FINAL

PHASE 1 REMEDIAL INVESTIGATION SAMPLING AND ANALYSIS PLAN ADDENDUM FOR HIGH PRIORITY AREAS OF CONCERN

FOR

THE RAVENNA ARMY AMMUNITION PLANT, RAVENNA, OHIO

PREPARED FOR

U.S. ARMY CORPS OF ENGINEERS NASHVILLE DISTRICT

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SAMPLING AND ANALYSIS PLAN ADDENDUM
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DEFINITIONS

Action Plan (AP)	An annual plan submitted by U.S. Army installations showing the status of current and future planned environmental activities at the installations.
Ammatol	A mixture of ammonium nitrate and trinitrotoluene (TNT).
Area of Concern (AOC)	Under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), a site where contamination is known or suspected to exist.
Defense Environmental Restoration Program (DERP)	A program established by Congress in 1984 to evaluate and clean up contamination from past U.S. Department of Defense (DoD) activities (Title 10 U.S. Code 2701-2707 and 2810).
Facility	All contiguous land and structures, other appurtenances, and improvements within the boundaries of a property or parcels.
Facility-wide	A term used to reference all land and structures comprising a facility.
Facility-wide Sampling and Analysis Plan (SAP)	A submittal document comprised of the Field Sampling Plan (FSP) and Quality Assurance Project Plan (QAPP); used to define all aspects of sampling and analytical work expected to be common to an installation. Not implementable without an investigation-specific SAP Addendum.
Feasibility Study (FS)	Based on data collected during the remedial investigation, options for final cleanup actions are developed and evaluated in the FS. The FS is divided into two phases: (1) an initial screening of alternatives, followed by (2) the detailed analysis of alternatives. The detailed analysis considers, among other things, cost-effectiveness, short- and long-term effectiveness, and the overall protection of human health and the environment.
Installation	A military facility or base.
Interim Remedial Action (IRA)	An early response action that is identified and implemented at any time during the study or design phase. IRAs are limited in scope, and they address only areas or media for which a final remedy will be developed by the remedial investigation (RI)/FS process. An IRA should be consistent with the final remedy for a site.
Investigation-Specific Sampling and Analysis Plan (SAP) Addendum	A submittal document comprised of the FSP and QAPP; used to define specific aspects of sampling and analytical work during the investigation of one or more AOCs. Tiered under the Facility-wide SAP and not implementable without the Facility-wide SAP.

No Further Action (NFA)	A no further action decision is a decision to close out a site from further response action. Such decisions can be made at different points in the process if data indicate that risks are within acceptable levels.
Phase I Remedial Investigation	Performed if the Preliminary Assessment (PA) recommends further investigation. Phase I investigations typically collect waste and environmental samples to determine the hazardous substances present at a site and whether they are being released to the environment.
Phase II Remedial Investigation (RI)	A field investigation that is more extensive than a Phase I RI. Its purpose is to characterize the nature and extent of contamination at a site. The Phase II RI also assesses the risks posed by on-site contamination to human health and the environment.
Pink Water	Waste water colored pink as a result of the photochemical reaction of TNT in water.
Preliminary Assessment (PA)	A limited-scope investigation designed to distinguish between sites that pose little or no threat to human health and the environment and sites that require further investigation. The PA is based on installation record searches, visual site inspections, and interviews of site personnel.
Relative Risk	The grouping of sites or AOCs in the DERP into High, Medium, and Low categories based on an evaluation of site information using three key factors: the contaminant hazard factor, the migration pathway factor, and the receptor factor.
Remedial Action (RA)	Involves the construction, operation, and implementation of the final cleanup remedy. Long-term RAs require continued monitoring, operation, and maintenance for a number of years.
Remedial Design (RD)	Involves the development of the actual design of the selected cleanup remedy, including preparation of all technical drawings and specifications needed to implement the cleanup action.
Removal Action	Taken to respond to a release, or threat of a release, of hazardous substances, pollutants, or contaminants so as to prevent, minimize, or mitigate harm to human health or the environment. Such actions may be taken during any phase of the site cleanup.
Resource Conservation and Recovery Act (RCRA) Facility Assessment (RFA)	The first step in the RCRA corrective action process. The RFA acts as a screen, first identifying and then eliminating solid waste management units (SWMUs), environmental media, or entire facilities from further consideration for corrective action. RFAs are performed as part of the RCRA permitting process.

Site	An area(s) of known or suspected release or source of contamination including all potentially affected media (soil, groundwater, surface water, sediment, air).
Solid Waste Management Unit (SWMU)	Under RCRA, a site where solid waste or wastelike material is known or suspected to exist.
Strategic and Critical Materials	A government phrase referring to substances/materials essential to the effective conduct of war.

INTRODUCTION

This Phase 1 Remedial Investigation (RI) Sampling and Analysis Plan (SAP) Addendum for High priority Areas of Concern (AOCs) at the Ravenna Army Ammunition Plant (RVAAP), Ravenna, Ohio, has been prepared for the RVAAP by Science Applications International Corporation (SAIC) under contract DACA62-94-D-0029, Delivery Order #0010, with the United States Army Corps of Engineers (USACE), Nashville District. This SAP Addendum has been developed to tier under and supplement the *Facility-wide Sampling and Analysis Plan for the Ravenna Army Ammunition Plant, Ravenna, Ohio* (USACE 1996) for the purpose of performing a Phase 1 RI, as defined in the Facility-wide SAP, at high priority AOCs at RVAAP. The Facility-wide SAP provides the base documentation (i.e., technical procedures and investigative protocols) for conducting investigations under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) at RVAAP, whereas, the SAP Addendum includes all of the investigation-specific sampling and analysis objectives, rationale, and activities, and criteria necessary to perform a Phase 1 RI of the high priority AOCs at RVAAP. Consequently, the Phase 1 RI of High Priority AOCs at RVAAP can not be implemented without the guidance provided in both documents. The Facility-wide SAP and the Phase 1 RI SAP Addendum have been developed following the USACE guidance document Requirements for the Preparation of Sampling and Analysis Plans, EM 200-1-3, September, 1994 (USACE 1994b), to collectively meet the requirements established by the Ohio Environmental Protection Agency (OEPA), Northeast District, and the United States Environmental Protection Agency (EPA), Region V for conducting CERCLA investigations.

As stated, this SAP Addendum contains only the project-specific details necessary to perform a Phase 1 RI at the 11 high priority AOCs at RVAAP as identified in the *Action Plan for the Ravenna Army Ammunition Plant, Ravenna, Ohio* (USACE 1996). Where appropriate, the Phase 1 RI SAP Addendum contains references to the Facility-wide SAP for base procedures and protocols for both the Field Sampling Plan (FSP) and Quality Assurance Project Plan (QAPP) