, 6010B/6020/7470A	0	-	0	0	-	TBD	TBD	0	0	TBD
Semivolatile Organics	SW-846, 8270C/3520C/3510C	0	-	0	0	-	TBD	TBD	0	0	TBD
Explosives	SW-846, 8330B	0	-	0	0	-	TBD	TBD	0	0	TBD
Nitrate	SW-846, 9056A/EPA 353.2	-	-	-	-	-	-	-	-	-	-
Volatile Organics	SW-846, 8260B/5030B	0	-	0	0	-	TBD	TBD	0	0	TBD
Pesticides	SW846, 8081A/3520C/3510C	0	-	0	0	-	TBD	TBD	0	0	TBD
PCBs	SW846, 8082/3520C/3510C	0	-	0	0	-	TBD	TBD	0	0	TBD
Nitroguanidine	SW846, 8330 Mod./8332 Mod.	0	-	0	0	-	TBD	TBD	0	0	TBD
Nitrocellulose	SW-846, 9056A Mod./EPA 353.2 Mod.[g]	0	-	0	0	-	TBD	TBD	0	0	TBD
Polycyclic Aromatic Hydrocarbons	SW-846, 8310	-	-	-	-	-	-	-	-	-	-
Cyanide	SW-846, 9010C/9012A	0	-	0	0	-	TBD	TBD	0	0	TBD
Liquid IDW Samples											
TCLP VOC	SW-846, 1311, 8260	-	-	4	-	-	-	-	-	-	-
TCLP SVOCs	SW-846, 1311, 8270	-	-	4	-	-	-	-	-	-	-
TCLP Pesticides	SW-846, 1311, 8081	-	-	4	-	-	-	-	-	-	-
TCLP Herbicides	SW-846, 1311, 8151	-	-	4	-	-	-	-	-	-	-
TCLP Metals	SW-846, 1311, 6010, 7470	-	-	4	-	-	-	-	-	-	-
Total Sulfide	SW846, 9030B/9034	-	-	4	-	-	-	-	-	-	-
Total Cyanide	SW-846, 9012A	-	-	4	-	-	-	-	-	-	-
Nitrate, Nitrite	EPA 353.2	-	-	4	-	-	-	-	-	-	-

Table 2-1. Sampling and Analytical Requirements (continued)

Parameter	Methods	Field Samples[a]			Field Duplicate Samples[b]	Site Source Water[c]	Sampler Rinsates[d]	Trip Blanks[e]	Total A-E Samples	USACE QA Split Samples[f]	USACE Trip Blanks[e]
		Discrete	MI	Total							
pH	EPA 150.1	-	-	4	-	-	-	-	-	-	-
Ignitability	SW-846 1010	-	-	4	-	-	-	-	-	-	-
Solid IDW Samples											
TCLP VOC	SW-846, 1311, 8260	-	-	16	-	-	-	-	-	-	-
TCLP SVOCs	SW-846, 1311, 8270	-	-	16	-	-	-	-	-	-	-
TCLP Pesticides	SW-846, 1311, 8081	-	-	16	-	-	-	-	-	-	-
TCLP Herbicides	SW-846, 1311, 8151	-	-	16	-	-	-	-	-	-	-
TCLP Metals	SW-846, 1311, 6010, 7470	-	-	16	-	-	-	-	-	-	-
Total Sulfide	SW846, 9030B/9034	-	-	16	-	-	-	-	-	-	-
Total Cyanide	SW-846, 9012A			16		-	-	-	-	-	-
Nitrate, Nitrite	EPA 353.2	-	-	16	-	-	-	-	-	-	-
pH	EPA 150.1	-	-	16	-	-	-	-	-	-	-
Ignitability	SW-846, 1010	-	-	16	-	-	-	-	-	-	-

[a]Matrix spike/matrix spike duplicate samples will be collected at a rate of 5% (1 per 20) of total samples per media. Full suite samples will be collected at a frequency of 10% or 15%, according to the FSP of this SAP Addendum.
[b]Duplicate samples are collected at a frequency of 10% per AOC; therefore, the total number of duplicate samples is greater than 10% of the total samples.
[c]Source waters will be collected from the potable water source and from the ASTM (de-ionized) water supply lot for the project. The source water sample quantities are included under the surface water subheading.
[d]Rinsate samples will be collected at a frequency of 10% for water samples (surface water and groundwater) for which undedicated, decontaminated equipment is used. For soil samples, two rinsate samples will be collected per field cycle.
[e]One trip blank will be collected for each shipping container (e.g., cooler) that contains soil or water samples for VOC analysis.
[f]USACE QA Split Samples will be collected at a frequency of 10% (1per 10).
[g]EPA 353.2 is a previously accepted method for nitrocellulose, but is not listed in the Facility-Wide QAPP. The method meets the project quanitation levels in Table 3-7 of the Facility-Wide QAPP. Nitrocellulose does not have a facity-wide CUG due to the absence of toxicity data; therefore, there are no levels to consider other than the project quanitation levels.
[h]Hexavalent chromium project quantitative limits for soil are 0.27 mg/kg and 0.002 mg/L for water
[i]Soil samples collected at C-Block may be analyzed for asbestos should a certified asbestos inspector determine on-site construction debris is asbestos containing material.
A-E = Architect-Engineer
ASTM = American Society of Testing and Materials
EM = Engineering Manual (USACE)
MI = Multi-Increment (sample)
N/A = not applicable
PCB = polychlorinated biphenyl
QA = Quality Assurance
RI = Remedial Investigation
TAL = Target Analyte List
TBD = To Be Determined
USACE = U.S. Army Corps of Engineers
VOC = Volatile Organic Compound
= not applicable/not required

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3.0 PROJECT ORGANIZATION

The functional project organization and responsibilities are described in the Facility-Wide Sampling and Analysis Plan (SAP) Section 2.0.

Analytical support for this work will be provided by White Water Associates with TestAmerica. The laboratory QAPPs will be forwarded, if required.

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4.0 QUALITY ASSURANCE OBJECTIVES FOR MEASUREMENT

4.1 DATA QUALITY OBJECTIVES

Data quality objective (DQO) summaries for this investigation will follow Tables 3-1 and 3-2 in the Facility-Wide QAPP. All QC parameters stated in the specific U.S. Environmental Protection Agency (USEPA) SW-846 methods will be adhered to for each chemical listed. The SW-846 method references found in the Facility-Wide QAPP have been revised to the Update III methods, as appropriate. Laboratories are required to comply with all methods as written; recommendations are considered requirements. Concurrence with the DoD QSM for Environmental Laboratories (DoD 2006), and the Louisville QSM Supplement is expected.

The contract laboratory will deliver an electronic data deliverable (EDD) that is automated data review (ADR) compatible. The contract laboratory must identify variances to the established library prior to any analysis being performed. No variances to the DoD QSM for Environmental Laboratories and the Louisville QSM Supplement are anticipated.

4.2 LEVEL OF QUALITY CONTROL EFFORT

QC efforts will follow Section 3.2 of the Facility-Wide QAPP. Field QC measurements will include field source water blanks, trip blanks, field duplicates, surrogates, and equipment rinsate blanks. Laboratory QC measurements will include method blanks, laboratory control samples (LCSs), laboratory duplicates, and matrix spike/matrix spike duplicate (MS/MSD) samples. LCS measurements will include the standard mid-level analyte concentration, plus a QC/method reporting level (MRL) low-level concentration. It is recognized that the laboratory will routinely perform and monitor the QC/MRL; however, guidance check limits will be utilized, as advisory and corrective action will not be required for individual analyte variances. The QC/MRL will be successfully analyzed at the beginning of the analytical sequences as required by the QSM. Additionally, the lab will analyze the QC/MRL sample at the close of the analytical sequence.

4.3 ACCURACY, PRECISION, AND SENSITIVITY OF ANALYSIS

Accuracy, precision, and sensitivity goals identified in Section 3.3 and Tables 3-1 through 3-9 of the Facility-Wide QAPP will be imposed for this investigation. As stated above, some of the analytical methods numbers have been updated (refer to Table 2-1 of this QAPP). Quality objectives related to individual method QC protocol will also follow requirements given in the DoD QSM for Environmental Laboratories and the Louisville QSM Supplement.

Laboratories will make all reasonable attempts to meet the program and project reporting levels in Tables 3-1 through 3-9 of the Facility-Wide QAPP for each individual sample analysis. When samples require dilution, both the minimum dilution and quantified dilution must be reported. All samples will be screened to determine optimum dilution ranges. Dilution runs will be performed to quantify high target analyte concentrations within the upper half of the calibration range, thus reducing the degree of dilution as much as possible. In addition, a five times less diluted run will then be performed to report other target analyte reporting levels as low as possible without destroying analytical detectors and instrumentation. If there are matrix interferences, non-target analyte, or high target analyte concentrations that preclude analysis of an undiluted sample, the laboratory project manager will contact Science Applications International Corporation (SAIC), USACE Louisville District, and Ohio EPA, forward analytical and chromatographic information from diluted runs, and obtain direction on how to proceed.

4.4 COMPLETENESS, REPRESENTATIVENESS, AND COMPARABILITY

Completeness, representativeness, and comparability goals identified in Section 3.4 and Tables 3-1 and 3-2 of the Facility-Wide QAPP will be imposed for this investigation.

5.0 SAMPLING PROCEDURES

Sampling procedures are described in Section 4.0 of the Facility-Wide SAP as referenced in Section 4.0 of the FSP of this SAP Addendum.

Tables 5-1 through 5-4 summarize sample container, preservation, and holding time requirements for the soil, wet sediment, water matrices, and investigation-derived waste (IDW) for this investigation.

As noted in the Facility-Wide QAPP, additional sample volumes will be provided, when necessary, for the express purpose of performing associated laboratory QC (MS/MSD). These laboratory QC samples will be designated by the field and identified for the laboratory on respective chain of custody (COC) documentation.

Table 5-1. Container Requirements for Soil and Wet Sediment Samples

Analyte Group	Container	Minimum Sample Size	Preservative	Holding Time
Volatile Organic Compounds	2 – 2 oz glass jar with septum cap (no headspace)	20 grams	Cool, 4°C	14 d
Semivolatile Organic Compounds	4 oz glass	30 grams	Cool, 4°C	14 d (extraction) 40 d (analysis)
Pesticide Compounds	4 oz glass	30 grams	Cool, 4°C	14 d (extraction) 40 d (analysis)
PCBs	4 oz glass	30 grams	Cool, 4°C	14 d (extraction) 40 d (analysis)
PAH Compounds	4 oz glass	30 grams	Cool, 4°C	14 d (extraction) 40 d (analysis)
Explosive Compounds	2 oz glass	10 grams	Cool, 4°C	14 d (extraction) 40 d (analysis)
Nitroguanidine	2 oz glass	10 grams	Cool, 4°C	14 d (extraction) 40 d (analysis)
Nitrocellulose	2 oz glass	10 grams	Cool, 4°C	14 d (extraction) 40 d (analysis)
Metals (TAL)	2 oz glass or plastic	20 grams	Cool, 4°C	180 d; Hg @ 28 d
Cyanide	4 oz glass	30 grams	Cool, 4°C	14 d
Hexavalent Chromium	4 oz glass	20 grams	Cool, 4°C	24hr (extraction) 24 hr (analysis)
Geotechnical parameters	Moisture/Density/Porosity/K – Shelby tube TOC – no special container Grain Size Fraction - no special container	Various 100 grams 5000 grams	Air tight, cool Cool N/A	N/A
Asbestos[a]	2 oz plastic or glass, plastic bag	1 oz	N/A	N/A

[a]Soil samples may be analyzed for asbestos at C-Block Quarry should a certified asbestos inspector determine the on-site debris is asbestos-containing material.
PCB = Polychlorinated Biphenyl
PAH = Polycyclic Aromatic Hydrocarbon
TAL = target analyte list
TOC= Total Organic Content
N/A = Not applicable
K= Permeability

Table 5-2. Container Requirements for Surface Water and Groundwater Samples

Analyte Group	Container	Minimum Sample Size	Preservative	Holding Time
Volatile Organic Compounds	(3) 40ml Glass Vial	(2) 40 ml	HCl to pH <2 Cool, 4°C	14 d
Semivolatile Organic Compounds	(2) 1 L Amber Glass	1 L	Cool, 4°C	7 d (extraction) 40 d (analysis)
Pesticide Compounds	(2) 1 L Amber Glass	1 L	Cool, 4°C	7 d (extraction) 40 d (analysis)
PCBs	(2) 1 L Amber Glass	1 L	Cool, 4°C	7 d (extraction) 40 d (analysis)
PAH Compounds	(2) 1 L Amber Glass	1 L	Cool, 4°C	7 d (extraction) 40 d (analysis)
Explosive Compounds	(2) 1 L Amber Glass	1 L	Cool, 4°C	7 d (extraction) 40 d (analysis)
Nitroguanidine	500 ml Amber Glass	10 ml	Cool, 4°C	14 d (extraction) 40 d (analysis)
Nitrocellulose	500 ml Amber Glass	100 ml	Cool, 4°C	14 d (extraction) 40 d (analysis)
Nitrate	250 ml poly	50 ml	Cool, 4°C	48 hrs
Metals (TAL)	1 L HNO3 Poly	300 ml	HNO3 to pH <2 Cool, 4°C	180 d; Hg @ 28 d
Cyanide	250 ml NaOH Poly	50 ml	NaOH to pH >12 Cool, 4°C	14 d

PCB = Polychlorinated Biphenyl
PAH = Polycyclic Aromatic Hydrocarbon
TAL = target analyte list

Table 5-3. Container Requirements for IDW Liquid Samples

Analyte Group	Container	Minimum Sample Size	Preservative	Holding Time
TCLP VOC	3 -40 mL glass vials with Teflon®-lined septum (no headspace)	80 mL	Cool, 4°C	7 d
TCLP SVOCs	2 - 1L amber glass bottle with Teflon®-lined lid	1000 mL	Cool, 4°C	7 d (extraction) 40 d (analysis)
TCLP Pesticides	2 - 1L amber glass bottle with Teflon®-lined lid	1000 mL	Cool, 4°C	7 d (extraction) 40 d (analysis)
TCLP Herbicides	2 - 1L amber glass bottle with Teflon®-lined lid	1000 mL	Cool, 4°C	7 d (extraction) 40 d (analysis)
TCLP Metals	1- 1L polybottle	500 mL	Cool, 4°C	7 d (extraction) 180 d; Hg @ 28 d
Sulfide	500 ml glass with no headspace	500 ml	Zinc acetate + NaOH to ph >9 Cool, 4°C	7 d
Nitrate, Nitrite	100 ml polybottle	100 ml	Cool, 4°C	48 hours
pH	100 ml polybottle	100 ml	Cool, 4°C	Immediate
Ignitability	500 ml polybottle	200 ml	Cool, 4°C	14 d

TCLP = Toxicity Characteristic Leaching Procedure
VOC=Volatile Organic Compounds
SVOCs= Semi-volatile Organic Compounds

Table 5-4. Container Requirements for IDW Soil Samples

Analyte Group	Container	Minimum Sample Size	Preservative	Holding Time
TCLP VOC	1 - 4 oz glass jar with Teflon-septa cap (no headspace)	20 g	Cool, 4°C	7 d
TCLP SVOCs, Pesticides, Herbicides, Metals	1 - 16 oz glass jar with Teflon-lined cap	200 g	Cool, 4°C	7 d (extraction) 40 d (analysis) metals 180 d Hg @ 28 d
Nitrate, Nitrite	100 ml polybottle	50 g	Cool, 4°C	48 hours
pH	100 ml polybottle	50 g	Cool, 4°C	Immediate
Ignitability	250 ml glass with Teflon-lined cap	100 g	Cool, 4°C	Immediate
Cyanide	100 ml polybottle	10 g	Cool, 4°C	14 d
Sulfide	100 ml glass	50 g	2 N Zinc Acetate Cool, 4°C	7 d

TCLP = Toxicity Characteristic Leaching Procedure
VOC=Volatile Organic Compounds
SVOC= Semi-volatile Organic Compounds

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6.0 SAMPLE CUSTODY

Sample custody procedures will follow those identified in Section 5.0 of the Facility-Wide QAPP.

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7.0 CALIBRATION PROCEDURES AND FREQUENCY

7.1 FIELD INSTRUMENTS/EQUIPMENT

Field instruments and equipment calibrations will follow procedures described in Section 6.1 of the Facility-Wide QAPP.

7.2 LABORATORY INSTRUMENTS

Calibration of laboratory equipment will follow procedures identified in Section 6.2 of the Facility-Wide QAPP, the contract laboratory QAPP, laboratory-specific standard operating procedures (SOPs), and corporate and facility-specific operating procedures.

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8.0 ANALYTICAL PROCEDURES

8.1 LABORATORY ANALYSIS

Analytical methods, parameters, and quantitation or detection limits are those listed in Tables 3-3 through 3-9 of the Facility-Wide QAPP. The SW-846 method references found in the Facility-Wide QAPP have been revised to the Update III methods, as appropriate. Laboratory analysis procedures are provided in Section 7.1 of the Facility-Wide QAPP.

The contract laboratory facilities will at all times maintain a safe and contaminant free environment for the analysis of samples. The laboratories will demonstrate, through instrument blanks, holding blanks, and analytical method blanks, that the laboratory environment and procedures will not and do not impact analytical results.

The contract laboratory facilities will also implement all reasonable procedures to maintain project reporting levels for all sample analyses. Where contaminant and sample matrix analytical interferences impact the laboratory's ability to obtain project reporting levels, the laboratory will institute sample clean-up processes, minimize dilutions, adjust instrument operational parameters, or propose alternative analytical methods or procedures. Elevated reporting levels will be kept to a minimum throughout the execution of this work. When samples require dilution, both the minimum dilution and quantified dilution must be reported. The contract laboratory will screen all samples to determine optimum dilution ranges. Dilution runs will be performed to quantify high target analyte concentrations within the upper half of the calibration range, thus reducing the degree of dilution as much as possible. In addition, a five times less diluted run will then be performed to report other target analyte reporting levels as low as possible without destroying analytical detectors and instrumentation. If there are matrix interferences, non-target analyte, or high target analyte concentrations that preclude analysis of an undiluted sample, the laboratory project manager will contact SAIC, USACE Louisville District, and Ohio EPA, forward analytical and chromatographic information from diluted runs, and obtain direction on how to proceed.

8.2 FIELD SCREENING ANALYTICAL PROTOCOLS

Procedures for instrument calibration, calibration frequency, and field analysis are identified in Section 6.0 of the Facility-Wide FSP, and in Section 4.0 of the FSP of this SAP Addendum. Only screening of samples for organic vapors using a photoionization detector will be conducted. Headspace analysis will not be conducted.

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9.0 INTERNAL QUALITY CONTROL CHECK

9.1 FIELD SAMPLE COLLECTION

Field QC sample types, numbers, and frequencies are identified in Sections 4.0 and 5.0 of the FSP of this SAP Addendum. In general, field duplicates will be collected at a frequency of 10%. Field equipment rinsates will be collected at a frequency of 10% for water samples, while one soil equipment rinsate sample will be collected per field cycle. Equipment rinsate samples pertain only to samples collected using reusable, decontaminated equipment. This will constitute a process check for the effectiveness of the decontamination procedure. Two site source water samples (one potable water source and one deionized water source) will be collected for the combined field effort.

9.2 FIELD MEASUREMENT

Refer to Section 4.0 of the FSP of this SAP Addendum for details regarding field measurements.

9.3 LABORATORY ANALYSIS

Analytical QC procedures will follow those identified in the referenced U.S. Environmental Protection Agency (USEPA) methodologies. These will include method blanks, LCS, MS, MSD, laboratory duplicate analysis, calibration standards, internal standards, surrogate standards, and calibration check standards.

The contract laboratory facilities will conform to their QAPP and implement their established SOPs to perform the various analytical methods required by the project. QC frequencies will follow those identified in Section 8.3 of the Facility-Wide QAPP.

Analyses will also be consistent with direction provided by the USACE Shell for Analytical Chemistry Requirements, Appendix I EM200-1-3, 1 February 2001, the DoD QSM for Environmental Laboratories, and the Louisville QSM Supplement. The following are clarifications to this guidance relative to this project:

- The QC/MDL check will be performed quarterly, until criteria can be established. After performance criteria are determined, the frequency of this QC check may be reduced to biannually or annually per instrument.

- Analytical method blanks will be considered clean as long as analyte concentrations are below reporting levels. Corrective actions will be performed for any analyte detected above the established method reporting level. Any analytes detected between the method detection limit and the MRL will be flagged appropriately.

- LCSs will contain all project target compounds. The marginal exceedances should not exceed the number allowed by the QSM.

- For methods that have multi-responders (i.e., aroclors and pesticides) within the same analytical process, the laboratory will not include all analytes within the matrix spiking mixture. A representative analyte will be employed for the MS evaluation.

- Inductively coupled plasma initial calibration curves will be confirmed through the analysis of a blank and three standards, and this documentation will be reported as part of the analytical data package.

- Inductively coupled plasma (ICP) serial dilution will be performed on a per batch basis. If the serial dilution falls outside acceptance criteria, a post-digestion spike analyses will be performed.

- Sediment samples having moisture levels that preclude soxlet extraction processes will be extracted by sonication methods.

10.0 DATA REDUCTION, VALIDATION, AND REPORTING

10.1 DATA REDUCTION

Data reduction will follow the established protocols defined in Section 9.1 in the Facility-Wide QAPP. Sample collection and field measurements will follow the established protocols defined in the Facility-Wide QAPP, Facility-Wide SAP, and this SAP Addendum. Laboratory data reduction will follow the contract laboratory QAPP guidance and will conform to general direction provided by the Facility-Wide QAPP; the USACE Shell for Analytical Chemistry Requirements, Appendix I EM200-1-3, February 2001; the DoD QSM for Environmental Laboratories; and the Louisville QSM Supplement.

10.2 DATA VERIFICATION/VALIDATION

Project data verification and validation will follow direction provided in the Facility-Wide QAPP Section 9.2 and diagramed in Figure 9-1. Protocol for analytical data verification and validation has been updated to the following references:

- DoD QSM for Environmental Laboratories, January 2006;
- Louisville QSM Supplement;
- USEPA National Functional Guidelines for Organic Data Review, EPA-540/R-99/008, October 1999; and
- USEPA National Functional Guidelines for Inorganic Data Review, EPA-540-R-04-004, October 2004.

All data will be reviewed and verified by SAIC according to the Facility-Wide QAPP.

Validation of 10% of the data will follow the direction provided in the Facility-Wide QAPP, the DoD QSM for Environmental Laboratories, and the Louisville QSM Supplement. An independent data validation subcontractor qualified by USACE, Louisville District will perform this data validation. The validator shall document the findings of the review using the checklists in Attachment B of the Louisville Chemistry Guideline (LCG), Rev. 5, June 2002, Samir Mansy. These checklists may be modified to implement QSM criteria.

10.3 DATA REPORTING

Data reports will follow the established protocols defined in Section 9.3 in the Facility-Wide QAPP. The contract laboratory will deliver an EDD that is ADR compatible. All data will be processed by ADR/environmental data management system (EDMS) software using the Ravenna library. All errors in the ADR/EDD found by CHECKER must be corrected by the laboratory prior to transmittal. EDDs with errors will not be accepted.

10.4 DATA QUALITY ASSESSMENT

Data quality will be assessed using the procedures provided in Section 9.4 of the Facility-Wide QAPP.

11.0 PERFORMANCE AND SYSTEM AUDITS

11.1 FIELD AUDITS

One field surveillance for the investigation will be performed by the SAIC QA/QC Officer, the SAIC Field Operations Manager, or another properly trained SAIC auditor. This surveillance will encompass the performance of sampling of any environmental medium. The surveillance will follow SAIC Quality Assurance Administrative Procedure (QAAP) 18.3.

USACE, USEPA Region 5, or Ohio EPA audits may be conducted at the discretion of the respective agency.

11.2 LABORATORY AUDITS

Routine USACE Hazardous, Toxic, and Radioactive Waste (HTRW) Center of Expertise (CX) on-site laboratory audits may be conducted by USACE, while audits by USEPA Region 5 or Ohio EPA may be conducted at the discretion of the respective agency.

Internal performance and systems audits will be conducted by the contract laboratory's QA staff, as defined in their QAPP.

More information regarding laboratory audits can be found in Section 10.2 of the Facility-Wide QAPP.

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12.0 PREVENTIVE MAINTENANCE PROCEDURES

Maintenance of all field and laboratory sampling and analytical equipment will follow direction provided in Section 11.0 of the Facility-Wide QAPP. Routine and preventive maintenance for all laboratory instruments and equipment will follow the direction of the contract laboratory QAPP.

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13.0 SPECIFIC ROUTINE PROCEDURES TO ASSESS DATA PRECISION, ACCURACY, AND COMPLETENESS

Field and laboratory data will be assessed as outlined in Sections 12.1 and 12.2, respectively, of the Facility-Wide QAPP.

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14.0 CORRECTIVE ACTIONS

Field and laboratory activity corrective action protocol will follow directions provided in Sections 13.1 and 13.2, respectively, of the Facility-Wide QAPP. Laboratory corrective actions will also follow the procedures in the contract laboratory QAPP.

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15.0 QA REPORTS

Procedures and reports will follow the protocol identified in Section 14.0 of the Facility-Wide QAPP and those directed by the contract laboratory QAPP.

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16.0 REFERENCES

DoD (U.S. Department of Defense) 2006. *Quality Systems Manual for Environmental Laboratories,* Environmental Data Quality Workgroup, Final Version 3. Final. January.

USACE (U.S. Army Corps of Engineers) 2000. *Environmental Data Quality Assurance Guideline, Louisville District*. May. (Draft).

USACE 2001. *Facility-Wide Sampling and Analysis Plan for Environmental Investigations at the Ravenna Army Ammunition Plant, Ravenna, Ohio*, DACA62-00-D-0001, Delivery Order CY02. Final. March.

USACE 2002. *Louisville Chemistry Guideline,* Samir A. Mansey, Environmental Chemistry Branch, Rev. 5, June.

USEPA (U.S. Environmental Protection Agency) 1999. *Contract Laboratory Program National Functional Guidelines for Organic Data Review*, EPA-540/R-99/008. Final. October.

USEPA 2004. *Contract Laboratory Program National Functional Guidelines for Inorganic Data Review*, EPA-540-R-04-004. Final. October.

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Part III

Final

Site Safety and Health Plan
for the
PBA 2008 Supplemental Investigation Sampling and Analysis Plan
Addendum No. 1

Ravenna Army Ammunition Plant
Ravenna, Ohio

Contract No. W912QR-04-D-0028
Delivery Order No. 0001

Prepared for:
U.S. Army Corps of Engineers
600 Martin Luther King, Jr. Place
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December 23, 2009

APPROVALS

Final

Site Safety and Health Plan
for the
PBA 2008 Supplemental Investigation Sampling and Analysis Plan
Addendum No. 1

December 2009

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12/16/09

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12/17/09

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Date

SAIC Health and Safety Manager

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ACRONYMS AND ABBREVIATIONS

ACGIH	American Conference of Governmental Industrial Hygienists
ACM	Asbestos Containing Material
AOC	Area of Concern
BGS	Below Ground Surface
Camp Ravenna	Camp Ravenna Joint Military Training Center
CIH	Certified Industrial Hygienist
COC	Chemical of Concern
CPR	Cardiopulmonary Resuscitation
CSP	Certified Safety Professional
CHP	Certified Health Physicist
EC	Environmental Compliance
FM	Field Manager
FOM	Field Operations Manager
FP	Flash Point
FWSHP	Facility-Wide Safety and Health Plan
FSP	Field Sampling Plan
GFCI	Ground-Fault Circuit Interrupter
HAZWOPER	Hazardous Waste Site Operations
H&S	Health & Safety
HTRW	Hazardous, Toxic, and Radioactive Waste
ICSC	International Chemical Safety Cards
IDHL	Immediately Dangerous to Life and Heath
IDW	Investigation-Derived Waste
IP	Ionization Potential
IRP	Installation Restoration Program
MEC	Munitions and Explosives of Concern
MRS	Munitions Response Site
MSDS	Material Safety Data Sheet
NA	Not Applicable
NACA	National Advisory Committee for Aeronautics
NGB	National Guard Bureau
NIOSH	National Institute for Occupational Safety and Health
NRR	Noise Reduction Rating
OEW	Ordnance and Explosive Waste
OHARNG	Ohio Army National Guard
Ohio EPA	Ohio Environmental Protection Agency
OJT	On-the-Job Training
O&M	Operations & Maintenance
PAH	Polycyclic Aromatic Hydrocarbon
PEL	Permissible Exposure Limit
PCB	Polychlorinated Biphenyl

ACRONYMS AND ABBREVIATIONS (CONTINUED)

PFD	Personal Flotation Device
PID	Photoionization Detector
PM	Project Manager
PPE	Personal Protective Equipment
PPM	Parts Per Million
PVC	Polyvinyl Chloride
RI	Remedial Investigation
RVAAP	Ravenna Army Ammunition Plant
SAIC	Science Applications International Corporation
SAP	Sampling and Analysis Plan
SRC	Site-Related Contamination
SSHO	Site Safety and Health Officer
SSHP	Site Safety and Health Plan
STEL	Short-Term Exposure Limit
SVOCs	Semivolatile Organic Compounds
TBD	To Be Determined
TLV	Threshold Limit Value
TWA	Time-Weighted Average
USACE	United States Army Corps of Engineers
USAE	U.S.A. Environmental
UXO	Unexploded Ordnance
VOC	Volatile Organic Compound
VP	Vapor Pressure

1.0 INTRODUCTION

Science Applications International Corporation's (SAIC) formal policy, stated in the Environmental Compliance and Health and Safety Program manual, is to take every reasonable precaution to protect the health and safety of our employees, the public, and the environment. To this end, the Ravenna Army Ammunition Plant (RVAAP) *Facility-Wide Safety and Health Plan* (FWSHP) (USACE 2001) and a Site Safety and Health Plan (SSHP) will collectively set forth the specific procedures required to protect SAIC and SAIC subcontractor personnel involved in the field activities. These plans are driven by requirements contained in the most current revisions of the United States Army Corps of Engineers (USACE) *Safety and Occupational Health Requirements for Hazardous, Toxic, and Radioactive Waste (HTRW)* and *Ordnance and Explosive Waste (OEW) Activities, ER-385-1-92,* and the USACE *Safety and Health Manual, EM-385-1-1*, which are available online via the USACE website. SAIC activities are also subject to the requirements of the SAIC Corporate Environmental Compliance and Health and Safety Program and associated procedures. All field personnel are required to comply with the requirements of these programs and plans.

The FWSHP addresses program issues and hazards and hazard controls common to the entire facility. This SSHP will be an addendum to the FWSHP serving as a lower tier document addressing the hazards and controls for each specific Sampling and Analysis Plan (SAP). Copies of the FWSHP and the SSHP Addendum will be present at the work site during all fieldwork. Neither the FWSHP nor the SSHP Addendum are stand-alone documents and therefore cannot be implemented without the other.

SAIC will perform supplemental remedial investigation (RI) sampling activities at the following 17 areas of concern (AOCs) within RVAAP:

- RVAAP-06: C-Block Quarry;
- RVAAP-12: Load Line 12;
- RVAAP-13: Building 1200;
- RVAAP-19 and -R-01: Landfill North of Winklepeck Burning Grounds (WBG);
- RVAAP-29: Upper and Lower Cobbs Ponds;
- RVAAP-33: Load Line 6;
- RVAAP-38: NACA Test Area;
- RVAAP-39: Load Line 5;
- RVAAP-40: Load Line 7;
- RVAAP-41: Load Line 8;
- RVAAP-42: Load Line 9;
- RVAAP-43: Load Line 10;
- RVAAP-44: Load Line 11;
- RVAAP-45: Wet Storage Area;
- RVAAP-46: Buildings F-15 and F-16;
- RVAAP-48: Anchor Test Area; and
- RVAAP-50 and -R-01: Atlas Scrap Yard.

The Field Sampling Plan (FSP) contains a description of each AOC. Included in the AOC site descriptions are previous investigation activities, summary statistics of results, and planned characterization activities.

The potential for chemical overexposure appears to be very low based on the nature of planned tasks and review of available historical data. There is some potential for chemical exposures via the inhalation pathway during drilling operations and dermal contact with soil. Sampling and drilling crews will use protective gloves to handle potentially contaminated materials, and, if necessary, the Site Safety and Health Officer (SSHO) will upgrade the required personal protective equipment (PPE). Physical hazards are associated with drilling equipment and soil sampling equipment (e.g., hand bucket augers). Task-specific hazard controls have been specified for these tasks. The SSHO will observe all site tasks during daily safety inspections and will use professional judgment and appropriate monitoring results to determine if upgrading PPE is required. A detailed analysis of these hazards and specific appropriate controls is presented in Table 3-2.

These investigations will be performed in Level D PPE, plus chemical-resistant gloves when handling potentially-contaminated materials. If one of several action levels is exceeded or the potential for increased risk becomes apparent during the investigation, protective procedures, including protective clothing, will be upgraded as necessary by the SSHO. Further details regarding PPE are contained in Section 7.0.

There is a potential to encounter discarded military munitions, munitions debris, unexploded ordnance (UXO) and munitions constituents at four AOCs with known munitions response site (MRS) boundaries or suspect munitions and explosives of concern (MEC) during these investigations. U.S.A. Environmental (USAE), SAIC's subcontractor, will provide MEC avoidance services at the following four AOCs; National Advisory Committee for Aeronautics (NACA) Test Area, the former Firestone Test Facility within Load Line 6 (LL6), Landfill North of WBG and Atlas Scrap Yard. USAE has prepared a MEC-specific SSHP to supplement the FWSHP and this SSHP.

2.0 FACILITY DESCRIPTION AND CONTAMINANT CHARACTERIZATION

2.1 FACILITY DESCRIPTION

The RVAAP facility description and history can be found in Section 2.1 of the FSP of this SAP Addendum. Descriptions, histories, previous investigation activities, and recommended characterization activities for each AOC are also presented in the FSP of this SAP Addendum.

2.2 CONTAMINANTS

Tables 2-1 to 2-5 present the contaminants known to occur in surface soil, subsurface soil, surface water, groundwater, and wet sediment. Inclusion in these tables indicate the potential to encounter a contaminant during sampling activities, but it does not necessarily indicate that the contaminant is present in sufficient quantity to pose a health risk to workers.

Table 2-1. Maximum Concentrations of Constituents of Potential Concern in Surface Soil (0 to 1 ft bgs)

Analyte	Units	Maximum Detect[a]	Analyte	Units	Maximum Detect
Anions			***Metals (continued)***		
Nitrate	mg/kg	32.00	Vanadium	mg/kg	43.90
Nitrate/Nitrite (NO3/NO2-N)	mg/kg	1.40	Zinc	mg/kg	1800.00
Sulfide	mg/kg	244.00	***Organics-Explosives***		
Metals			1,3,5-Trinitrobenzene	mg/kg	0.02
Aluminum	mg/kg	33900.00	1,3-Dinitrobenzene	mg/kg	0.02
Antimony	mg/kg	2.90	2,4,6-Trinitrotoluene	mg/kg	22.00
Arsenic	mg/kg	54.00	2,4-Dinitrotoluene	mg/kg	0.05
Barium	mg/kg	436.00	2,6-Dinitrotoluene	mg/kg	0.28
Beryllium	mg/kg	5.90	2-Amino-4,6-Dinitrotoluene	mg/kg	0.54
Cadmium	mg/kg	14.50	2-Nitrotoluene	mg/kg	0.43
Calcium	mg/kg	195000.00	3-Nitrotoluene	mg/kg	0.13
Chromium	mg/kg	920.00	4-Amino-2,6-Dinitrotoluene	mg/kg	0.64
Chromium, hexavalent	mg/kg	5.40	4-Nitrotoluene	mg/kg	0.07
Cobalt	mg/kg	38.20	HMX	mg/kg	11.00
Copper	mg/kg	1760.00	Nitrobenzene	mg/kg	0.02
Cyanide	mg/kg	4.20	Nitrocellulose	mg/kg	45.40
Iron	mg/kg	76000.00	Nitroguanidine	mg/kg	0.09
Lead	mg/kg	13200.00	RDX	mg/kg	45.00
Magnesium	mg/kg	25100.00	Tetryl	mg/kg	0.63
Manganese	mg/kg	6240.00	***Organics-Pesticide/PCB***		
Mercury	mg/kg	882.00	4,4'-DDD	mg/kg	0.00047
Nickel	mg/kg	41.40	4,4'-DDE	mg/kg	0.11
Potassium	mg/kg	2910.00	4,4'-DDT	mg/kg	0.02
Selenium	mg/kg	2.80	Aldrin	mg/kg	0.00017
Silver	mg/kg	80.00	Dieldrin	mg/kg	0.00044
Sodium	mg/kg	1700.00	Endosulfan I	mg/kg	0.00035
Thallium	mg/kg	2.90	Endosulfan II	mg/kg	0.00037

Table 2-1. Maximum Concentrations of Constituents of Potential Concern in Surface Soil (0 to 1 ft bgs) (continued)

Analyte	Units	Maximum Detect[a]	Analyte	Units	Maximum Detect
Organics-Pesticide/PCB (continued)			***Organics-Semivolatile (continued)***		
Endosulfan sulfate	mg/kg	0.00038	2,4,6-Trichlorophenol	mg/kg	0.09
Endrin	mg/kg	0.00056	2,4-Dichlorophenol	mg/kg	0.08
Endrin aldehyde	mg/kg	0.00043	2,4-Dimethylphenol	mg/kg	0.29
Endrin ketone	mg/kg	0.00038	2,4-Dinitrophenol	mg/kg	0.26
Heptachlor	mg/kg	0.0019	2-Chloronaphthalene	mg/kg	0.07
Heptachlor epoxide	mg/kg	0.00098	2-Chlorophenol	mg/kg	0.09
Lindane	mg/kg	0.0003	2-Methyl-4,6-dinitrophenol	mg/kg	0.18
Methoxychlor	mg/kg	0.003	2-Methylnaphthalene	mg/kg	1.00
PCB-1016	mg/kg	0.0031000	2-Methylphenol	mg/kg	0.16
PCB-1221	mg/kg	0.01	2-Nitrobenzenamine	mg/kg	0.14
PCB-1232	mg/kg	0.01	2-Nitrophenol	mg/kg	0.10
PCB-1242	mg/kg	0.01	3,3'-Dichlorobenzidine	mg/kg	0.15
PCB-1248	mg/kg	0.01	3-Nitrobenzenamine	mg/kg	0.18
PCB-1254	mg/kg	0.11	4-Bromophenyl phenyl ether	mg/kg	0.12
PCB-1260	mg/kg	0.12	4-Chloro-3-methylphenol	mg/kg	0.11
Toxaphene	mg/kg	0.01	4-Chlorobenzenamine	mg/kg	0.17
alpha-BHC	mg/kg	0.0002100	4-Chlorophenyl phenyl ether	mg/kg	0.11
alpha-Chlordane	mg/kg	0.24	4-Methylphenol	mg/kg	0.15
beta-BHC	mg/kg	0.0034000	4-Nitrobenzenamine	mg/kg	0.18
delta-BHC	mg/kg	0.0049	4-Nitrophenol	mg/kg	0.48
gamma-Chlordane	mg/kg	0.23	Acenaphthene	mg/kg	2.10
Organics-Semivolatile			Acenaphthylene	mg/kg	7.90
1,2,4-Trichlorobenzene	mg/kg	0.06	Anthracene	mg/kg	9.60
1,2-Dichlorobenzene	mg/kg	0.11	Benz(a)anthracene	mg/kg	36.00
1,3-Dichlorobenzene	mg/kg	0.12	Benzenemethanol	mg/kg	2.10
1,4-Dichlorobenzene	mg/kg	0.10	Benzo(a)pyrene	mg/kg	41.00
2,4,5-Trichlorophenol	mg/kg	0.09	Benzo(b)fluoranthene	mg/kg	54.00

Table 2-1. Maximum Concentrations of Constituents of Potential Concern in Surface Soil (0 to 1 ft bgs) (continued)

Analyte	Units	Maximum Detect[a]	Analyte	Units	Maximum Detect
Organics-Semivolatile (continued)			***Organics-Semivolatile (continued)***		
Benzo(ghi)perylene	mg/kg	24.00	Pentachlorophenol	mg/kg	0.24
Benzo(k)fluoranthene	mg/kg	19.00	Phenanthrene	mg/kg	83.00
Benzoic acid	mg/kg	0.24	Phenol	mg/kg	0.27
Bis(2-chloroethoxy)methane	mg/kg	0.08	Pyrene	mg/kg	93.00
Bis(2-chloroethyl) ether	mg/kg	0.12	***Organics-Volatile***		
Bis(2-chloroisopropyl) ether	mg/kg	0.23	1,1,1-Trichloroethane	mg/kg	0.0008
Bis(2-ethylhexyl)phthalate	mg/kg	6.60	1,1,2,2-Tetrachloroethane	mg/kg	0.0008
Butyl benzyl phthalate	mg/kg	0.24	1,1,2-Trichloroethane	mg/kg	0.0009
Carbazole	mg/kg	4.90	1,1-Dichloroethane	mg/kg	0.001
Chrysene	mg/kg	46.00	1,1-Dichloroethene	mg/kg	0.001
Di-n-butyl phthalate	mg/kg	0.09	1,2-Dichloroethane	mg/kg	0.0008
Di-n-octylphthalate	mg/kg	0.35	1,2-Dichloroethene	mg/kg	0.003
Dibenz(a,h)anthracene	mg/kg	5.70	1,2-Dichloropropane	mg/kg	0.001
Dibenzofuran	mg/kg	1.90	2-Butanone	mg/kg	0.02
Diethyl phthalate	mg/kg	0.12	2-Hexanone	mg/kg	0.002
Dimethyl phthalate	mg/kg	0.10	4-Methyl-2-pentanone	mg/kg	0.004
Fluoranthene	mg/kg	98.00	Acetone	mg/kg	0.09
Fluorene	mg/kg	7.90	Benzene	mg/kg	0.0009
Hexachlorobenzene	mg/kg	0.09	Bromodichloromethane	mg/kg	0.0009
Hexachlorobutadiene	mg/kg	0.09	Bromoform	mg/kg	0.001
Hexachlorocyclopentadiene	mg/kg	0.16	Bromomethane	mg/kg	0.004
Hexachloroethane	mg/kg	0.10	Carbon disulfide	mg/kg	0.003
Indeno(1,2,3-cd)pyrene	mg/kg	24.00	Carbon tetrachloride	mg/kg	0.001
Isophorone	mg/kg	0.07	Chlorobenzene	mg/kg	0.001
N-Nitroso-di-n-propylamine	mg/kg	0.13	Chloroethane	mg/kg	0.002
N-Nitrosodiphenylamine	mg/kg	0.14	Chloroform	mg/kg	0.0008
Naphthalene	mg/kg	2.80	Chloromethane	mg/kg	0.001

Table 2-1. Maximum Concentrations of Constituents of Potential Concern in Surface Soil (0 to 1 ft bgs) (continued)

Analyte	Units	Maximum Detect[a]	Analyte	Units	Maximum Detect
Organics-Volatile (continued)			***Organics-Volatile (continued)***		
Dibromochloromethane	mg/kg	0.0009	Toluene	mg/kg	0.0042
Dimethylbenzene	mg/kg	0.0040	Trichloroethene	mg/kg	0.0008
Ethylbenzene	mg/kg	0.001	Vinyl chloride	mg/kg	0.001
Methylene chloride	mg/kg	0.0046	cis-1,3-Dichloropropene	mg/kg	0.001
Styrene	mg/kg	0.0015	trans-1,3-Dichloropropene	mg/kg	0.001
Tetrachloroethene	mg/kg	0.0009			

[a]The maximum detect concentration is the maximum concentration of a COPC detected in the given media at the any one of the 17 AOCs during previous investigations.

Table 2-2. Maximum Concentrations of Constituents of Potential Concern in Subsurface Soil (1 to 13 ft bgs)

Analyte	Units	Maximum Detect[a]	Analyte	Units	Maximum Detect
Anions			***Metals (continued)***		
Nitrate	mg/kg	15.00	Zinc	mg/kg	390.00
Sulfate	mg/kg	44.90	***Miscellaneous***		
Sulfide	mg/kg	161.00	TPH - Diesel Range Organics	mg/kg	2900.00
Metals			TPH - Gasoline Range Organics	mg/kg	630.00
Aluminum	mg/kg	24500.00	***Organics-Explosives***		
Antimony	mg/kg	1.30	Nitrocellulose	mg/kg	2.80
Arsenic	mg/kg	44.10	***Organics-Pesticide/PCB***		
Barium	mg/kg	4190.00	4,4'-DDD	mg/kg	0.06
Beryllium	mg/kg	3.20	4,4'-DDE	mg/kg	0.02
Cadmium	mg/kg	30.00	4,4'-DDT	mg/kg	0.04
Calcium	mg/kg	39000.00	Endrin aldehyde	mg/kg	0.0027
Chromium	mg/kg	54.00	Heptachlor	mg/kg	0.0037
Cobalt	mg/kg	33.00	PCB-1254	mg/kg	0.79
Copper	mg/kg	733.00	alpha-Chlordane	mg/kg	0.0022
Cyanide	mg/kg	1.00	gamma-Chlordane	mg/kg	0.0022
Iron	mg/kg	54800.00	***Organics-Semivolatile***		
Lead	mg/kg	250.00	1,4-Dichlorobenzene	mg/kg	0.27
Magnesium	mg/kg	9200.00	2-Methylnaphthalene	mg/kg	4.60
Manganese	mg/kg	2300.00	Acenaphthene	mg/kg	0.07
Mercury	mg/kg	9.70	Acenaphthylene	mg/kg	0.23
Nickel	mg/kg	37.00	Anthracene	mg/kg	0.13
Potassium	mg/kg	3200.00	Benz(a)anthracene	mg/kg	0.46
Selenium	mg/kg	2.50	Benzo(a)pyrene	mg/kg	0.70
Silver	mg/kg	0.22	Benzo(b)fluoranthene	mg/kg	1.00
Sodium	mg/kg	1800.00	Benzo(ghi)perylene	mg/kg	0.65
Thallium	mg/kg	2.50	Benzo(k)fluoranthene	mg/kg	0.23
Vanadium	mg/kg	32.00	Bis(2-ethylhexyl)phthalate	mg/kg	0.43

Table 2-2. Maximum Concentrations of Constituents of Potential Concern in Subsurface Soil (1 to 13 ft bgs) (continued)

Analyte	Units	Maximum Detect[a]	Analyte	Units	Maximum Detect
Organics-Semivolatile (continued)			***Organics-Semivolatile (continued)***		
Carbazole	mg/kg	0.14	Phenanthrene	mg/kg	1.10
Chrysene	mg/kg	0.62	Pyrene	mg/kg	1.00
Di-n-butyl phthalate	mg/kg	0.14	***Organics-Volatile***		
Di-n-octylphthalate	mg/kg	0.02	Acetone	mg/kg	0.16
Dibenz(a,h)anthracene	mg/kg	0.11	Carbon tetrachloride	mg/kg	0.001
Dibenzofuran	mg/kg	0.52	Chlorobenzene	mg/kg	0.26
Fluoranthene	mg/kg	1.00	Dimethylbenzene	mg/kg	0.15
Fluorene	mg/kg	0.42	Methylene chloride	mg/kg	0.02
Indeno(1,2,3-cd)pyrene	mg/kg	0.52	Styrene	mg/kg	0.0027
Naphthalene	mg/kg	1.80	Toluene	mg/kg	0.01

[a]The maximum detect concentration is the maximum concentration of a COPC detected in the given media at the any one of the 17 AOCs during previous investigations.

Table 2-3. Maximum Concentrations of Constituents of Potential Concern in Surface Water

Analyte	Units	Maximum Detect[a]	Analyte	Units	Maximum Detect
Anions			***Metals (continued)***		
Nitrate	mg/L	2200	Zinc	mg/L	1.1
Sulfate	mg/L	50.6	***Organics-Explosives***		
Sulfide	mg/L	2.3	1,3,5-Trinitrobenzene	mg/L	0.009
Metals			2,4,6-Trinitrotoluene	mg/L	0.011
Aluminum	mg/L	17.8	2,4-Dinitrotoluene	mg/L	0.012
Antimony	mg/L	0.0059	2,6-Dinitrotoluene	mg/L	0.0045
Arsenic	mg/L	0.351	2-Amino-4,6-dinitrotoluene	mg/L	0.00016
Barium	mg/L	0.382	2-Nitrotoluene	mg/L	0.0051
Beryllium	mg/L	0.0008	3-Nitrotoluene	mg/L	0.00049
Cadmium	mg/L	0.0032	4-Amino-2,6-Dinitrotoluene	mg/L	0.00053
Calcium	mg/L	184	4-Amino-2,6-dinitrotoluene	mg/L	0.00037
Chromium	mg/L	0.0488	4-Nitrotoluene	mg/L	0.0039
Chromium, hexavalent	mg/L	0.02	HMX	mg/L	0.029
Cobalt	mg/L	0.062	Nitrocellulose	mg/L	0.12
Copper	mg/L	0.193	RDX	mg/L	0.042
Iron	mg/L	38	Tetryl	mg/L	0.01
Lead	mg/L	3.15	***Organics-Pesticide/PCB***		
Magnesium	mg/L	49.5	beta-BHC	mg/L	0.000062
Manganese	mg/L	15.8	***Organics-Semivolatile***		
Mercury	mg/L	0.0219	2,4,6-Trichlorophenol	mg/L	0.00031
Nickel	mg/L	0.0867	2,4-Dimethylphenol	mg/L	0.088
Potassium	mg/L	15.7	2-Methylphenol	mg/L	0.072
Selenium	mg/L	0.0104	4-Methylphenol	mg/L	0.086
Silver	mg/L	0.092	Benz(a)anthracene	mg/L	0.00017
Sodium	mg/L	25	Benzenemethanol	mg/L	0.012
Thallium	mg/L	0.0017	Benzo(a)pyrene	mg/L	0.00012
Vanadium	mg/L	0.0319	Benzo(b)fluoranthene	mg/L	0.00011

Table 2-3. Maximum Concentrations of Constituents of Potential Concern in Surface Water (continued)

Analyte	Units	Maximum Detect[a]	Analyte	Units	Maximum Detect
Organics-Semivolatile (continued)			***Organics-Semivolatile (continued)***		
Benzo(k)fluoranthene	mg/L	0.00014	Pyrene	mg/L	0.00016
Benzoic acid	mg/L	0.41	***Organics-Volatile***		
Bis(2-ethylhexyl)phthalate	mg/L	0.13	Acetone	mg/L	0.016
Chrysene	mg/L	0.00017	Carbon disulfide	mg/L	0.0037
Dibenz(a,h)anthracene	mg/L	0.00013	Chloromethane	mg/L	0.001
Fluoranthene	mg/L	0.00014	Methylene chloride	mg/L	0.0064
Indeno(1,2,3-cd)pyrene	mg/L	0.00013	Toluene	mg/L	0.064
Isophorone	mg/L	0.0022	Trichloroethene	mg/L	0.002
Phenol	mg/L	0.068			

[a]The maximum detect concentration is the maximum concentration of a COPC detected in the given media at the any one of the 17 AOCs during previous investigations.

Table 2-4. Maximum Concentrations of Constituents of Potential Concern in Groundwater

Analyte	Units	Maximum Detect[a]	Analyte	Units	Maximum Detect
Anions			***Organics-Explosives (continued)***		
Nitrate	mg/L	0.57	4-Nitrotoluene	mg/L	0.00027
Sulfate	mg/L	97.7	HMX	mg/L	0.000066
Metals			Nitrobenzene	mg/L	0.000088
Aluminum	mg/L	5.6	Nitrocellulose	mg/L	0.3
Antimony	mg/L	0.0039	Nitroglycerin	mg/L	0.00035
Arsenic	mg/L	0.016	RDX	mg/L	0.00025
Barium	mg/L	0.115	***Organics-Pesticide/PCB***		
Beryllium	mg/L	0.00036	4,4'-DDD	mg/L	0.00035
Calcium	mg/L	118	4,4'-DDT	mg/L	0.000024
Iron	mg/L	8.76	Endrin	mg/L	0.00031
Lead	mg/L	0.0015	Heptachlor	mg/L	0.000087
Magnesium	mg/L	40.2	Heptachlor epoxide	mg/L	0.00006
Manganese	mg/L	3.02	Methoxychlor	mg/L	0.000038
Nickel	mg/L	0.11	alpha-Chlordane	mg/L	0.000015
Potassium	mg/L	3.86	beta-BHC	mg/L	0.00021
Sodium	mg/L	48	delta-BHC	mg/L	0.000012
Thallium	mg/L	0.0011	***Organics-Semivolatile***		
Zinc	mg/L	0.0671	2-Methylnaphthalene	mg/L	0.00025
Miscellaneous			4-Chloro-3-methylphenol	mg/L	0.002
Cyanide	mg/L	0.0099	4-Nitrobenzenamine	mg/L	0.0041
Perchlorate	mg/L	0.000088	Benz(a)anthracene	mg/L	0.00016
TPH - Diesel Range Organics	mg/L	0.06	Benzo(a)pyrene	mg/L	0.00017
Organics-Explosives			Benzo(b)fluoranthene	mg/L	0.00013
1,3,5-Trinitrobenzene	mg/L	0.000052	Benzo(ghi)perylene	mg/L	0.001
2,4,6-Trinitrotoluene	mg/L	0.0012	Benzo(k)fluoranthene	mg/L	0.00022
2,6-Dinitrotoluene	mg/L	0.000084	Benzoic acid	mg/L	0.0097
2-Nitrotoluene	mg/L	0.0002	Bis(2-ethylhexyl)phthalate	mg/L	0.4

Table 2-4. Maximum Concentrations of Constituents of Potential Concern in Groundwater (continued)

Analyte	Units	Maximum Detect[a]	Analyte	Units	Maximum Detect
Organics-Semivolatile (continued)			***Organics-Volatile (continued)***		
Chrysene	mg/L	0.00014	1,2-Dichloroethene	mg/L	0.001
Di-n-butyl phthalate	mg/L	0.00056	1,2-Dimethylbenzene	mg/L	0.00049
Dibenz(a,h)anthracene	mg/L	0.00024	2-Butanone	mg/L	0.064
Diethyl phthalate	mg/L	0.0013	Acetone	mg/L	0.047
Fluoranthene	mg/L	0.00032	Carbon disulfide	mg/L	0.0069
Indeno(1,2,3-cd)pyrene	mg/L	0.00072	Carbon tetrachloride	mg/L	0.0016
Phenanthrene	mg/L	0.00024	Chloromethane	mg/L	0.00015
Phenol	mg/L	0.028	Dimethylbenzene	mg/L	0.0014
Pyrene	mg/L	0.0004	M + P Xylene	mg/L	0.00087
Organics-Volatile			Methylene chloride	mg/L	0.011
1,1,1-Trichloroethane	mg/L	0.01	Toluene	mg/L	0.0002
1,1-Dichloroethane	mg/L	0.0022	Trichloroethene	mg/L	0.003
1,1-Dichloroethene	mg/L	0.0026			

[a]The maximum detect concentration is the maximum concentration of a COPC detected in the given media at the any one of the 17 AOCs during previous investigations.

Table 2-5. Maximum Concentrations of Constituents of Potential Concern in Wet Sediment (0 to 1 ft bgs)

Analyte	Units	Maximum Detect[a]	Analyte	Units	Maximum Detect
Anions			***Metals (continued)***		
Nitrate/Nitrite (NO_3/NO_2-N)	mg/kg	13	Vanadium	mg/kg	37.8
Sulfate	mg/kg	4220	Zinc	mg/kg	792
Sulfide	mg/kg	975	***Organics-Explosives***		
Metals			1,3-Dinitrobenzene	mg/kg	0.059
Aluminum	mg/kg	26300	2,4,6-Trinitrotoluene	mg/kg	2.2
Antimony	mg/kg	3.2	2,6-Dinitrotoluene	mg/kg	0.16
Arsenic	mg/kg	418	2-Amino-4,6-dinitrotoluene	mg/kg	0.11
Barium	mg/kg	398	4-Amino-2,6-dinitrotoluene	mg/kg	0.22
Beryllium	mg/kg	2	Nitrobenzene	mg/kg	0.38
Cadmium	mg/kg	7.3	Nitrocellulose	mg/kg	4.8
Calcium	mg/kg	38600	***Organics-Pesticide/PCB***		
Chromium	mg/kg	329	4,4'-DDD	mg/kg	0.026
Chromium, hexavalent	mg/kg	10.6	4,4'-DDE	mg/kg	0.059
Cobalt	mg/kg	29.9	4,4'-DDT	mg/kg	0.0065
Copper	mg/kg	481	Endosulfan sulfate	mg/kg	0.0045
Cyanide	mg/kg	2.8	Endrin aldehyde	mg/kg	0.072
Iron	mg/kg	55200	Heptachlor	mg/kg	0.0019
Lead	mg/kg	156	Heptachlor epoxide	mg/kg	0.037
Magnesium	mg/kg	7350	Lindane	mg/kg	0.013
Manganese	mg/kg	9440	PCB-1016	mg/kg	3.3
Mercury	mg/kg	2.9	PCB-1254	mg/kg	11
Nickel	mg/kg	49.2	PCB-1260	mg/kg	0.061
Potassium	mg/kg	2640	gamma-Chlordane	mg/kg	0.068
Selenium	mg/kg	6.5	***Organics-Semivolatile***		
Silver	mg/kg	534	1,2,4-Trichlorobenzene	mg/kg	0.064
Sodium	mg/kg	1450	1,2-Dichlorobenzene	mg/kg	0.092
Thallium	mg/kg	3.2	2-Methylnaphthalene	mg/kg	0.19

Table 2-5. Maximum Concentrations of Constituents of Potential Concern in Wet Sediment (0 to 1 ft bgs) (continued)

Analyte	Units	Maximum Detect[a]	Analyte	Units	Maximum Detect
Organics-Semivolatile (continued)			***Organics-Semivolatile (continued)***		
Acenaphthene	mg/kg	0.72	Dibenz(a,h)anthracene	mg/kg	0.67
Acenaphthylene	mg/kg	0.0018	Dibenzofuran	mg/kg	0.47
Anthracene	mg/kg	2	Fluoranthene	mg/kg	12
Benz(a)anthracene	mg/kg	4.9	Fluorene	mg/kg	0.84
Benzo(a)pyrene	mg/kg	4.4	Indeno(1,2,3-cd)pyrene	mg/kg	3.9
Benzo(b)fluoranthene	mg/kg	6.4	Naphthalene	mg/kg	0.14
Benzo(ghi)perylene	mg/kg	3	Phenanthrene	mg/kg	8
Benzo(k)fluoranthene	mg/kg	1.6	Pyrene	mg/kg	8.3
Bis(2-ethylhexyl)phthalate	mg/kg	0.66	***Organics-Volatile***		
Butyl benzyl phthalate	mg/kg	0.0088	2-Butanone	mg/kg	0.035
Carbazole	mg/kg	0.81	Acetone	mg/kg	0.33
Chrysene	mg/kg	4.6	Methylene chloride	mg/kg	0.048
Di-n-butyl phthalate	mg/kg	0.23	Toluene	mg/kg	0.019

[a]The maximum detect concentration is the maximum concentration of a COPC detected in the given media at the any one of the 17 AOCs during previous investigations.

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3.0 HAZARD/RISK ANALYSIS

The purpose of the task hazard/risk analysis is to identify and assess potential hazards that may be encountered by personnel and to prescribe required controls. Table 3-1, a general checklist of hazards that may be posed by this project, indicates whether a particular major type of hazard is present. If additional tasks or significant hazards are identified during the work, this document will be modified by addendum or field change order to include the additional information.

Table 3-1. Hazards Inventory

Yes	No	Hazard
	X	Confined space entry
	X	Excavation entry (excavations may be entered)
X		Heavy equipment (drill rigs, backhoe)
X		Fire and explosion (fuels)
X		Electrical shock (utilities and tools)
X		Exposure to chemicals (contaminants and chemical tools)
X		Temperature extremes
X		Biological hazards (poison ivy, Lyme disease, West Nile disease)
	X	Radiation or radioactive contamination
X		Noise (heavy equipment)
X		Drowning
X		ACM (C-Block Quarry only)
X		MEC (potential to encounter UXO)

ACM = Asbestos Containing Material.
MEC = Munitions and Explosives of Concern.
UXO = Unexploded Ordnance.

Specific tasks are as follows:

- Soil and Sediment sampling via hand augers or scoops (sediment sampling potentially via boat);
- Surface water sampling;
- Vegetation clearing with chainsaws, machetes, and sling blades, as required;
- Civil surveying;
- Investigation-derived waste handling and disposition;
- Subsurface soil sampling using hollow stem auger drill rigs or geoprobe;
- Well development and groundwater sampling; and
- Equipment decontamination.

3.1 TASK-SPECIFIC HAZARD ANALYSIS

Table 3-2 presents task-specific hazards, relevant hazard controls, and required monitoring, if appropriate, for all of the planned tasks.

3.2 POTENTIAL EXPOSURES

Prior sampling results indicate that the primary chemicals of potential concern at the 17 AOCs are as follows:

- Metals (antimony, arsenic, barium, chromium, lead, manganese, mercury, silver, and thallium);
- Polychlorinated Biphenyls (PCBs);
- Polycyclic aromatic hydrocarbons (PAHs) [such as benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, dibenz(a,h)anthracene, and indeno(1,2,3-cd)pyrene];
- Bis(2-ethylhexy)phthalate, a semi-volatile organic compound (SVOC); and
- Trichloroethene, a volatile organic compound (VOC) (in groundwater only).

Information on the potential contaminants and reagents and chemicals that will be used for the project is contained in Table 3-3. Exposure to chemical tools, such as corrosive sample preservatives, or flammable fuels, is a possibility and will be controlled through standard safe handling practices.

Table 3-2. Hazards Analysis

Safety and Health Hazards	Controls	Monitoring Requirements
	Mobilize to Work Site	
Traffic accident	Compliance with EH&S Procedure 110, Vehicle Operation (valid drivers license, seat belt use, routine vehicle inspections, no cell phone use while driving, compliance with applicable laws and regulations, and defensive driving). The visual inspection includes the vehicle and any associated items such as trailers or external cargo carriers. The operator verifies that the following items are present and functional: seatbelt(s), lights, turn signals, operating brakes, and tires (approximately proper inflation).	A general "walk-around" visual safety inspection prior to operating a vehicle each day of use.
	Civil Surveys and Visual Surveys	
General safety hazards (moving equipment, slips, falls)	Level D PPE: long pants, shirts with sleeves, safety glasses, safety shoes or boots, and hard hats if overhead hazards are present (see Section 5.0 of the FWSHP). Site-specific training, buddy system, proper housekeeping.	Daily safety inspections
Contact with MEC	MEC avoidance and clearance will be conducted in accordance with the MEC Work Plan for the RVAAP 2008 PBA (USA Environmental 2009).	Visual and instrument surveys for ordnance conducted by MEC Avoidance Subcontractor.
Exposure to chemicals	Nitrile or similar gloves for contact with potentially contaminated material. Gloves will be disposed after single use. Wash face and hands and any other exposed areas prior to taking anything by mouth. Hazardous waste site operations training and medical clearance. Site training must include hazards and controls for exposure to site contaminants and chemicals used on-site. MSDSs on-site. All chemical containers will have contents and hazards labeled.	None
Biological hazards (bees, ticks, mosquitoes, Lyme disease, histoplasmosis, wasps, snakes, West Nile Virus)	PPE (boots, work clothes). Insect repellant on boots, pants, and elsewhere, as necessary, to repel ticks and mosquitoes. Pant legs tucked into boots or otherwise closed to minimize tick entry. Inspect for ticks during the day and at the end of each workday (see Section 9.0 of FWSHP). Avoidance of accumulations of bird or bat droppings (see Section 9.0 of FWSHP).	Visual survey

Safety and Health Hazards	Controls	Monitoring Requirements
Vehicle accidents	Compliance with EH&S Procedure 110, Vehicle Operation (valid drivers license, seat belt use, routine vehicle inspections, no cell phone use while driving, compliance with applicable laws and regulations, and defensive driving). The visual inspection includes the vehicle and any associated items such as trailers or external cargo carriers. The operator verifies that the following items are present and functional: seatbelt(s), lights, turn signals, operating brakes, and tires (approximately proper inflation). While driving on RVAAP facility personnel shall take necessary precautions to avoid hitting deer.	A general "walk-around" visual safety inspection prior to operating a vehicle each day of use. Verification of valid drivers licenses by FM

Table 3-2. Hazards Analysis (continued)

Safety and Health Hazards	Controls	Monitoring Requirements
Temperature extremes	If temperature is above 70°F or below 40°F, administrative controls will be implemented (see Section 8.0 of FWSHP). Routine breaks in established cooled (shaded) or heated break area depending on the season and provisions for emergency heating or cooling. Chilled drinks if temperature exceeds 70°F. Keep clothing dry if temperature is below 40°F.	Temperature measurements at least twice daily. Pulse rates at the start of each break if wearing impermeable clothing
Severe weather	Locate nearest severe weather shelter/strong structure before beginning fieldwork. Suspend fieldwork if lighting within 5 miles of site or tornado warning issued. Do not work in areas subject to flash flooding (ditch, etc.) if rain is forecast in immediate area or upstream of site.	Visual observation for lightning, strong winds, or heavy rain. Check forecast prior to starting work daily.
Groundwater Well Development, Groundwater Monitoring, Groundwater Sampling, and Sample Preservation		
General safety hazards (moving equipment, lifting, slips, falls)	Level D PPE: long pants, shirts with sleeves, safety glasses, safety boots, hard hats if overhead hazards are present (see Section 5.0 of FWSHP). Buddy system. Site-specific training. Proper housekeeping. Lifts of >50 lbs will be performed by two or more personnel or with mechanical assistance, extensive heavy lifting will require additional lifting training. Exclusion zone if there is a potential for unauthorized entry. Compliance with SAIC EH&S Procedure 150.	Daily site safety inspections
Noise	None, unless SSHO determines that equipment potentially exceeds 85 dBA	Daily safety inspection
Fire (fuels)	Fuel stored in safety cans with flame arresters. Fire extinguisher rated 2A and 5B (serviced annually and inspected monthly) in all fuel use areas. No ignition sources in fuel storage areas. Bonding (metal to metal contact) during pouring. Gasoline-powered equipment must be shut down and allowed to cool for 5 min. prior to fueling.	Daily site safety inspections
Exposure to chemicals	Level D PPE, including nitrile or PVC gloves, to handle potentially contaminated material. Minimal contact, wash face and hands prior to taking anything by mouth. Hazardous waste site operations training and medical clearance required by site workers. Fifteen-minute eyewash within 100 ft when pouring corrosive sample preservatives; eyewash bottle within 10 ft when adding water to pre-preserved sample containers. Site training must include hazards and controls of exposure to contaminants and chemicals used on-site. MSDSs for chemical tools kept on-site. All chemical containers will have contents and hazards labeled.	Daily site safety inspections. PID monitoring if prior monitoring during soil boring indicated a potential for exposure
Electrical shock	GFCI for all electrical hand tools. Compliance with SAIC EH&S Procedure 190.	Daily safety inspection

Table 3-2. Hazards Analysis (continued)

Safety and Health Hazards	Controls	Monitoring Requirements
Temperature extremes	If temperature is above 70°F or below 40°F, administrative controls will be implemented (see Section 8.0 of FWSHP). Routine breaks in established cooled (shaded) or heated break area depending on the season and provisions for emergency heating or cooling. Chilled drinks if temperature exceeds 70°F. Keep clothing dry if temperature is below 40°F.	Temperature measurements at least twice daily. Pulse rates at the start of each break if wearing impermeable clothing
Biological hazards (bees, ticks, Lyme disease, histoplasmosis, wasps, snakes, West Nile Virus)	PPE (boots and work clothes). Insect repellant on boots, pants, and elsewhere, as necessary, to repel ticks and mosquitoes. Pant legs tucked into boots or otherwise closed to minimize tick entry. Inspect for ticks during the day and at the end of each workday (see Section 9.0 of FWSHP). Avoidance of accumulations of bird or bat droppings (see Section 9.0 of FWSHP).	Visual survey
Soil Boring and Soil Sampling Using Auger Drill Rig or Geoprobe		
General safety hazards (rotating machinery, suspended loads, moving equipment, slips, falls)	Level D PPE: long pants, shirts with sleeves, safety glasses, safety boots, work gloves for material handling plus hard hat (see Section 5.0 of FWSHP). Buddy system. Site-specific training. Proper housekeeping. No employees under lifted loads. At least two functional kill switches. Functional backup alarm. Drill rig manual on-site. Only experienced operators. Exclusion zone at least equal to mast height if there is any potential for unauthorized entry. Compliance with SAIC EH&S Procedure 150.	Daily site safety inspections. Weekly drill rig inspections Kill switches will be confirmed to be functional each day that the rig is used.
Rotating and/or moving equipment.	Only experienced operators. Rigs will be operated per subcontractor's standard procedures or per manufacturer's directions; all hoses and cables will be inspected daily. Rigs will have two functional kill switches or "dead-man" control tested daily when in use. At no time should anyone work in close proximity to the rotating augers. Prior to coupling augers driller shall inspect auger joints to ensure no obvious defects that may affect auger performance. If burs are noticed on the auger ends, corrective measures must be taken, or the auger must be set aside and a different one must be used.	Daily inspections of auger joints, hoses, cables, and rigs.
Subsurface utilities (electric shock, fire, damage to utilities)	FM will ensure that each boring location has been cleared to preclude contact with buried utilities through compliance with EH&S Procedure 130.	FM clearance of utilities.

Table 3-2. Hazards Analysis (continued)

Safety and Health Hazards	Controls	Monitoring Requirements
Contact with overhead structures or utilities	Rig will not be allowed to come within 10 feet of overhead power lines. At the time the mast is being towered up drill crew members should not be engaged in any other activity, the task at that time is to assist in towering up in the safest manner possible. At the time the mast is being towered down, other drill crew members should not be engaged in any other activity, the task at that time is to assist in towering down in the safest manner possible. The mast of the drill rig must be towered down before moving to the next location.	FM will survey location and ensure absence of obstructions and overhead utilities prior to rig set-up.
Noise	Hearing protection ≥NRR 25 within 7.6 m (25 ft) of rig unless rig-specific monitoring indicates noise exposure of less than 85 dBA.	Daily safety inspections
Fire (vehicle fuels or subsurface contaminants)	Fuels stored in safety cans with flame arrestors. Bonding (metal to metal) and grounding during fuel transfers. Fuel storage areas marked with no smoking or open flames signs. Fire extinguishers in all fuel use areas.	Combustible gas indicator if buried organic material or other source of flammable gas is suspected
Contact with MEC	MEC avoidance and clearance will be conducted in accordance with the MEC Work Plan for the RVAAP 2008 PBA (USA Environmental 2009). Compliance with SAIC EH&S Procedure 120.	Visual and instrument surveys by MEC Avoidance Subcontractor
Exposure to chemicals	Level D PPE, including nitrile or PVC gloves, to handle potentially contaminated material. Minimal contact, wash face and hands prior to taking anything by mouth. Hazardous waste site operations training and medical clearance required by site workers. Fifteen-minute eyewash within 100 ft when pouring corrosive sample preservatives; eyewash bottle within 10 ft when adding water to pre-preserved sample containers. Site training must include hazards and controls of exposure to contaminants and chemicals used on-site. MSDSs for chemical tools kept on-site. All chemical containers will have contents and hazards labeled.	PID or other sampling, as appropriate
Exposure to potential ACM (C-Block Quarry only)	Level D PPE, including nitrile or PVC gloves, to handle potentially contaminated material. Minimal contact, wash face and hands prior to taking anything by mouth. Avoid, all friable potential ACM. For non-friable potential ACM, restrict activities that could cause airborne asbestos and avoid contact in general. Dampen soil with spray bottle to reduce possibility of potential ACM becoming airborne. Do not break friable potential ACM. Remain upwind of soil being sampled.	Visual observation of soil.

Table 3-2. Hazards Analysis (continued)

Safety and Health Hazards	Controls	Monitoring Requirements
Temperature extremes	If temperature is above 70°F or below 40°F, administrative controls will be implemented (see Section 8.0 of FWSHP). Routine breaks in established cooled (shaded) or heated break area depending on the season and provisions for emergency heating or cooling. Chilled drinks if temperature exceeds 70°F. Keep clothing dry if temperature is below 40°F.	Temperature measurements at least twice daily. Pulse rates at the start of each break if wearing impermeable clothing
Biological hazards (bees, ticks, Lyme disease, histoplasmosis, wasps, snakes, West Nile Virus)	PPE (boots and work clothes). Insect repellant on boots, pants, and elsewhere, as necessary, to repel ticks and mosquitoes. Pant legs tucked into boots or otherwise closed to minimize potential for tick entry. Snake chaps if working in overgrown areas. Inspect for ticks during the day and at the end of each workday (see Section 9.0 of FWSHP). Avoidance of accumulations of bird or bat droppings (see Section 9.0 of FWSHP).	Visual survey
Electric shock	Identification and clearance of overhead and underground utilities. GFCI required for electric hand tools. Note – one live overhead electrical line is present at Load Line 2. Compliance with SAIC EH&S Procedure 190.	Visual of all work areas
Severe weather	Locate nearest severe weather shelter/strong structure before beginning fieldwork. Suspend fieldwork if tornado warning issued. Because of the high potential for lightning strike on the mast of a drilling rig, drilling must cease when thunder and lightning storms approach and are within 5 miles. Workers should take shelter away from the rig during the potential for lightening. If possible, the mast should be lowered prior to the advancement of thunder and lightning storms. A minimum of 20 minutes should be allowed after a lightning strike before drilling resumes. Do not work in areas subject to flash flooding (ditch, etc.) if rain is forecast in immediate area or upstream of site.	Visual observation for lightning, strong winds, or heavy rain. Check forecast prior to starting work daily.
	Soil Sampling via Hand Auger or Scoops	
General safety hazards (contact with sharp edges, slips, falls)	Level D PPE: long pants, shirts with sleeves, safety boots, safety glasses, plus heavy-duty work gloves and hard hat (see Section 5.0 of FWSHP). Buddy system. Site-specific training. Proper housekeeping. Only experienced operators.	Daily site safety inspections
Subsurface utilities (electric shock, fire, damage to utilities)	FM will ensure that each boring location has been cleared to preclude contact with buried utilities through compliance with EH&S Procedure 130.	FM clearance of utilities.
Contact with MEC	MEC avoidance and clearance will be conducted in accordance with the MEC Work Plan for the RVAAP 2008 PBA (USA Environmental 2009). Compliance with SAIC EH&S Procedure 120.	Visual and instrument surveys by MEC Avoidance Subcontractor

Table 3-2. Hazards Analysis (continued)

Safety and Health Hazards	Controls	Monitoring Requirements
Exposure to chemicals	Level D PPE plus nitrile or equivalent gloves for contact with contaminated material. Wash face and hands prior to taking anything by mouth. Hazardous waste site operations training and medical clearance. Site training must include the hazards and appropriate controls for site contaminants and chemicals to be used or stored on-site. MSDSs on-site. Chemical containers labeled to indicate contents and hazard. Medical clearance for hazardous waste work.	Daily safety inspection
Exposure to potential ACM (C-Block Quarry only)	Level D PPE, including nitrile or PVC gloves, to handle potentially contaminated material. Minimal contact, wash face and hands prior to taking anything by mouth. Avoid, all friable potential ACM. For non-friable potential ACM, restrict activities that could cause airborne asbestos and avoid contact in general. Dampen soil with spray bottle to reduce possibility of potential ACM becoming airborne. Do not break friable potential ACM. Remain upwind of soil being sampled.	Visual observation of soil.
Temperature extremes	If temperature is above 70°F or below 40°F, administrative controls will be implemented (see Section 8.0 of FWSHP). Routine breaks in established cooled (shaded) or heated break area depending on the season and provisions for emergency heating or cooling. Chilled drinks if temperature exceeds 70°F. Keep clothing dry if temperature is below 40°F.	Temperature measurements at least twice per day. Pulse rates at the start of each break if wearing impermeable clothing
Biological hazards (bees, ticks, Lyme disease, histoplasmosis, wasps, snakes, West Nile Virus)	PPE (boots, work clothes). Insect repellant on boots, pants, and elsewhere, as necessary, to repel ticks and mosquitoes. Pant legs tucked into boots or otherwise closed to minimize potential for tick entry. Snake chaps if working in overgrown areas. Inspect for ticks during the day and at the end of each workday (see Section 9.0 of FWSHP). Avoidance of accumulations of bird or bat droppings (see Section 9.0 of FWSHP).	Visual survey
Severe weather	Locate nearest severe weather shelter/strong structure before beginning fieldwork. Suspend fieldwork if lighting within 5 miles of site or tornado warning issued. Do not work in areas subject to flash flooding (ditch, etc.) if rain is forecast in immediate area or upstream of site.	Visual observation for lightning, strong winds, or heavy rain. Check forecast prior to starting work daily.
Surface Water Sampling and Wet Sediment Sampling from a Boat Using Hand Augers and Hand Tools		
General safety hazards (water safety concerns, manual lifting, slips, trips, falls, equipment handling, boat and motor safety, and weather.)	Level D PPE: long pants, shirts with sleeves, safety boots, safety glasses, and work gloves for manual work (see Section 5.0 of FWSHP). Buddy system. Site-specific training. Personnel flotation device, see Drowning below. Properly trained personnel to operate boat and motor (Follow EM 385-1-1 19.C requirements). Proper housekeeping.	Daily site safety inspections

Table 3-2. Hazards Analysis (continued)

Safety and Health Hazards	Controls	Monitoring Requirements
Fire (outboard motor fuels)	Fuels stored in safety cans with flame arrestors. Bonding (metal to metal) and grounding during fuel transfers, gasoline-powered motor shut down during fueling. Fuel storage areas marked with no smoking or open flames signs. Fire extinguishers in all fuel use areas. Fire extinguisher (serviced annually and inspected monthly) on board.	Daily safety inspections
Exposure to chemicals	Level D PPE plus nitrile or equivalent gloves for contact with contaminated material. Wash face and hands prior to taking anything by mouth. Hazardous waste site operations training and medical clearance. Site training must include the hazards and appropriate controls for site contaminants and chemicals to be used or stored on-site. MSDSs on-site. Chemical containers labeled to indicate contents and hazard. Medical clearance for hazardous waste work.	Daily safety inspection
Drowning (on or within 2 ft of water **less** than 4 feet deep)	Level D PPE plus nitrile or equivalent gloves for contact with potentially contaminated water, waterproof waders to enter water, and safety glasses. If water level rises above 4 feet, contact PM. Always use the Buddy System when entering into a flowing or standing body of water. If on a watercraft, PFD is required. CPR and First Aid training for all onsite personnel.	Daily inspection of surface water level, site conditions and weather conditions. Water level conditions should be monitored throughout the day.
Drowning (on or within 2 ft of water **greater** than 4 feet deep)	Level D PPE plus nitrile or equivalent gloves for contact with potentially contaminated water, waterproof waders to enter water, and safety glasses. Dry blankets, an extra set of clothing and a place to warm up are required. If water > 4 ft at bank, contact PM, and PFD is required. PFD must be approved by coast guard. If on a watercraft, PFD is required. Always use the Buddy System when entering into a flowing or standing body of water. CPR and First Aid training for all onsite personnel.	Daily inspection of surface water level, site conditions and weather conditions. Water level conditions should be monitored throughout the day.
Biological hazards (bees, ticks, Lyme disease, histoplasmosis, wasps, snakes, West Nile Virus)	PPE (boots, work clothes). Insect repellant on boots, pants, and elsewhere, as necessary, to repel ticks and mosquitoes. Pant legs tucked into boots or otherwise closed to minimize potential for tick entry. Snake chaps if working in overgrown areas. Inspect for ticks during the day and at the end of each workday (see Section 9.0 of FWSHP). Avoidance of accumulations of bird or bat droppings (see Section 9.0 of FWSHP).	Visual survey
Temperature extremes	If temperature is above 70°F or below 40°F, administrative controls will be implemented (see Section 8.0 of FWSHP). Routine breaks in established cooled (shaded) or heated break area depending on the season and provisions for emergency heating or cooling. Chilled drinks if temperature exceeds 70°F. Keep clothing dry if temperature is below 40°F.	Temperature measurements at least twice per day. Pulse rates at the start of each break if wearing impermeable clothing

Table 3-2. Hazards Analysis (continued)

Safety and Health Hazards	Controls	Monitoring Requirements
Severe weather	Locate nearest severe weather shelter/strong structure before beginning fieldwork. Suspend fieldwork if lighting within 5 miles of site or tornado warning issued. Do not work in areas subject to flash flooding (ditch, etc.) if rain is forecast in immediate area or upstream of site.	Visual observation for lightning, strong winds, or heavy rain. Check forecast prior to starting work daily.

Table 3-2. Hazards Analysis (continued)

Safety and Health Hazards	Controls	Monitoring Requirements
Surface Water and Wet Sediment Sampling on Foot		
General safety hazards (water safety concerns, manual lifting, slips, trips, and falls)	Level D PPE: long pants, shirts with sleeves, safety boots, safety glasses, and work gloves for manual work (see Section 5.0 of FWSHP). Buddy system. Site-specific training. Proper housekeeping.	Daily site safety inspections
Contact with MEC	MEC avoidance and clearance will be conducted in accordance with the MEC Work Plan for the RVAAP 2008 PBA (USA Environmental 2009). Compliance with SAIC EH&S Procedure 120.	Visual and instrument surveys by MEC Avoidance Subcontractor
Exposure to chemicals	Level D PPE plus nitrile or equivalent gloves for contact with contaminated material. Wash face and hands prior to taking anything by mouth. Hazardous waste site operations training and medical clearance. Site training must include the hazards and appropriate controls for site contaminants and chemicals to be used or stored on-site. MSDSs on-site. Chemical containers labeled to indicate contents and hazard. Medical clearance for hazardous waste work.	Daily safety inspection
Drowning (on or within 2 ft of water **less** than 4 feet deep)	Level D PPE plus nitrile or equivalent gloves for contact with potentially contaminated water, waterproof waders to enter water, and safety glasses. If water level rises above 4 feet, contact PM. Always use the Buddy System when entering into a flowing or standing body of water. CPR and First Aid training for all onsite personnel.	Daily inspection of surface water level, site conditions and weather conditions. Water level conditions should be monitored throughout the day
Biological hazards (bees, ticks, Lyme disease, histoplasmosis, wasps, snakes, West Nile Virus)	PPE (boots, work clothes). Insect repellant on boots, pants, and elsewhere, as necessary, to repel ticks and mosquitoes. Pant legs tucked into boots or otherwise closed to minimize potential for tick entry. Snake chaps if working in overgrown areas. Inspect for ticks during the day and at the end of each workday (see Section 9.0 of FWSHP). Avoidance of accumulations of bird or bat droppings (see Section 9.0 of FWSHP).	Visual survey
Temperature extremes	If temperature is above 70°F or below 40°F, administrative controls will be implemented (see Section 8.0 of FWSHP). Routine breaks in established cooled (shaded) or heated break area depending on the season and provisions for emergency heating or cooling. Chilled drinks if temperature exceeds 70°F. Keep clothing dry if temperature is below 40°F.	Temperature measurements at least twice per day. Pulse rates at the start of each break if wearing impermeable clothing
Severe weather	Locate nearest severe weather shelter/strong structure before beginning fieldwork. Suspend fieldwork if lighting within 5 miles of site or tornado warning issued. Do not work in areas subject to flash flooding (ditch, etc.) if rain is forecast in immediate area or upstream of site.	Visual observation for lightning, strong winds, or heavy rain. Check forecast prior to starting work daily.

Table 3-2. Hazards Analysis (continued)

Safety and Health Hazards	Controls	Monitoring Requirements
Vegetation Clearing with Chainsaws, Machetes, Sling Blades and Heavy Equipment		
General safety hazards (contact with sharp edges, slips, falls)	Level D PPE: long pants, shirts with sleeves, safety boots, safety glasses, plus heavy-duty work gloves and hard hat (see Section 5.0 of FWSHP). Buddy system. Site-specific training. Proper housekeeping. Only experienced operators. Personnel operating brush-clearing tools must maintain separation of at least 15 ft. Machetes equipped with lanyard and lanyard looped around wrist. Tools must be inspected daily and taken out of service if damaged. Exclusion zone if there is a potential for entry of unauthorized personnel.	Daily site safety inspections
Chainsaw (kickback and related hazards)	Chainsaw chaps and face shield as additional PPE. Saws must have automatic chain brake or kickback device. Idle speed adjusted so chain does not move when idling. Only experienced operators may use chainsaw. Saws must not be used to cut above shoulder height. Saws must be held with both hands when operating. Additional requirements at 385-1-1 Section 31.	Daily inspection
Noise (chainsaw and heavy equipment)	Hearing protection ≥ NRR 25 within 7.6 m (25 ft) of operating chainsaw or heavy equipment unless specific monitoring indicates noise exposure of less than 85 dBA.	Daily safety inspections
Fire (fuels)	Fuels stored in safety cans with flame arrestors. Bonding (metal to metal) and grounding during fuel transfers. Fuel storage areas marked with no smoking or open flames signs. Fire extinguishers in all fuel use areas. Gasoline-powered equipment turned off and allowed to cool for at least 5 min prior to fueling.	Daily safety inspection
Contact with MEC	MEC avoidance and clearance will be conducted in accordance with the MEC Work Plan for the RVAAP 2008 PBA (USA Environmental 2009). Compliance with SAIC EH&S Procedure 120.	Visual and instrument surveys by MEC Avoidance Subcontractor
Exposure to chemicals	Level D PPE plus nitrile or equivalent gloves for contact with contaminated material. Wash face and hands prior to taking anything by mouth. Hazardous waste site operations training and medical clearance. Site training must include the hazards and appropriate controls for site contaminants and chemicals to be used or stored on-site. MSDSs on-site. Chemical containers labeled to indicate contents and hazard. Medical clearance for hazardous waste work.	Daily safety inspection
Temperature extremes	If temperature is above 70°F or below 40°F, administrative controls will be implemented (see Section 8.0 of FWSHP). Routine breaks in established cooled (shaded) or heated break area depending on the season and provisions for emergency heating or cooling. Chilled drinks if temperature exceeds 70°F. Keep clothing dry if temperature is below 40°F.	Temperature measurements at least twice per day. Pulse rates at the start of each break if wearing impermeable clothing

Table 3-2. Hazards Analysis (continued)

Safety and Health Hazards	Controls	Monitoring Requirements
Severe weather	Locate nearest severe weather shelter/strong structure before beginning fieldwork. Suspend fieldwork if lighting within 5 miles of site or tornado warning issued. Do not work in areas subject to flash flooding (ditch, etc.) if rain is forecast in immediate area or upstream of site.	Visual observation for lightning, strong winds, or heavy rain. Check forecast prior to starting work daily.
Heavy Equipment	Have predetermined haul routes and communicate with all site personnel. Have all utilities located prior to excavating and post warnings signs for overhead utilities. Only experienced operators. Make eye contact with operator before approaching, crossing in front of, or behind. Have equipment specific owner's manual available on site for review. Keep charged and inspected fire extinguisher in cab. Wear seat belts while in equipment. Functional backup alarm. Replace all broken glass and mirrors. Stay out of swing radius of machines. No employees under lifted loads. Do not smoke while refueling and keep fire extinguisher available. Never operate equipment beyond limits as defined by manufacturer, such as lifting too heavy of a load or working on too steep of an incline.	Daily safety inspection. Daily inspection of equipment to verify brakes and operating systems are in proper working condition.
Vehicle accidents	Compliance with EH&S Procedure 110, Vehicle Operation (valid drivers license, seat belt use, routine vehicle inspections, no cell phone use while driving, compliance with applicable laws and regulations, and defensive driving). The visual inspection includes the vehicle and any associated items such as trailers or external cargo carriers. The operator verifies that the following items are present and functional: seatbelt(s), lights, turn signals, operating brakes, and tires (approximately proper inflation). While driving on RVAAP facility personnel shall take necessary precautions to avoid hitting deer.	A general "walk-around" visual safety inspection prior to operating a vehicle each day of use. Verification of valid drivers licenses by FM
Lifting injuries	Compliance with EH&S Procedure 150 "Manual Lifting" to limiting individual lifts by SAIC personnel to 50 pounds.	Verification/observation of lifting by SAIC personnel by FM.
Biological hazards (bees, ticks, Lyme disease, histoplasmosis, wasps, snakes, West Nile Virus)	PPE (boots, work clothes). Insect repellant on boots, pants, and elsewhere, as necessary, to repel ticks and mosquitoes. Pant legs tucked into boots or otherwise closed to minimize potential for tick entry. Snake chaps if working in overgrown areas. Inspect for ticks during the day and at the end of each workday (see Section 9.0 of FWSHP). Avoidance of accumulations of bird or bat droppings (see Section 9.0 of FWSHP).	Visual survey

Table 3-2. Hazards Analysis (continued)

Safety and Health Hazards	Controls	Monitoring Requirements
	Investigation-Derived Waste Handling	
General hazards (lifting equipment, manual lifting, slips)	Level D PPE: long pants, shirts with sleeves, safety glasses, safety shoes or boots, heavy-duty gloves for materials handling, and hard hat if overhead hazards are present (see Section 5.0 of FWSHP). Buddy system. Site-specific training. Proper housekeeping. Unnecessary personnel will stay well clear of operating equipment. Functional back-up alarm on fork trucks, Bobcats, trucks, etc. Ravenna O&M contractor personnel will provide any required fork truck services in the IDW staging area (Building 1036). IDW movement from field sites to Building 1036 will be conducted by the drilling subcontractor using a backhoe equipped with forks and drum dollys. No personnel allowed under lifted loads. Lifts of greater than 50 lbs will be made with two or more personnel or with lifting equipment in compliance with SAIC EH&S Procedure 150. Hazardous waste safety training. Compliance with EM 385-1-1 Sections 14 and 16.	Daily safety inspections of operations. Daily inspection of equipment to verify brakes and operating systems are in proper working condition
Contact with MEC	MEC avoidance and clearance will be conducted in accordance with the MEC Work Plan for the RVAAP 2008 PBA (USA Environmental 2009). Compliance with SAIC EH&S Procedure 120.	Visual and instrument surveys by MEC Avoidance Subcontractor
Exposure to chemicals	Level D PPE plus nitrile or equivalent gloves for contact with contaminated material. Wash face and hands prior to taking anything by mouth. Hazardous waste site operations training and medical clearance. Site training must include hazards and controls for exposure to site contaminants and chemicals used on-site. MSDSs on-site.	Daily safety inspections
Vehicle accidents	Compliance with EH&S Procedure 110, Vehicle Operation (valid drivers license, seat belt use, routine vehicle inspections, no cell phone use while driving, compliance with applicable laws and regulations, and defensive driving). The visual inspection includes the vehicle and any associated items such as trailers or external cargo carriers. The operator verifies that the following items are present and functional: seatbelt(s), lights, turn signals, operating brakes, and tires (approximately proper inflation). While driving on RVAAP facility personnel shall take necessary precautions to avoid hitting deer.	A general "walk-around" visual safety inspection prior to operating a vehicle each day of use. Verification of valid drivers licenses by FM
Lifting injuries	Compliance with EH&S Procedure 150 "Manual Lifting" to limiting individual lifts by SAIC personnel to 50 pounds.	Verification/observation of lifting by SAIC personnel by FM.

Table 3-2. Hazards Analysis (continued)

Safety and Health Hazards	Controls	Monitoring Requirements
Fire (vehicle fuels and flammable contaminants)	Fuels stored in safety cans with flame arrestors. Bonding (metal to metal) and grounding during fuel transfers. Fuel storage areas marked with no smoking or open flames signs. Gasoline-powered equipment will be shut down and allowed to cool for 5 min before fueling. Fire extinguishers in all fuel use areas.	Daily safety inspection
Noise	Hearing protection within 7.6 m (25 ft) of any noisy drum moving equipment unless equipment-specific monitoring indicates exposures less than 85 dBA.	Daily safety inspections
Biological hazards (bees, ticks, Lyme disease, histoplasmosis, wasps, snakes, West Nile Virus)	PPE (boots, work clothes). Insect repellant on pants, boots, and elsewhere, as necessary, to repel ticks and mosquitoes. Pant legs tucked into boots or otherwise closed to minimize tick entry. Snake chaps if working in overgrown areas. Inspect for ticks during the day and at the end of each workday (see Section 9.0 of FWSHP). Avoidance of accumulations of bird or bat droppings (see Section 9.0 of FWSHP).	Visual survey
Electric shock	Identification and clearance of overhead utilities. GFCI for all electrical hand tools. Compliance with SAIC EH&S Procedure 190.	Visual survey of all work areas
Temperature extremes	If temperature is above 70°F or below 40°F, administrative controls will be implemented (see Section 8.0 of FWSHP). Routine breaks in established cooled (shaded) or heated break area depending on the season and provisions for emergency heating or cooling. Chilled drinks if temperature exceeds 70°F. Keep clothing dry if temperature is below 40°F.	Temperature measurements at least twice daily. Pulse rates at the start of each break if wearing impermeable clothing
Severe weather	Locate nearest severe weather shelter/strong structure before beginning fieldwork. Suspend fieldwork if lighting within 5 miles of site or tornado warning issued. Do not work in areas subject to flash flooding (ditch, etc.) if rain is forecast in immediate area or upstream of site.	Visual observation for lightning, strong winds, or heavy rain. Check forecast prior to starting work daily.
Equipment Decontamination (Hot Water Washing, Soap and Water Washing, HCl, and Methanol Rinse)		
General equipment decontamination hazards (hot water, slips, falls, equipment handling)	Level D PPE plus nitrile or PVC gloves (see Section 5.0 of FWSHP). Face shield and Saranax or rain suit when operating steam washer. Site-specific training. Proper housekeeping.	Daily safety inspections
Noise (spray washer)	Hearing protection when washer is operating unless equipment-specific monitoring indicates that exposure is less than 85 dBA.	None
Fire (decontamination solvents and gasoline)	Flammable material stored in original containers or in safety cans with flame arrestors. Fire extinguisher kept near decontamination area.	Daily safety inspection

Table 3-2. Hazards Analysis (continued)

Safety and Health Hazards	Controls	Monitoring Requirements
Exposure to chemicals	Level D PPE plus nitrile or equivalent gloves for contact with contaminated material. Wash face and hands prior to taking anything by mouth. Minimal contact. Hazardous waste site operations training and medical clearance. Site training must include hazards and controls for exposure to site contaminants and chemicals used on-site. MSDSs on-site. All chemical containers labeled to indicate contents and hazard.	None
Temperature extremes	If temperature is above 70°F or below 40°F, administrative controls will be implemented (see Section 8.0 of FWSHP). Routine breaks in established cooled (shaded) or heated break area depending on the season and provisions for emergency heating or cooling. Chilled drinks if temperature exceeds 70°F. Keep clothing dry if temperature is below 40°F.	Temperature measurements at least twice a day. Pulse rates at the start of each break if wearing impermeable clothing

ACM = Asbestos Containing Material
CPR = Cardiopulmonary Resuscitation
EH&S = Energy, Environment, & Infrastructure Environmental Health and Safety
FM = Field Manager
FWSHP = Facility Wide Safety and Health Plan
GFCI = ground-fault circuit interrupter
IDW = investigation-derived waste
MEC = munitions and explosives of concern
MSDS = Material Safety Data Sheet
NRR= Noise Reduction Rating
O&M = operations and maintenance
PFD = personal floatation device
PID = photoionization detector
PVC = polyvinyl chloride
PPE = personal protective equipment
RVAAP = Ravenna Army Ammunition Plant
SSHO = Site Safety and Health Officer
SAIC = Science Applications International Corporation
UXO = unexploded ordnance

Table 3-3. Potential Exposures

Chemical	TLV/PEL/STEL/IDLH[a,b,d]	Health Effects/ Potential Hazards[b]	Chemical and Physical Properties[b]	Exposure Route(s)
Hydrochloric acid (potentially used to preserve water samples or for equipment decontamination)	TLV: 2 ppm ceiling IDLH: 50 ppm	Irritation of eyes, skin, respiratory system	Liquid; VP: fuming; IP: 12.74 eV; FP: none	Inhalation Ingestion Contact
Nitric acid (potentially used to preserve water samples)	TLV/TWA: 2 ppm STEL: 4 ppm IDLH: 25 ppm	Irritation of eyes, skin, respiratory system; dental erosion	Colorless, yellow, or red, fuming liquid with an acrid, suffocating odor; IP: 11.95 eV; VP: 48mm	Inhalation Ingestion Contact
Sulfuric acid (potentially used to preserve water samples)	TLV/TWA: 1 mg/m^3. STEL: 3 mg/m^3 IDLH: 15 mg/m^3	Irritation of eyes, skin, nose, throat, respiratory system; dental erosion; eye, skin burn; dermatitis	Colorless to dark brown, oily, odorless liquid; VP: 0.001 mm; FP: none; IP: none	Inhalation Ingestion Contact
Sodium Hydroxide (potentially used to preserve water samples)	TLV: 2 mg/m^3 ceiling IDLH: 10 mg/m^3	Irritation of eyes, skin, respiratory system	Colorless to white, odorless solid. VP: 0 mm; VP: NA	Inhalation Ingestion Contact
Isopropyl alcohol (potentially used for equipment decontamination)	TLV/TWA: 200 ppm STEL: 500 ppm IDLH: 2,000 ppm	Irritation of eyes, skin, respiratory system; drowsiness; headache	Colorless liquid with alcohol odor; VP: 33 mm; IP: 10.10 eV; FP: 53°F	Inhalation Ingestion Contact
Methanol (potentially used for equipment decontamination)	TLV/TWA: 200 ppm Skin notation IDLH: 6,000 ppm	Irritation of eyes, skin, respiratory system; headache; optic nerve damage	Liquid; VP: 96 mm; IP: 10.84 eV; FP: 52°F	Inhalation Absorption Ingestion Contact
Gasoline (used for fuel)	TLV/TWA: 300 ppm, A2 IDLH: Ca	Potential carcinogen per NIOSH, dizziness, eye irritation, dermatitis	Liquid with aromatic odor; FP: -45°F; VP: 38-300 mm	Inhalation Ingestion Absorption Contact

Table 3-3. Potential Exposures (continued)

Chemical	TLV/PEL/STEL/IDLH[a,b,d]	Health Effects/ Potential Hazards[b]	Chemical and Physical Properties[b]	Exposure Route(s)
Diesel (used for fuel for heavy equipment)[c]	TLV/TWA: 100 ppm, A3	Irritation of eyes, skin, respiratory system ; dizziness; headache; nausea; central nervous system	Brown slightly viscous liquid, with characteristic odor; FP:125.6°F	Inhalation Ingestion Contact
Diesel Exhaust	NA	Irritation of eyes and respiratory system; potential occupational carcinogen	Appearance odor and properties vary depending upon the specific diesel exhaust component.	Inhalation Contact
Liquinox (used for decontamination)	TLV/TWA: None	Inhalation may cause local irritation to mucus membranes	Yellow odorless liquid (biodegradable cleaner); FP: NA	Inhalation Ingestion
Antimony (potential contaminant)	TLV: 0.5 mg/m³ NIOSH REL: TWA: 0.5 mg/m³ IDLH: 50 mg/m³	Dust explosion possible if in powder or granular form, mixed with air.	Silver-white, lustrous, hard, brittle solid; scale-like crystals; or a dark-gray, lustrous powder.	Inhalation Ingestion Contact
Asbestos (C-Block Quarry only)	TWA: 0.1 f/cc Exclusion Limit: 1.0 f/cc (30 min.)	Human carcinogen; target organs include respiratory system and eyes	White or greenish (chrysotile), blue (crocidolite), or gray-green (amosite) fibrous, odorless solids	Inhalation Ingestion Contact
Arsenic (potential contaminant)	NIOSH REL: Ca C 0.002 mg/m³ [15-minute] OSHA PEL: [1910.1018] TWA 0.010 mg/m³	Ulceration of nasal septum, dermatitis, respiratory irritation, hyperpigmentation of skin, potential occupational carcinogen; nausea and vomiting or sensation of “pins and needles” in hands and feet	Silver-gray or tin-white, brittle, odorless solid	Inhalation Ingestion Contact
Barium (potential contaminant)	TLV: 0.5 mg/m³ NIOSH REL: TWA: 0.5 mg/m³ IDLH: 50 mg/m³	The substance is irritating to the eyes , the skin and the respiratory tract . Exposure could cause hypokalaemia , resulting in cardiac disorders and muscular disorders. Exposure may result in death.	White, odorless solid. Noncombustible Solid, but will accelerate the burning of combustible materials	Inhalation Ingestion Contact
Chromium (potential contaminant)	TWA 0.5 mg/m³ PEL: TWA 1 mg/m³	Irritation eyes, skin; lung fibrosis (histologic)	Blue-white to steel-gray, lustrous, brittle, hard, odorless solid	Inhalation Ingestion Contact

Table 3-3. Potential Exposures (continued)

Chemical	TLV/PEL/STEL/IDLH[a,b,d]	Health Effects/ Potential Hazards[b]	Chemical and Physical Properties[b]	Exposure Route(s)
Lead (potential contaminant)	NIOSH REL: TWA (8-hour) 0.050 mg/m^3 PEL: [1910.1025] TWA 0.050 mg/m^3	Weakness, exhaustion; insomnia; facial pallor; anorexia, weight loss, malnutrition; constipation, abdominal pain; anemia; tremor; paralysis wrist, ankles; kidney disease; irritation eyes; main target is the nervous system	A heavy, ductile, soft, gray solid	Ingestion Inhalation Contact
Manganese (potential contaminant)	NIOSH REL: TWA 1 mg/m^3 ST 3 mg/m^3 OSHA PEL: C 5 mg/m^3	Mental confusion; dry throat, cough, chest tightness, dyspnea (breathing difficulty), flu-like fever; low-back pain; vomiting; malaise; weakness, exhaustion; kidney damage	A lustrous, brittle, silvery solid	Inhalation Ingestion
Mercury (potential contaminant)	TLV: 0.025 mg/m^3 as TWA; (skin OSHA PEL: 0.1 mg/m3 NIOSH REL: Hg Vapor: TWA 0.05 mg/m3 skin NIOSH IDLH: 10 mg/m3 (as Hg)	The substance is irritating to the skin. Inhalation of the vapors may cause pneumonitis. The substance may cause effects on the central nervous system and kidneys. The effects may be delayed. Medical observation is indicated.	Silver-white, heavy, odorless liquid.	Inhalation Ingestion Contact
PCBs (potential contaminant)	TLV: 0.5 mg/m^3 as TWA; OSHA PEL: TWA 0.5 mg/m3 NIOSH REL*: Ca TWA 0.001 NIOSH IDLH: Ca 5 mg/m3	Repeated or prolonged contact with skin may cause dermatitis. Chloracne is the most visible effect. The substance may have effects on the liver. Animal tests show that this substance possibly causes toxic effects upon human reproduction.	Light Yellow Viscous Liquid.	Inhalation Ingestion Contact
PAHs (potential contaminant)	Benzo(a)pyrene : OSHA PEL: 0.2 mg/m^3	Suspected human carcinogen	PAHs are typically colorless, white, or pale yellow-green solid	Inhalation Ingestion Contact
Silver (potential contaminant)	TLV (metal): 0.1 mg/m^3 OSHA PEL: TWA 0.01 mg/m3 NIOSH REL: TWA 0.01 mg/m3 NIOSH IDLH: 10 mg/m3	Inhalation of high amounts of metallic silver vapors may cause lung damage with pulmonary oedema.	White, lustrous solid.	Inhalation Ingestion

Table 3-3. Potential Exposures (continued)

Chemical	TLV/PEL/STEL/IDLH[a,b,d]	Health Effects/ Potential Hazards[b]	Chemical and Physical Properties[b]	Exposure Route(s)
SVOCs: Bis(2-ethylhexyl)phthalate (potential contaminant)	OSHA PEL: 5 mg/m³ NIOSH STEL: 10 mg/m3 NIOSH IDLH: 5000 mg/m3	It exhibits low toxicity from acute (short-term) and chronic (long-term) exposures. Acute exposure to large oral doses of DEHP can cause gastrointestinal distress in humans. No information is available on the chronic, reproductive, developmental, or carcinogenic effects of DEHP in humans.	Colorless liquid with almost no odor.	Inhalation Ingestion Contact
Thallium (potential contaminant)	NIOSH REL: TWA 0.1 mg/m3 OSHA PEL: TWA 0.1 mg/m3 IDLH 15 mg/m3 (	Properties vary depending upon the specific soluble thallium compound.	Appearance and odor vary depending upon the specific soluble thallium compound.	Inhalation Ingestion Contact
VOC (potential contaminant – Trichloroethene in groundwater only)	Trichloroethene: TLV: 50 ppm as TWA; 100 ppm as STEL; OSHA PEL: TWA 100 ppm C 200 ppm 300 ppm (5-minute maximum peak in any 2 hours)	Repeated or prolonged contact with skin may cause dermatitis. The substance may have effects on the central nervous system, resulting in loss of memory. The substance may have effects on the liver and kidneys This substance is probably carcinogenic to humans	Colorless liquid (unless dyed blue) with a chloroform-like odor.	Inhalation Ingestion Contact

[a]From 2008 Threshold Limit Values, American Conference of Governmental Industrial Hygienists.
[b]From NIOSH Guide to Chemical Hazards website.
[c]From ICSC website
[d]From OSHA 1910.1000 TABLE Z-1

A2 = suspected human carcinogen
A3= not classifiable as a human carcinogen
FP = flash point
ICSC= International Chemical Safety Cards
IDLH = immediately dangerous to life and health
IP = ionization potential
NA=Not Applicable
NIOSH = National Institute for Occupational Safety and Health
PEL = permissible exposure limit
ppm = parts per million
STEL = short-term exposure limit
TLV = threshold limit value
TWA = time-weighted average
VP = vapor pressure

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4.0 MUNITIONS AND EXPLOSIVES OF CONCERN AVOIDANCE

MEC Avoidance will be performed during field activities in accordance with the MEC Work Plan for the RVAAP 2008 PBA (USA Environmental 2009).

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5.0 STAFF ORGANIZATION, QUALIFICATIONS, AND RESPONSIBILITIES

This Section presents the personnel responsible for site safety and health and emergency response. Table 5-1 identifies the SAIC and subcontractor staff that will fill key roles. See Section 3.0 of the FWSHP for information on the roles and responsibilities of key positions.

Table 5-1. Staff Organization

Position	Name	Phone
SAIC Health and Safety Manager	Steve Davis CIH, CSP	865-481-4755
SAIC Project Manager	Kevin Jago	865-481-4614
SAIC Task Lead	Heather Miller	330-573-8571
SAIC Field Operations Manager	Heather Miller	330-573-8571
SAIC Site Safety and Health Officer	Heather Miller	330-573-8571
USA Environmental MEC Avoidance	Don Shaw	813-846-9138

Subcontractor Site Safety and Health Officer will be SSHO for all remedial activities.
CIH= Certified Industrial Hygienist.
CSP = Certified Safety Professional.
MEC = munitions and explosives of concern.
SAIC = Science Applications International Corporation.
TBD = To be determined.

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6.0 TRAINING

Training requirements, from Section 4.0 of the FWSHP, are summarized in Table 6-1 and in Table 3-2.

Table 6-1. Training Requirements

Training	Worker	Supervisor	Site Visitor (exclusion zone)
HAZWOPER (40-hr, 3-day OJT)	√	√	√
HAZWOPER Annual Refresher (8 hr)	√	√	√
HAZWOPER Supervisors Training (8 hr)		√	
General Hazard Communication Training	√	√	√
Respiratory Protection Training (required only if respirators are worn)	√	√	√
Hearing Conservation Training (for workers in hearing conservation program)	√	√	√
Pre-entry Briefing	√	√	√
Site-Specific Hazard Communication (contained in pre-entry briefing)	√	√	√
Safety Briefing (daily and whenever conditions or tasks change)	√	√	√
CPR and First Aid Training	√	√	
Equipment-Specific Training (Equipment Operators)	√		

√ = required.
HAZWOPER = Hazardous Waste Site Operations.
OJT = on-the-job training.
CPR = Cardio Pulmonary Resuscitation.

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7.0 PERSONAL PROTECTIVE EQUIPMENT

General guidelines for selection and use of PPE are presented in Section 5.0 of the FWSHP. Specific PPE requirements for this work are presented in the hazard/risk analysis section (Section 3.0).

If potential ACM is observed during sampling activities, work will be stopped and the FOM notified. The FOM will contact the SSHO and PM and the situation will be evaluated. Each situation will be evaluated independently to determine if the PPE level requires upgrading or modification.

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8.0 MEDICAL SURVEILLANCE

Medical surveillance requirements, as presented in Section 6.0 of the FWSHP, are summarized in Table 8-1.

Table 8-1. Medical Surveillance Requirements

Baseline	Routine	Overexposure	Termination
Prior to work assessment	Every 12 months, unless greater frequency is deemed appropriate by attending physician. Not to exceed 2-year interval	Upon developing symptoms or where exposure limits have been exceeded or suspected to have been exceeded	Upon termination or re-assignment

All medical exams shall include (see Section 6.2 of the Facility Wide Safety and Health Plan):

- medical/work history;
- physical exam by physician;
- audiometry;
- blood screening and blood count;
- chest x-ray, as specified by physician;
- electrocardiogram, as specified by physician;
- spirometry; and
- urinalysis.

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9.0 EXPOSURE MONITORING/AIR SAMPLING PROGRAM

Assessment of airborne chemical concentrations will be performed, as appropriate, to ensure that exposures do not exceed acceptable levels. Action levels, with appropriate responses, have been established for this monitoring. In addition to the specified monitoring, the SSHO may perform or require additional monitoring, such as organic vapor monitoring in the equipment decontamination area or personnel exposure monitoring for specific chemicals. The deployment of monitoring equipment will depend on the activities being conducted and the potential exposures. All personal exposure monitoring records will be maintained in accordance with 29 *Code of Federal Regulations* 1910.1020. The minimum monitoring requirements and action levels are presented in Table 9-1.

Most of the supplemental RI activities are not expected to pose airborne exposure hazards for the following reasons:

- Work will be performed in open areas with natural ventilation.

- Prior site sampling indicated that contaminant concentrations are unlikely to pose an airborne hazard. If a general evaluation of an AOC is being conducted, where the chemicals of concern (COCs) have not previously been identified, then monitoring based on previous AOC usage will be performed during the sampling activities.

- The most probable contaminants are metals, SVOCs (including PAHs), explosives, and propellants. Exposure to these chemicals can be controlled through dust suppression techniques.

Table 9-1. Monitoring Requirements and Action Limits

Hazard or Measured Parameter	Area	Interval	Limit	Action	Tasks
Airborne organics with PID or equivalent	AOCs with known or expected volatile organic contaminants. Breathing zone [14 in.] in front of employee's shoulder.	From 1 to 3 ft BGS and if site conditions, such as discolored soil or chemical smells, indicate that monitoring is necessary	<5 ppm >5 ppm	Level D Withdraw and evaluate • evaluate need for PPE upgrade • identify contaminants • notify project manager and H&S manager	Drilling, hand auguring, and other intrusive work, or during surface or groundwater sampling
Noise	All areas perceived as noisy when heavy equipment or other motorized equipment in use.	Any area where there is some doubt about noise levels	85 dBA And any area perceived as noisy	Require the use of hearing protection	Hearing protection will be worn within the exclusion zone, around power augers, or other motorized equipment
Visible airborne dust potentially containing SRCs	All	Continuously	Visible dust generation	Stop work; use dust suppression techniques such as wetting surface	All

BGS = below ground surface
H&S = health and safety
PID = photoionization detector
PPE = personal protective equipment
ppm = parts per million
SRC = site-related contaminant (e.g. PAHs, metals, propellants)

10.0 HEAT/COLD STRESS MONITORING

General requirements for heat/cold stress monitoring are contained in Section 8.0 of the FWSHP.

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11.0 STANDARD OPERATING SAFETY PROCEDURES

Standard operating safety procedures are described in Section 9.0 of the FWSHP.

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12.0 SITE CONTROL MEASURES

Site control measures are described in Section 10.0 of the FWSHP. No formal site control is expected to be necessary for this work, as the work areas are somewhat remote and bystanders are not anticipated. The RVAAP facility is not open to the public, and only authorized personnel are allowed entry. If the SSHO determines that a potential exists for unauthorized personnel to approach within 25 ft of a work zone or otherwise be at risk due to proximity, then exclusion zones will be established as described in Section 10.0 of the FWSHP.

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13.0 PERSONNEL HYGIENE AND DECONTAMINATION

Personal hygiene and decontamination requirements are described in Section 11.0 of the FWSHP and in Section 3.0 of this addendum.

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14.0 EMERGENCY PROCEDURES AND EQUIPMENT

Emergency contacts, telephone numbers, directions to the nearest medical facility, and general procedures can be found in the FWSHP (Section 12.0). All emergencies onsite will be coordinated first through **Guard Post 1 [(330) 358-2017]** who will coordinate the response. The SAIC Field Operations Manager will remain in charge of all SAIC and subcontractor personnel during emergency activities. The SAIC field office will serve as the assembly point if it becomes necessary to evacuate one or more remedial locations. During mobilization, the SSHO will verify that the emergency information in Section 12 of the FWSHP is correct.

Each field team shall have a 2-way radio capable of contacting Guard Post 1 for communications purposes.

During field operations all onsite personnel shall have CPR/first aid training.

Table 14-1. Emergency Contact Phone Numbers

Position	Phone
RVAAP Guard Post 1 (Police, Fire, Emergency Medical)	 (330) 358-2017
Hospital (Robinson Memorial, Ravenna)	(330) 297-2449/0811
RVAAP Facility Manager Mark Patterson	 (330) 358-7311
RVAAP Operation and Maintenance Contractor Jim McGee, Vista Sciences	 (330) 358-3005
USACE Mark W. Nichter	 (502) 315-6375
Ohio EPA, Eileen Mohr	Office: (330) 963-1221
SAIC Project Manager, Kevin Jago Jed Thomas	 (865) 481-4614 Office: (330) 405-5802 Cell: (216) 214-2599
SAIC Health and Safety Personnel, Steve Davis CIH, CSP Heather Miller	 (865) 481-4755 Office: (330) 405-5814 Cell: (330) 573-8571

RVAAP = Ravenna Army Ammunition Plant
USACE = U.S. Army Corps of Engineers
Ohio EPA = Ohio Environmental Protection Agency
SAIC = Science Applications International Corporation, Inc.
CIH= Certified Industrial Hygienist
CSP = Certified Safety Professional

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15.0 LOGS, REPORTS, AND RECORD KEEPING

Logs, reports, and record keeping requirements are described in Section 13 of the FWSHP.

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16.0 REFERENCES

American Conference of Governmental Hygienists (ACGIH) 2008. Threshold Limit Values 2008.

International Occupational Heath and Safety Information Centre 2008. *ICSC (International Chemical Safety Cards).* December 2007.

NIOSH (National Institute for Occupational Safety and Health) 2005. *NIOSH Pocket Guide to Chemical Hazards*. September 2005.

USACE (U.S. Army Corps of Engineers) 2007. *Safety and Occupational Health Requirements for Hazardous, Toxic, and Radioactive Waste (HTRW) and Ordnance and Explosive Waste (OEW) Activities,* ER-385-1-92. May 2007.

USACE 2003. *Safety and Health Manual,* EM-385-1-1.

USACE 2001. *Facility Wide Safety and Health Plan for Environmental Investigations at the Ravenna Army Ammunition Plant, Ravenna, Ohio,* DACA62-00-D-0001, D.O. CY02, March 2001.

USACE 2004. *Facility-Wide Groundwater Monitoring Program for the Ravenna Army Ammunition Plant, Ravenna, Ohio,* GS-10F-0350M, D.O. DACA27-03-F-0047, September 2004.

USA Environmental 2009. *MEC Work Plan for the RVAAP 2008 PBA* (currently being developed).

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17.0 FACILITY AND HOSPITAL MAPS

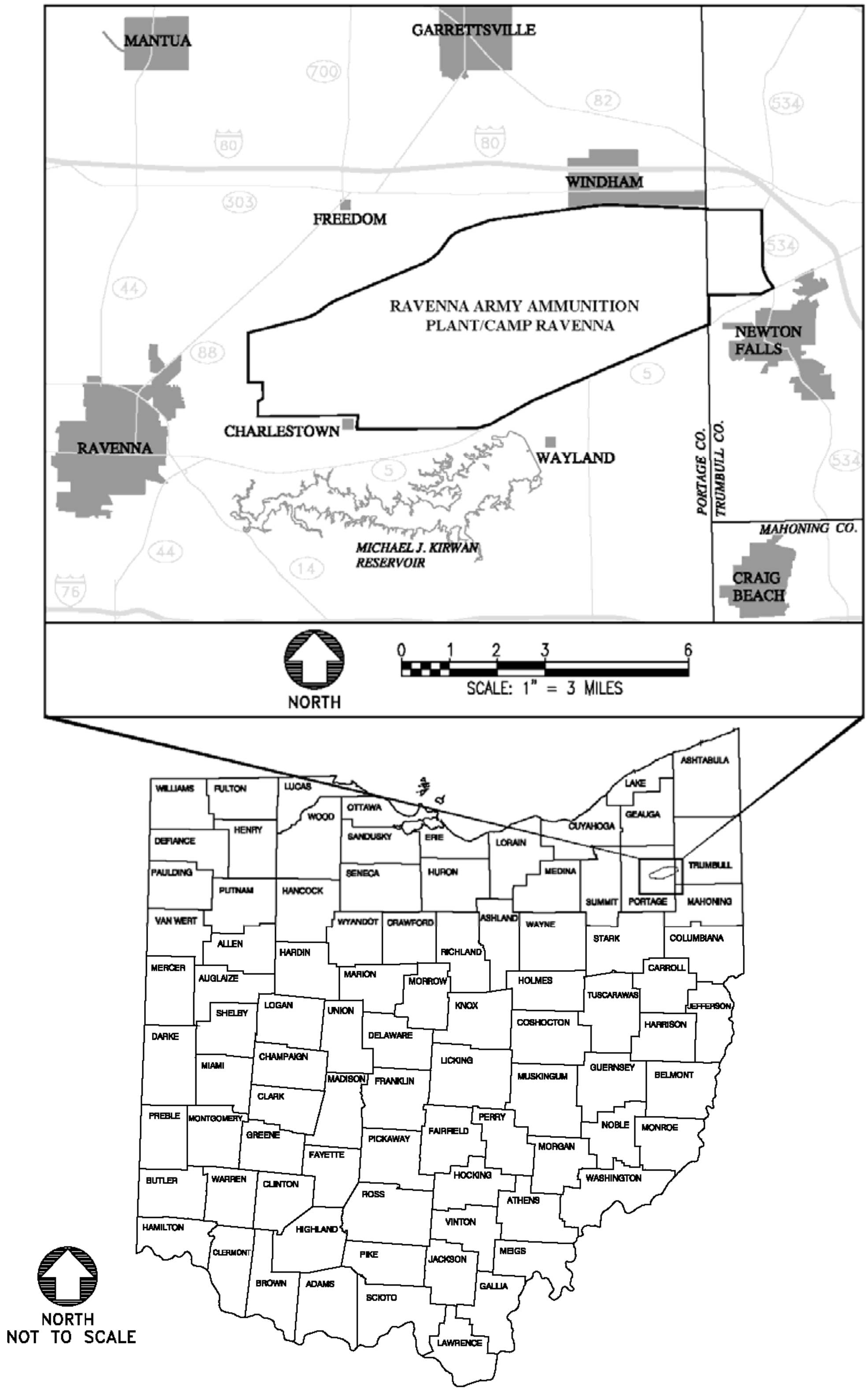

Figure 1. General Location and Orientation of RVAAP/Camp Ravenna

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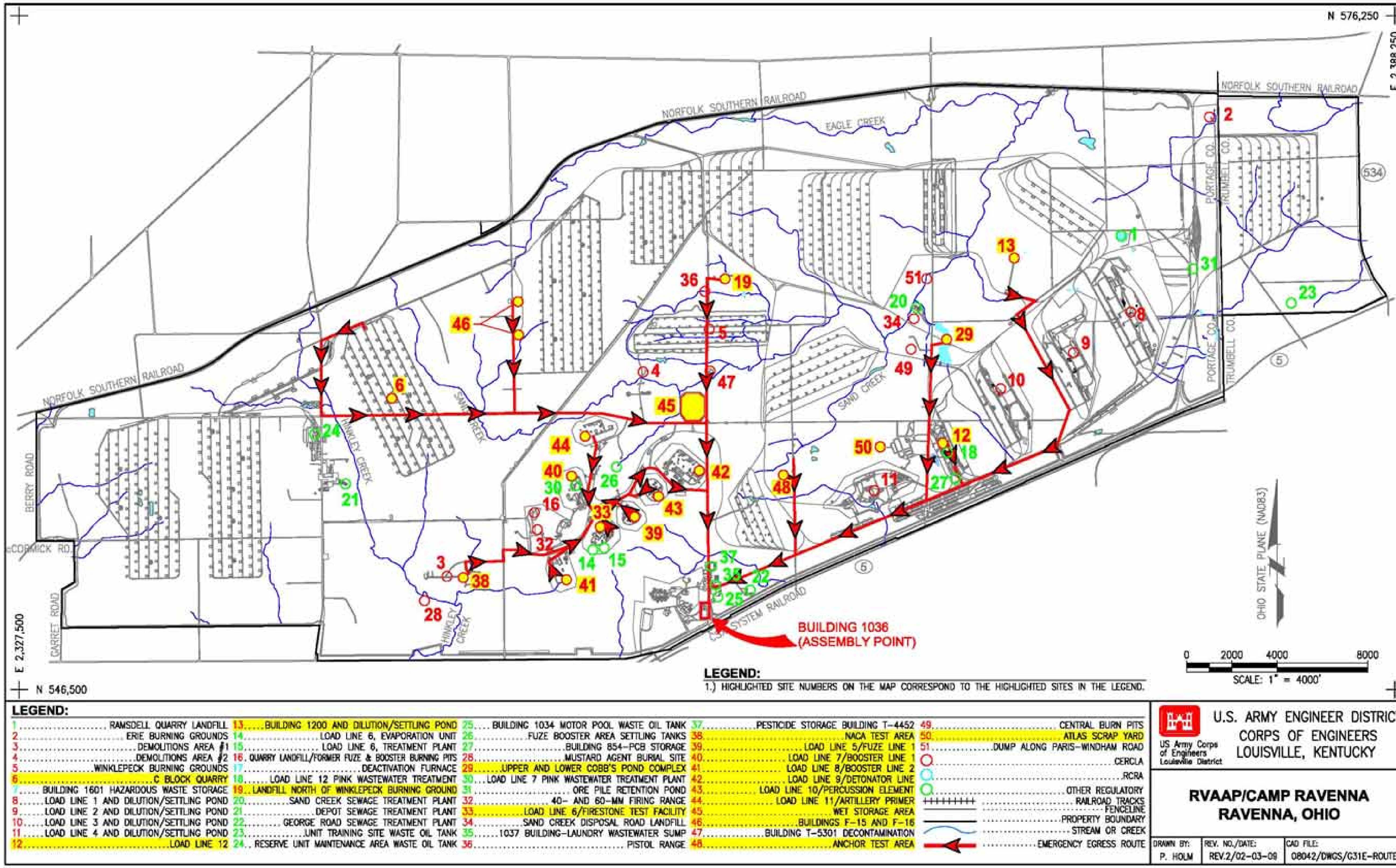

Figure 2. **RVAAP/Camp Ravenna Site Map and Egress Route**

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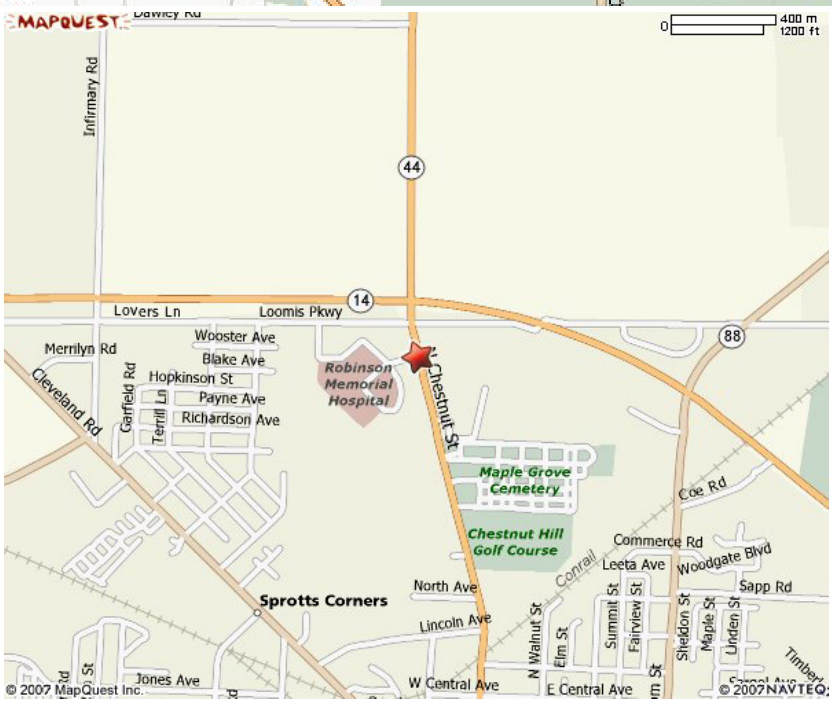

Figure 3. Route Map to Pre-Notified Medical Facility

Robinson Memorial Hospital
6847 N. Chestnut Street
Ravenna, Ohio
(330) 297-0811

Directions: West on State Route 5. Stay straight onto OH-59 West. Turn Right onto OH-14/OH-44. Turn Left onto North Chestnut St.

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Ohio EPA (Todd R. Fisher, Bonnie Buthker, and Eileen T. Mohr)					
O-1	General	Pg. 3-1, 3-3	While it is not anticipated that the final FW CUGs will be much different from the draft FW CUGs, they are still draft FW CUGs. Use of the draft FW CUGs to determine extent of contamination may pose some problems in the future.	Please refer to the Final United States Army Corps of Engineers Ravenna Army Ammunition Plant (RVAAP) Position Paper for the Application and Use of Facility-Wide Human Health Cleanup Goals Ravenna Army Ammunition Plant Ravenna, Ohio dated June 2009. Please make all necessary changes to the draft so that it is in concert with the recommendations set forth in this position paper.	Agree. Section 3.2.1 page 3-1 line 39 through page 3-3 line 20 will be replaced with the text included at the end of this CRT. Exact changes are not shown because the order of the text was rearranged. Section heading numbers will be added upon insertion into the document.
O-2	Contractor Statement of Independent Review	N/A	On this page, Jennifer Loerch is listed as an Independent Technical Review Team Leader; however, she is also listed as one of the principal authors on the Report Documentation Page. If she one of the principal authors, she should not be a member of the Independent Technical Review Team	Please explain and/or make the appropriate changes to the text.	Clarification. Jennifer Loerch was not a member of the Technical Review team. She signed the *Contractor Statement of Independent Technical Review* as the Design Team Leader. Kevin Jago was the Independent Technical Review Team Leader. No text changes proposed.
O-3	Page 3-1, lines 14-15	Pg. 3-1	The text states that "previous investigations have been performed at each of the AOCs in an effort to understand the nature and extent of contamination as summarized in Appendices A through Q."	The purpose of the 14 AOCs Site Characterization was to identify Contaminants of Potential Concern (COPC), Contaminants of Potential Ecological Concern (COPEC), and horizontal extent of contamination to some degree. To imply that it was an effort to understand the nature and extent of contamination is overreaching. The 14 AOCs Site Characterization was not	Clarification. The text was written to address all the various evaluations, assessments, and investigations performed at the 17 AOCs. The text will be revised as follows: ~~Previous~~ Each AOC has previously undergone at least one form of investigation~~s~~ (e.g., assessment, RI, characterization) ~~have been performed at each of the AOCs in an effort~~ to partially characterize ~~understand~~ the nature and

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				intended to be a Remedial Investigation (RI).	extent of any potential contamination, as well as evaluate any associated human or ecological health risks. These investigations are ~~as~~ summarized in Appendices A through Q
O-4	Page 3-3, lines 37-41	Pg. 3-3, 3-4	The text states that at "AOCs where a PAH exceeded the screening criterion and no other SVOC exceeded screening criteria, samples will be analyzed for PAHs and 10% or 15% will be analyzed for the RVAAP full suite of parameters (which includes all SVOCs)." At AOCs where a PAH exceed the screening criterion, all samples should be analyzed for SVOCs, not just PAHs.	Please make the appropriate changes to the text.	Clarification. Per the discussion on 12/7/09, Page 3-3 lines 38-41 will be revised as follows to indicate that all samples at these AOCs will be analyzed for PAHs: "...at AOCs where a PAH exceeded the screening criterion and no other SVOC exceeded screening criteria, all samples will be analyzed for PAHs and 10% or 15% will be analyzed for the RVAAP full suite of parameters (which includes all SVOCs)." To clarify the determination of 10% or 15% of samples for full suite analysis by AOC, Page 3-3 lines 31-35 will be revised as follows: • "The RVAAP full suite of parameters will be analyzed for ~~at least~~ 10% or 15% of the soil and wet sediment samples (by medium) taken at each AOC. The determination of the 10% or 15% frequency was based on the previous sampling activities performed at each AOC. For AOCs that have undergone previous RIs (Landfill North of WBG; Upper and Lower Cobbs Ponds; Load Lines 6, 9, and 11; and NACA Test Area), 10% of the collected samples will be analyzed for the RVAAP full suite. For AOCs not previously characterized extensively (C-Block Quarry; Load Lines

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					5, 7, 8, 10, and 12; Building 1200; Wet Storage Area; Buildings F-15/F-16; Anchor Test Area; and Atlas Scrap Yard), RVAAP full suite samples will be collected at a frequency of 15% to ensure adequate characterization of all chemicals. The RVAAP full suite of parameters is listed in Table 1-1 of the Quality Assurance Project Plan (QAPP), Part II of this SAP Addendum." To clarify the approach, we will have the following SVOC sampling data at the completion of this RI SAP: 1) Previous data collected for SVOC analyses; and 2) 10-15% of all soil samples will be analyzed for full suite (including SVOCs). With respect to the previous data collected, the following is the average amount of samples analyzed for SVOCs at each AOC: 25% surface soil samples, 49% subsurface soil samples, and 36% wet sediment samples We feel those samples in addition to the selectively placed 10-15% full suite analysis would be adequate to determine nature and extent of SVOC contamination at each AOC. Please note that placement of the full suite analysis will take into consideration filling any SVOC data gaps (if any).

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					The intention of the approach presented in lines 37-41 would be to bound the nature and extent of a previously identified chemical which, in these cases, would be a PAH. We propose that we leave the approach presented in Lines 37-41, given that the amount of SVOC data that has been collected and will be collected will adequately characterize nature and extent of SVOC contamination.
O-5	Table 3-1	Pg. 3-5	Table title does not reflect that the CUGs are draft.	Please add the word "Draft" in front of the word "Facility-Wide" on the table's title.	Agree. "Draft" will be added in front of "Facility-Wide".
O-6	Page 3-9, lines 25 -32	Pg. 3-10	The text states that "subsurface soil to various depths was previously investigated at the following AOCs:" It is Ohio EPA's recollection that not enough subsurface samples were taken at some of the AOCs listed.	We need to make sure we address all data gaps, especially those which define vertical contamination.	Agree. SAIC concurs that additional subsurface soil samples are required to 1) fill data gaps and 2) define vertical contamination. As presented in Appendices A to Q, each AOC is slated for additional subsurface soil sampling to meet these requirements. An additional paragraph is recommended to be inserted at line 34 on Page 3-9. "Previous investigations have defined the vertical extent of contamination at the Landfill North of WBG and no additional samples are planned. The subsurface soil samples at the other five AOCs were not adequate to define the vertical nature and extent of contamination at these AOCs; therefore, additional subsurface soil samples will be collected. Subsurface soil samples will also be collected at AOCs where no previous subsurface investigation has been performed.

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					All prior subsurface investigations…"
O-7	Page 3-9, lines 34-35	Pg. 3-10	The text states "All prior subsurface investigations were performed using discrete borings as MI sampling is not feasible for subsurface soil." Subsurface MI sampling is feasible, but may not be cost-effective in certain situations. USACE has been working with other contractors at RVAAP to use MI for subsurface sampling at Sand Creek	Please strike "as MI Sampling is not feasible for surface soil" from the text.	Agree. The text will be revised as recommended. "All prior subsurface investigations were performed using discrete borings ~~as MI sampling is not feasible for subsurface soil~~."
O-8	Page 3-12, lines 14-19	Pg. 3-12	The text states that existing data such as the RVAAP Facility-Wide Surface Water Study were incorporated into sample planning to help define downstream areas that may require addition sampling. The RVAAP Facility-Wide Surface Water Study is over 2 years old. This is inconsistent with the statement on Page 3-11, lines 15-16 stating if no current data (last 2 years for surface water) or no data are available, additional samples will be collected.	Please correct this discrepancy in the text.	Agree. The text on Page 3-11, lines 15-16 will be revised as follows: ~~current data (last 2 years for surface water and 4 years for wet sediment) or~~ If no data are available, or existing data are deemed to be nonrepresentative of current conditions, additional samples will be collected. At some of the AOCs, the previous data are up to eight years old (e.g., Cobbs Ponds and Load Line 12) and contemporaneous data are needed to fill data gaps.
O-9	Page 3-12, lines 36-37	Pg. 3-13	The text states that discrete sample collection points are more appropriate. Rather than defaulting back to how historical sediment samples were collected, Ohio EPA would like to see MI sediment	A minimum of 10 aliquots should be collected at each sediment sample location and homogenized into one sample.	Agree. As discussed on 12/7/09, for wet sediment samples, SAIC will collect 10 aliquots in an area (e.g., 5-ft radius) that will be representative of a discrete sample point location. These samples be considered composite samples, instead of MI samples. The

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			samples collected. This is consistent with our Division of Surface Water sediment sampling practices.		reasoning for this recommended terminology is the wet sediment sample would be considered to have been extracted from a discrete point location, not an area that would normally be associated with an MI sample. Consequently, the wet sediment data can be used in risk assessment data sets with other previously collected discrete soil samples. Lines 2-22 on Page 3-12 will be revised as follows: In this SAP Addendum, wet sediment samples will be collected as composite samples from discrete sampling locations ~~sample methods (not mI sample methods)~~. Discrete samples rather than MI samples will be utilized for the collection of wet sediment for the following reasons:...” Because the composite samples will be considered to be collected from a discrete location, no changes are proposed to lines 36-37.

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O-10	Page 3-12, lines 39-43	N/A	The text states that discrete sample collection points are more appropriate. Rather than defaulting back to how historical sediment samples were collected, Ohio EPA would like to see MI sediment samples collected. This is consistent with our Division of Surface Water sediment sampling practices.	A minimum of 10 aliquots should be collected at each sediment sample location and homogenized into one MI sample.	Agree. Please refer to response to comment O-9. Because the composite samples will be considered to be collected from a discrete location, no changes are proposed to lines 39-43.
O-11	Page 3-13, lines 1-5	N/A	The text states that "wet sediment data from the Facility-Wide Biological and Surface Water Study were collected using discrete samples, and these data will be integrated into the nature and extent assessments for streams exiting the AOC's noted above where appropriate. Therefore, to assure comparability, future samples should be discrete." It is the Ohio EPA's recollection that the sediment samples collected were more of an MI sample than discrete.	Please verify how sediment samples were collected during the FW Biological and Surface Water study. Regardless of how they were collected in the past, the Ohio EPA would like to see a minimum of 10 aliquots per sample and composited into one sample.	Agree that composite samples consisting of 10 aliquots will be collected for wet sediment samples (please refer to response to comment O-9). It was confirmed that the Facility-Wide Biological and Water Quality Study from 2003 utilized MI sampling techniques to collect wet sediment samples. Therefore, lines 1-4 on Page 3-13 will be deleted.
O-12	Page 3-13, lines 16-37	Pg. 3-14	Again , the text makes reference to collecting one discrete sample at various locations.	Please see comment #10 above	Agree. Please refer to response to comment O-9. Each bullet point on Page 3-13 will be revised to state that "One surface water and co-located composite wet sediment sample will be collected..."
O-13	Page 3-15, lines 3-32	Pg. 3-16	The text states that "if exceedances are present in subsurface soil	Please change "may be required" to "will be required" in the text.	Agree. The text will be revised as follows:

Comment Number	Page or Sheet	New Page or Sheet	Comment	Recommendation	Response
			samples or the vadose zone model predicts a potential pathway to groundwater, the installation of additional monitoring wells may be required.”		“….. , the installation of additional monitoring wells ~~may~~ will be required.”
O-14	Page 4-4, Section 4.2	Pg. 4-4	This section references the use of the trowel method (FWSAP 4.5.2.2.1).	A minimum of 10 aliquots should be collected at each sediment sample location and homogenized into one sample.	Agree. Please refer to the response to comment O-9. Section 4.2 will be revised as follows: “Wet sediment samples will be collected as composite samples using 10 aliquots per samples. Ten separate aliquots will be collected to the same depth within an area with an approximately 5-ft radius. These 10 aliquots will be composited in a stainless steel bowl, then the composited sample will be transferred the appropriate sample container(s). The aliquots for the composite wet sediment samples will be collected using two possible methods. The trowel method (Section 4.5.2.2.1 of the Facility-Wide SAP) will be used when the water depth above the sediment sample location is less than six inches. The hand core sampler method (Section 4.5.2.2.2 of the Facility-Wide SAP) will be used when the depth of water above the sediment sample location is greater than six inches. Parameters to be analyzed vary by AOC (Appendices A through Q). The composite sampling method will not be utilized for VOC analysis. If a sample is designated for VOC analysis, one discrete sample/aliquot will be collected from within the

Comment Number	Page or Sheet	New Page or Sheet	Comment	Recommendation	Response
					5-ft radius sample area using one of the methods listed above. Wet sediment portions designated for VOC analysis will be placed directly in the sample container and will not be composited or further processed in the field."
O-15	Page 4-7, lines 6-17	Pg. 4-4, 6-8 3-3	Surface water and ground water should be sampled for RVAAP full suite.	Please make the appropriate changes to the text.	Agree. All surface water samples will be collected for full suite analysis. With regards to groundwater, current information shows that all wells planned to be sampled as part of this SAP are now being sampled for four quarters under the FWGWMP. Therefore, no groundwater samples are needed for this SAP. The text will be revised to remove locations of groundwater sampling originally proposed in the Draft SAP. However, groundwater sampling procedures will remain in the text in the event groundwater sampling is warranted after the PBA08 SAP data is analyzed. Revised text for Section 3.2.1.4 pertaining to the groundwater sampling activities is provided at the end of this CRT. The text on Page 4-7 beginning with line 6 will be revised as follows: "The following chemical analyses will be conducted for soil, surface water, and wet sediment~~, and groundwater~~ samples: • All samples will be analyzed for explosives. ~~Samples will also be analyzed for chemicals that exceeded screening criteria on an AOC specific basis (Section 3.2.1). Parameters are detailed for each AOC in~~

Comment Number	Page or Sheet	New Page or Sheet	Comment	Recommendation	Response
					~~Appendices A through Q.~~ • Soil and wet sediment samples will also be analyzed for chemicals that exceeded screening criteria on an AOC-specific basis (Section 3.2.1). Parameters are detailed for each AOC in Appendices A through Q. • All surface water samples will be analyzed for the RVAAP full suite of parameters. • As discussed in Section 3.2.1, 10-15% of the soil and wet sediment samples at each AOC will be analyzed for the RVAAP full suite of parameters (Table 4-1 of the QAPP). • As discussed in Sections 4.1.1.2 and 4.2, MI soil and composite wet sediment samples will not be analyzed for VOCs; instead, a discrete ~~surface soil~~ sample will be collected and specially handled for VOC analysis." Additionally, Page 3-3 lines 25-29 will be revised as follows: • Soil and wet sediment s~~S~~amples will be analyzed for chemicals that have previously exceeded the screening criteria in a particular medium. For the purposes of determining analytical parameters, surface and subsurface soil are considered to be one medium. Therefore, an exceedance in surface soil would lead to the collection of that parameter suite in all surface and subsurface soil samples at that AOC. • All surface water samples will be

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					analyzed for the RVAAP full suite of parameters.
O-16	Page 4-10, lines 12-13	Pg. 4-10	The text states that "an appropriate numerical model (e.g., SESOIL) will be employed for vadose zone soil leaching modeling."	Please be more specific on which model you will be using. If there are other models, then they should be mentioned. The model selected must be approved by Ohio EPA.	Agree. The text will be revised as follows: "~~Based on AOC characterization data, an appropriate numerical model (e.g.,~~ SESOIL~~)~~ will be employed for vadose zone soil leaching modeling. Vadose zone soil leaching modeling simultaneously evaluates water transport, sediment transport and pollutant fate. The results will be used as a screening tool to assess contaminant fate and transport for risk analysis. Data collected during the subsurface soil sampling and the historic surface soil sampling will be used to construct the SESOIL model to evaluate any potential future impacts from chemicals in soil to groundwater. The SESOIL model will predict the rate of contaminant migration through the unsaturated zone to the water table based on leaching from contaminated soils to groundwater. The results of the SESOIL modeling will be used in the groundwater transport model to simulate lateral transport of contaminants from source areas (AOCs) to receptor locations."
O-17	Page 4-10 lines 26-27	Pg. 4-10	The text states that "an appropriate groundwater flow and fate and transport numerical model will be selected following review of existing data and acquisition of new information specified under the SAP Addendum. " The text further states that potential models to be	Please be more specific on which model you will be using. If there are other models, then they should be mentioned. The model selected must be approved by Ohio EPA.	Agree. The text will be revised as follows: AT123 ~~n appropriate~~ groundwater flow and fate and transport numerical model will ~~be selected following review of existing data and acquisition of new information specified under this SAP Addendum. Potential integrated fate and transport models to be considered for use~~

Comment Number	Page or Sheet	New Page or Sheet	Comment	Recommendation	Response
			considered for use include AT123D and MODFLOW+MT3DMS, MODPATH.		~~include AT123D and MODFLOW + MT3DMS. Upon establishing a groundwater flow field for Load Line 12, MODPATH may~~ be used to conduct particle track modeling to evaluate potential rates and likely direction of chemical transport in the groundwater system. The model will use existing groundwater contaminant concentrations and/ or predicted concentrations in groundwater based on SESOIL model output. The results can be evaluated at receptor locations and can assist in determination of monitoring well locations."
O-18	Page 4-11 lines 33-34	Pg. 4-11	The text states that "together, these WOE elements constitute additional scientific management decision points that no cleanup goals will be needed for protection of ecological resources at the 17 AOCs." This represents a conclusion.	Please remove or modify to indicate that there will be an evaluation.	Agree. The text on Page 4-11, lines 33-34 will be revised as follows: "Together, these WOE elements constitute additional scientific management decision points ~~that no cleanup goals will be needed~~ that will be used in an evaluation whether cleanup goals are necessary for the protection of ecological resources at the 17 AOCs."
O-19	Page 7-1 line 5	Page 7-1	The entity "Ohio EPA" has been omitted as a recipient of the letter report.	Please add "Ohio EPA" to the text.	Agree. Text will be revised as follows: "….submitted to ~~the~~ Ohio EPA, USACE and RVAAP……"
O-20	All Appendices General	N/A	Wet sediment samples should be collected a bit differently than if they were discrete.	A minimum of 10 aliquots should be collected at each sediment sample location and homogenized into one MI sample.	Agree. Please refer to the response to comment O-9. The text and tables in all appendices will be revised to reflect the collection of composite wet sediment samples consisting of 10 aliquots.

Comment Number	**Page or Sheet**	**New Page or Sheet**	**Comment**	**Recommendation**	**Response**
O-21	Appendix A page A-1 lines 4-9	Pg. A-1	The text states "the quarry bottom has a measured maximum depth of 25 ft below the surrounding grade and the fill material ranges in depth from 1.5 to 5 ft below grade." This makes it sound like the quarry is almost full, while the material at the bottom of the quarry is significantly less.	Please make the appropriate changes to the text.	Agree. The text will be revised as follows: "the quarry bottom has a measured maximum depth of 25 ft below the surrounding grade and the fill material ranges ~~in depth~~ from 1.5 to 5 ft thick ~~below grade~~."
O-22	Appendix A page A-1 lines 13-17	Pg. A-1	The text states that five site investigations at RVAAP have included sampling at C-Block Quarry. It further states that these investigations were conducted to characterize the nature and extent of any potential contamination as well as any associate risks. Where these investigations RI's?	No RI's were performed at C-Block quarry. What were these investigations? Please verify.	Agree. The text will be revised as follows: ~~Since 1989, five site investigations at RVAAP have included sampling at C-Block Quarry~~. Two ~~These~~ investigations have been ~~were~~ conducted at C-Block Quarry to characterize ~~the nature and extent of any~~ potential contamination, as well as evaluate any associated human or ecological health risks. In the RVAAP 1996 Relative Risk Site Evaluation (RRSE), completed by the US Army Center for Health Promotion and Preventive Medicine (USACHPPM) ~~Final Action Plan for RVAAP~~, C-Block Quarry was ~~rated as~~ scored a "low" risk AOC based on three soil samples (USACE 1996a). The report concluded there was no evidence of contaminants migrating; however, there are no physical barriers to prevent receptors from entering the AOC (USACE 1996a). ~~This rating was based solely on surface soil as the medium of concern. however, it did consider contaminant migration (MKM 2007a).~~
O-23	Appendix A page A-1	N/A	The text states that "in the 1996 Final Action Plan for RVAAP, C-Block	The Ohio EPA is not familiar with this document. Low, Medium, and High Risks	Agree. See response to O-22.

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	lines 13-17		Quarry was rated as a low risk AOC (USACE 1996a)."	were evaluated and assigned to AOCs in the Relative Risk Site Evaluation. Please verify.	
O-24	Appendix A page A-3 lines 27-30	Pg. A-3	The text states that "suspect ACM construction debris was observed in previous investigations."	If this is the case, then sampling for asbestos would be required.	Agree. The text will be revised as follows: "Suspect asbestos-containing material (ACM) construction debris was observed in previous investigations. Therefore, a certified asbestos inspector will be present during soil sampling activities at C-Block Quarry. If the inspector determines the debris is ACM, the soil samples collected from the borings will be analyzed for asbestos. If it is ~~determined~~ observed by the inspector that ~~asbestos in~~ these materials may represent an exposure hazard (i.e., friable ACM) ~~and removal is required, a~~ the soil samples will be collected by the certified asbestos inspector ~~will sample and characterize suspect ACM construction debris for remedial alternative evaluation and waste characterization purposes~~."
O-25	Appendix A Table A-3 pages A-4 subsurface soil	N/A	The rationale states that "CBLss-006M is not recommended for further evaluation because chromium concentration is only slightly above background and previous hexavalent chromium concentration is below the laboratory detection limit."	Since chromium concentration exceeded background, chromium should be sampled for.	Clarification. Not all surface soil exceedances of screening levels are investigated with a soil boring to define the vertical extent of contamination. The following text from lines 1-5 on Page 3-10 clarifies the subsurface soil sampling approach: "If an MI or discrete surface soil result was greater than the screening criteria, then the results were compared to the CUG to determine whether or not a potential source area or "hot spot" exists. If necessary, additional samples

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					are proposed to define the vertical extent of chemicals. A representative number of soil boring locations have been chosen at or near previous surface soil screening criteria exceedances to characterize the vertical extent of contamination." Because chromium concentrations were measured at very high levels at C-Block, it is agreed that a soil boring location will be added to MI area CBLss-006M. Table A-3 and Figure A-3 will be revised to reflect a 5th boring location in MI area CBLss-006M.
O-26	Appendix A Table A-3 pages A-4	App A Table A-3	No mention of sampling for asbestos in this table.	Please add asbestos to this table where needed.	Agree. Table A-3 will be revised to include asbestos analysis for all surface and subsurface soil samples, if the certified asbestos inspector determines the construction debris is ACM.
O-27	Appendix A Table A-3 pages A-4 subsurface soil	App A Table A-3	The text states that "all samples will be analyzed for metals and explosives."	Please change "metals" to "TAL metals" in the text.	Agree. "Metals" will be replaced with "TAL metals" in the text.
O-28	Appendix B, Table B-2, surface water	App B Table B-2	The rationale states that "RVAAP full suite of parameters will be analyzed for 15% of the samples.	All surface water and groundwater samples must be analyzed for RVAAP full suite.	Agree. Please refer to the response to comment O-15. This table will be adjusted to reflect full suite analysis for surface water.
O-29	Appendix B, Table B-2, surface water	App B Table B-2	The rationale states that samples will be analyzed for explosives, metals, PCBs, and SVOCs.	Please change "metals" to "TAL metals"	Agree. "Metals" will be replaced with "TAL metals" in the text.

Comment Number	Page or Sheet	New Page or Sheet	Comment	Recommendation	Response
O-30	Appendix C, page C-1 lines 34-35	Pg. C-1	The text states that the "RI also concluded that sediment samples had inorganic concentrations below USGS values for sediment and low concentrations of explosives were detected in the sediments of the settling pond an drainage area leading from Building 1200." USGS values are not used at RVAAP.	Please remove USGS reference from the text.	Clarification. The RI was produced in 1998 and the RVAAP background values were established in 2001 as part of the Winklepeck Burning Grounds Phase II RI. The text will be revised as follows: "The RI also concluded that there were no Chemicals of Potential Concern (COPCs) identified ~~sediment samples had inorganic concentrations below USGS values for sediment and low concentrations of explosives were detected~~ in the sediments of the settling pond and drainage area leading from Building 1200.
O-31	Appendix D, Table D-2, surface water	App D Table D-3	The rationale states that samples will be analyzed for explosives, metals, PCBs, and SVOCs.	Please change "metals" to "TAL metals"	Agree. "Metals" will be replaced with "TAL metals" in the text.
O-32	Appendix D, Table D-2, surface water	App D Table D-3	The rationale states that one sample (10%) will be analyzed for full suite	All surface water and groundwater samples must be analyzed for RVAAP full suite.	Agree. Please refer to the response to comment O-15. This table will be adjusted to reflect full suite analysis for surface water.
O-33	Appendix E Table E-3, surface soil, subsurface soil	Table E-3	The rationale states that samples will be analyzed for explosives, metals, PCBs, and SVOCs.	Please change "metals" to "TAL metals"	Agree. "Metals" will be replaced with "TAL metals" in the text.
O-34	Appendix E, Table E-3, surface water	Table E-3	See comment 32 above	All surface water and groundwater samples must be analyzed for RVAAP full suite.	Agree. Please refer to the response to comment O-15. This table will be adjusted to reflect full suite analysis for surface water.

Comment Number	Page or Sheet	New Page or Sheet	Comment	Recommendation	Response
O-35	Appendix F, Table F-3, Surface soil	App F Table F-3	The rationale states that samples will be analyzed for metals, explosives, and PAHs	Please change “metals” to “TAL metals” and “PAHs” to “SVOCs”	Agree that “metals” will be replaced with “TAL metals” in the text. Regarding PAHs, please refer to the response to comment O-4.
O-36	Appendix F, Table F-3 Subsurface soil	App F Table F-3	The rationale states that samples will be analyzed for metals, explosives, and PAHs	Please change “metals” to “TAL metals” and “PAHs” to “SVOCs”	Agree that “metals” will be replaced with “TAL metals” in the text. Regarding PAHs, please refer to the response to comment O-4.
O-37	Appendix F, Table F-3, surface water	App F Table F-3	The rationale states that samples will be analyzed for metals and explosives.	All surface water and groundwater samples must be analyzed for RVAAP full suite.	Agree. Please refer to the response to comment O-15. This table will be adjusted to reflect full suite analysis for surface water.
O-38	Appendix G, Table G-3, Surface soil	App G Table G-3	The rationale states that samples will be analyzed for metals, explosives, and PAHs.	Please change “metals” to “TAL metals” and “PAHs” to “SVOCs”	Agree that “metals” will be replaced with “TAL metals” in the text. Regarding PAHs, please refer to the response to comment O-4.
O-39	Appendix G, Table G-3, subsurface soil	App G Table G-3	The rationale states that samples will be analyzed for metals, explosives, and PAHs.	Please change “metals” to “TAL metals” and “PAHs” to “SVOCs”	Agree that “metals” will be replaced with “TAL metals” in the text. Regarding PAHs, please refer to the response to comment O-4.
O-40	Appendix H, Table H-3, surface soil	App H Table H-3	The rationale states that samples will be analyzed for metals, explosives, and PAHs.	Please change “metals” to “TAL metals” and “PAHs” to “SVOCs”	Agree that “metals” will be replaced with “TAL metals” in the text. Regarding PAHs, please refer to the response to comment O-4.
O-41	Appendix H, Table H-3, subsurface soil	App H Table H-3	The rationale states that samples will be analyzed for metals, explosives, and PAHs.	Please change “metals” to “TAL metals” and “PAHs” to “SVOCs”	Agree that “metals” will be replaced with “TAL metals” in the text. Regarding PAHs, please refer to the response to comment O-4.
O-42	Appendix I,	App I	The rationale states that samples will	Please change “metals” to “TAL metals”	Agree that “metals” will be replaced with “TAL

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	Table I-3, surface soil	Table I-3	be analyzed for metals, explosives, and PAHs.	and "PAHs" to "SVOCs"	metals" in the text. Regarding PAHs, please refer to the response to comment O-4.
O-43	Appendix I, Table I-3, subsurface soil	App I Table I-3	The rationale states that samples will be analyzed for metals, explosives, and PAHs.	Please change "metals" to "TAL metals" and "PAHs" to "SVOCs"	Agree that "metals" will be replaced with "TAL metals" in the text. Regarding PAHs, please refer to the response to comment O-4.
O-44	Appendix J, Table J-3, surface soil	App J Table J-3	The rationale states that samples will be analyzed for metals, explosives, and PAHs.	Please change "metals" to "TAL metals" and "PAHs" to "SVOCs"	Agree that "metals" will be replaced with "TAL metals" in the text. Regarding PAHs, please refer to the response to comment O-4.
O-45	Appendix J, Table J-3, subsurface soil	App J Table J-3	The rationale states that samples will be analyzed for metals, explosives, and PAHs.	Please change "metals" to "TAL metals" and "PAHs" to "SVOCs"	Agree that "metals" will be replaced with "TAL metals" in the text. Regarding PAHs, please refer to the response to comment O-4.
O-46	Appendix K, Table K-3, surface soil	App K Table K-3	The rationale states that samples will be analyzed for metals, explosives, and PAHs.	Please change "metals" to "TAL metals" and "PAHs" to "SVOCs"	Agree that "metals" will be replaced with "TAL metals" in the text. Regarding PAHs, please refer to the response to comment O-4.
O-47	Appendix K, Table K-3, subsurface soil	App K Table K-3	The rationale states that samples will be analyzed for metals, explosives, and PAHs.	Please change "metals" to "TAL metals" and "PAHs" to "SVOCs"	Agree that "metals" will be replaced with "TAL metals" in the text. Regarding PAHs, please refer to the response to comment O-4.
O-48	Appendix L, Table L-3, surface soil	App L Table L-3	The rationale states that samples will be analyzed for metals, explosives, and PAHs.	Please change "metals" to "TAL metals" and "PAHs" to "SVOCs"	Agree that "metals" will be replaced with "TAL metals" in the text. Regarding PAHs, please refer to the response to comment O-4.
O-49	Appendix L, Table L-3, subsurface	App L Table L-3	The rationale states that samples will be analyzed for metals, explosives, and PAHs.	Please change "metals" to "TAL metals" and "PAHs" to "SVOCs"	Agree that "metals" will be replaced with "TAL metals" in the text. Regarding PAHs, please

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	soil				refer to the response to comment O-4.
O-50	Appendix M, Table M-3, surface soil	App M Table M-3	The rationale states that samples will be analyzed for metals, explosives, PCBs, and PAHs.	Please change “metals” to “TAL metals” and “PAHs” to “SVOCs”	Agree that “metals” will be replaced with “TAL metals” in the text. Regarding PAHs, please refer to the response to comment O-4.
O-51	Appendix M, Table M-3, subsurface soil	App M Table M-3	The rationale states that samples will be analyzed for metals, explosives, PCBs, and PAHs.	Please change “metals” to “TAL metals” and “PAHs” to “SVOCs”	Agree that “metals” will be replaced with “TAL metals” in the text. Regarding PAHs, please refer to the response to comment O-4.
O-52	Appendix M, Table M-3, surface water	App M Table M-3	The rationale states that samples will be analyzed for metals, explosives, SVOCs, and VOCs	All surface water and groundwater samples must be analyzed for RVAAP full suite.	Agree. Please refer to the response to comment O-15. This table will be adjusted to reflect full suite analysis for surface water.
O-53	Appendix N, Table N-3, surface soil	App N Table N-3	The rationale states that samples will be analyzed for metals, explosives, and PAHs.	Please change “metals” to “TAL metals” and “PAHs” to “SVOCs”	Agree that “metals” will be replaced with “TAL metals” in the text. Regarding PAHs, please refer to the response to comment O-4.
O-54	Appendix N, Table N-3, subsurface soil	App N Table N-3	The rationale states that samples will be analyzed for metals, explosives, and PAHs.	Please change “metals” to “TAL metals” and “PAHs” to “SVOCs”	Agree that “metals” will be replaced with “TAL metals” in the text. Regarding PAHs, please refer to the response to comment O-4.
O-55	Appendix N, Table N-3, surface water	App N Table N-3	The rationale states that samples will be analyzed for explosives, metals, and SVOCs.	All surface water and groundwater samples must be analyzed for RVAAP full suite.	Agree. Please refer to the response to comment O-15. This table will be adjusted to reflect full suite analysis for surface water.
O-56	Appendix O, Table O-3, surface soil	App O Table O-3	The rationale states that samples will be analyzed for metals, explosives, and PAHs.	Please change “metals” to “TAL metals” and “PAHs” to “SVOCs”	Agree that “metals” will be replaced with “TAL metals” in the text. Regarding PAHs, please refer to the response to comment O-4.

Draft PBA 2008 Supplemental Investigation SAP Addendum No. 1 at the Ravenna Army Ammunition Plant, Ravenna, Ohio
Comment Response Table - Revised
December 11, 2009

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O-57	Appendix O, Table O-3, subsurface soil	App O Table O-3	The rationale states that samples will be analyzed for metals, explosives, and PAHs.	Please change "metals" to "TAL metals" and "PAHs" to "SVOCs"	Agree that "metals" will be replaced with "TAL metals" in the text. Regarding PAHs, please refer to the response to comment O-4.
O-58	Appendix P, Table P-3 surface soil	App P Table P-3	The rationale states that samples will be analyzed for metals and explosives.	Please change "metals" to "TAL metals"	Agree. "Metals" will be replaced with "TAL metals" in the text.
O-59	Appendix P, Table P-3, subsurface soil	App P Table P-3	The rationale states that samples will be analyzed for metals and explosives.	Please change "metals" to "TAL metals"	Agree. "Metals" will be replaced with "TAL metals" in the text.
O-60	Appendix Q, Table Q-3, surface soil	App Q Table Q-3	The rationale states that samples will be analyzed for metals, explosives, and PAHs.	Please change "metals" to "TAL metals" and "PAHs" to "SVOCs"	Agree that "metals" will be replaced with "TAL metals" in the text. Regarding PAHs, please refer to the response to comment O-4.
O-61	Appendix Q, Table Q-3, subsurface soil	App Q Table Q-3	The rationale states that samples will be analyzed for metals, explosives, and PAHs.	Please change "metals" to "TAL metals" and "PAHs" to "SVOCs"	Agree that "metals" will be replaced with "TAL metals" in the text. Regarding PAHs, please refer to the response to comment O-4.
O-62	Part III SSHP, Table 3-3, Potential Exposures	Pg. 3-2 and Table 3-3	This table makes no mention of explosives, chromium VI, SVOCs, etc. This table is inconsistent with Section 3.2 Potential Exposure	Please review Table 3-3 and Section 3.2 and make the necessary changes to make them consistent with each other.	Agree. Section 3.2 and Table 3-3 will be revised to include all chemicals detected at the 17 AOCs with concentrations greater than the CUG (HI=1, Target Risk = 10^{-5}).
O-63	Part III SSHP, page 5-1, line 7	Part III SSHP, page 5-1	This table contains several "TBDs"	The table must be free of TBDs in the final document.	Agree. The following individuals and their phone numbers will be added to Table 5-1: SAIC Field Operations Manger – Heather Miller

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					SAIC Site Safety and Health Officer – Heather Miller MEC Avoidance Subcontractor – USA Environmental
O-64	Part III SSHP, Page 14-1, lines 11-12	Part III SSHP, Page 14-1	The text states that each field team shall have a cellular phone and/or a 2-way radio capable of contacting Post 1 for communication purposes. Cellular reception is intermittent at best.	Change the text to state that each field team should have a 2-way radio.	Agree. The text will be revised as follows: "Each field team shall have a ~~cellular phone and/or a~~ 2-way radio capable of contacting Post 1 for communication purposes."
Camp Ravenna (Katie Elgin)					
CR-1	Pg 3-11, Line 42	Pg. 3-13	"For AOCs that contain no permanent water bodies (Load Lines 5, 6, 7, 9, and 10)…" LL6 contains a small pond. Does this classify as 'a permanent water body' and require surface water and wet sediment samples?		Agree. The figure will be revised to include the existing water body. Surface water and wet sediment samples were previously collected, and no additional samples will be necessary. The text will be revised as follows: • No samples will be collected at AOCs where previous sampling satisfies data needs for definition of nature and extent, the distance to any water body is 1,500 or more feet and migration is not likely. For these reasons, no samples are proposed at ~~five~~ six AOCs (C-Block Quarry, Building 1200, Buildings F-15 and F-16, Anchor Test Area, ~~and~~ Atlas Scrap Yard, and Load Line 6). • For AOCs that contain no permanent water bodies (Load Lines 5, ~~6,~~ 7, 9, and 10), no surface water or wet sediment samples will be collected, as

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					there is nothing to measure in terms of those media. While ditches are present in these AOCs, they typically contain water only a small part of the year and meet the definition of dry sediment.
CR-2	Pg 4-8, Section 4.9 Ohio Rapid Assessment Method for Wetlands	Pg. 4-11	In this section, should you also mention completing wetland delineations? You actually need a formal wetland delineation in order to complete the ORAM. Additionally, ultimately I would think that the wetland delineation would be more important to you than the ORAM because it gives you a quantitative value and an area rather than just a qualitative value from the ORAM. Plus, the regulatory agencies will require wetland delineations. Please clarify.		Clarification. The Ohio Rapid Assessment Method for Wetlands will be removed from the PBA08 RI SAP as neither a formal wetlands delineation nor an ORAM is necessary at the RI phase of the project. The SERAs previously performed will provide the information necessary to perform the ecological WOE. In addition, as stated in lines 15-17 on Page 4-11, a SERA will be performed at the one AOC (NACA Test Area) without an existing SERA. If during the WOE evaluation it is determined that additional data is needed, the data will be collected through a survey of the AOC. Wetland delineations will be performed as necessary under this project to support planning and permitting requirements during the remedial design/remedial actions phase of the CERCLA process. Also, the following sentence will be added to the end of line 17 on Page 4-11: "If during the WOE evaluation it is determined that additional data is needed, the data will be collected through a survey of the AOC."
CR-3	Pg A-3, Line 27	N/A	"Suspect ACM construction debris was observed in previous investigations. If it is determined that		See response to comment O-24.

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			asbestos in these materials may represent an exposure hazard and removal is required, a certified asbestos inspector will sample and characterize ACM construction debris for remedial alternative evaluation and waste characterization purposes." Will surrounding soils also be analyzed for asbestos? Does that need mentioned here as well?		
CR-4	General	Figures	Please identify road names on all Figures. Also, please check your buildings to make sure the buildings on the Figures that are indicated as 'demolished' are actually demolished.		Agree. Road names will be added and disposition of buildings will be verified on Figures.
CR-5	Figure G-1	Figure G-1	Change "Plane Storage" to "Former Plane Storage". Should 'stream' (in the Legend) be identified as 'Water bodies' (stream, wetland, pond) since it encompasses all types of waterbodies?		Agree. Figure G-1 will be revised as recommended.
CR-6	General	N/A	For LLs 5, 7, 8, and 10 where USACE completed MI sampling under the removed building slabs, will these results be summarized in this document under the prior report summaries?		Agree. SAIC is currently obtaining plans and data results for this sampling from USACE and will include available and relevant results in the site-specific appendices. If data is not available prior to the submittal of the Final SAP, a summary of this data will be included in the RI Report.
CR-7	Pg K-1, Line	Pg K-1	"The buildings at Load Line 9 were		Agree. The text will be revised to include the

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	13		thermally decontaminated and demolished to 2 feet below ground surface in 2003. The concrete and brick were crushed to maintain the roads at RVAAP. An unused water tower is the only structure remaining at Load Line 9." I believe that the foundations and footers have since been completely removed from this site. Please mention this in the text.		removal of 22 foundations and footers, steam lines and unused utility poles in 2007.
CR-8	Figure O-3	Figures O-1, O-2, and O-3	PIKA just finished the slab and debris removal at Buildings F-15 and F-16. The buildings need to be identified as 'demolished' on this Figure. Also, should the building footprints now be sampled?		Agree. Figures O-1 through O-3 will be revised to reflect the building being demolished. One MI sample will be added for the area of each of the building footprints, for a total of two additional MI samples at this AOC. Samples will be analyzed for metals, explosives, and SVOCs, similar to other samples from this AOC.
CR-9	Pg P-1, Line 4	Pg P-1	"Although operational information is relatively limited about Anchor Test Area (Figure P-1), the AOC was used for research, development, the testing of explosively-driven soil anchoring devices." This is an incomplete sentence. Did you mean 'research, development, and testing of explosively-driven soil anchoring devices'?		Agree. Text will be revised as follows: "Although operational information is relatively limited about Anchor Test Area (Figure P-1), the AOC was used for research, development, and ~~the~~ testing of explosively-driven soil anchoring devices."

Revised text for Section 3.2.1 (please refer to the response to comment O-1):

"The general decision rules applied to the investigation activities for all AOCs are presented for each media in the following sections. Each AOC is proceeding through the CERCLA process individually. Each AOC varies in regard to historic use, previous investigations, and data gaps. Therefore, the general decision rules are applied to each AOC individually to develop a specific sample design (provided in Appendices A through Q for each AOC).

Selection of Sampling Locations

For this SAP Addendum, the determination of the nature and extent of contamination is accomplished by comparing existing analytical data to chemical-specific screening criteria. The screening criteria used are the facility-wide cleanup goals (FWCUGs) developed in the Draft Facility-Wide Human Health Cleanup Goals Report for the RVAAP (USACE 2008b), herein referred to as the Draft FWCUG Report. The draft FWCUGs are subject to change as the Draft FWCUG Report is finalized. Therefore, revised or additional data comparisons for risk management decisions and evaluations may need to be conducted at a later point.

The chemical-specific FWCUGs at the 10^{-6} cancer risk level and non-carcinogenic risk Hazard Quotient (HQ) using the 0.1 risk value are the specific screening criteria used in this SAP Addendum. The FWCUGs were used to determine which analytes and which areas must be further evaluated to assess nature and extent of contamination. The use of the FWCUGs is consistent with guidance in USACE's Final RVAAP Position Paper for the Application and Use of Facility-Wide Human Health Cleanup Goals (USACE 2009b). The FWCUGs at these risk levels were developed in the Draft FWCUG Report for multiple receptors. In order to ensure the nature and extent of contamination is defined to the most restrictive future receptor/land use, the screening criterion for each chemical in each medium was the FWCUG with the least value for any of the receptors at these risk levels. It is assumed that the presence of concentrations at or less than their background value indicates the absence of contamination. If the screening criterion for an inorganic chemical was less than the background value, then the background value was used as the screening criterion for determining exceedances that need to be further investigated. The screening criteria values and their descriptions are presented in Table 3-1.

To ensure that the full list of chemicals that might possibly be present at the AOCs are considered in the selection of sample locations, the chemical reduction process in Section 2.0 of USACE's Final RVAAP Position Paper for the Application and Use of Facility-Wide Human Health Cleanup Goals (USACE 2009b) was not completed on an AOC-specific basis at this phase. Instead, all chemicals detected in the existing data were compared to the screening criteria (FWCUGs). If an existing sample result exceeds the screening criteria for any of the chemicals listed in Table 3-1 and the exceedance is not currently bound (i.e., there is no sample less than the screening criteria to define the extent or source of contamination), then further extent delineation will be conducted during implementation of this SAP Addendum. The use of the term "exceedance" within this SAP Addendum refers to a sample result that is greater than the screening criteria presented in Table 3-1 for one or more chemicals. For groundwater, the maximum detected concentration at a well was used for the comparison against screening criteria.

If a sample result exceeded the screening criteria defined above, it was also compared to the FWCUG representing an HI of 1.0 or a Target Risk of 10^{-5} for the same receptor (from the Draft FWCUG Report). This comparison was performed to facilitate the identification of potential source areas or "hot spots" that may require additional sampling specifically designed to refine the extent of a target source area. A comparatively small list of chemicals exceeded these FWCUGs (see Appendices A through Q).

In Appendices A through Q, which detail the AOC-specific sampling approaches, the FWCUGs representing an HI = 0.1 or Target Risk = 10^{-6} are referred to as the screening criteria, and the FWCUGs representing an HI = 1.0 or a Target Risk = 10^{-5} are referred to as the FWCUGs. While both sets of values are established as FWCUGs in the Draft FWCUG Report, distinguishing terms have been established in this SAP Addendum for ease of use based on the utilization of the values for the purpose of evaluating nature and extent.

Determination of AOC-Specific Chemicals of Potential Concern

Upon completion of data collection activities conducted as part of this SAP Addendum, all available chemical data, including newly acquired data, will be evaluated to determine chemicals of potential concern (COPCs) for each AOC. The process for determining AOC-specific COPCs will follow the procedures described in Section 2.0 of USACE's Final RVAAP Position Paper for the Application and Use of Facility-Wide Human Health Cleanup Goals (USACE 2009b), including the development of AOC-specific CUGs for additional chemicals if necessary.

Chemical Parameters to Be Analyzed
The chemical parameters to be analyzed at each AOC..."

Revised text for Section 3.2.1.4 (please refer to the response to comment O-15):

In order to complete the definition of nature and extent of characterization, groundwater evaluation is required ~~Additional information is required to fully characterize and define the nature and extent of contamination in groundwater~~ at the 16 AOCs addressed by this SAP Addendum (groundwater at Load Line 12 is being addressed under a separate investigation at an accelerated schedule). Under the current Facility-Wide Groundwater Monitoring Program (FWGWMP), groundwater monitoring well sampling has been or is currently ~~is~~ being conducted at ~~8~~ 13 of the 16 AOCs. In October 2008, all of the wells in the following AOCs had four quarters of sampling completed under the FWGWMP:

- C-Block Quarry;
- Building 1200;
- Landfill North of WBG;
- Upper and Lower Cobbs Ponds;
- Load Line 6 (wells LL6mw-001, LL6mw-002, LL6mw-003, and LL6mw-004 only);
- NTA;
- Load Line 5; and
- Load Line 11 (wells LL11mw-2 and LL11mw-7 only).

The remaining wells at Load Line 6 (LL6mw-005, LL6mw-006, and LL6mw-007) and Load Line 11 (LL11mw-1, LL11mw-3, LL11mw-4, LL11mw-5, LL11mw-6, LL11mw-8, LL11mw-9, and LL11mw-10) are currently being sampled under the FWGWMP, and four quarters of sampling will be completed in October 2009. The following five AOCs were added to the FWGWMP in April 2009 and four quarters of sampling will be completed in January 2010:

- Load Line 7;
- Load Line 8;

- Load Line 9;
- Load Line 10; and
- Atlas Scrap Yard.

During a quarterly event, each well is sampled for water quality parameters, explosives, propellants, target analyte list (TAL) metals, cyanide, nitrate, semi-volatile organic compounds (SVOCs), polychlorinated biphenyls (PCBs), pesticides, and volatile organic compounds (VOCs). The current groundwater sampling conducted under the FWGWMP will provide sufficient data to evaluate nature and extent of contamination in groundwater for these 13 AOCs. Therefore, no additional sampling is required as part of this SAP Addendum ~~at the sites listed above~~.

~~All of the wells within the 5 AOCs listed below have been sampled once for water quality parameters, explosives, propellants, TAL metals, cyanide, nitrate, SVOCs, PCBs, pesticides and VOCs:~~

- ~~Load Line 7;~~
- ~~Load Line 8;~~
- ~~Load Line 9;~~
- ~~Load Line 10; and~~
- ~~Atlas Scrap Yard.~~

~~Each well will be sampled and analyzed for the RVAAP full suite of analytes. Groundwater sampling procedures are provided in Section 4.4.~~ Historic groundwater data from each AOC and chemicals that have exceeded screening criteria in soil are presented in Appendices A through Q.

Currently, subsurface soil or groundwater data does not exist for the three AOCs...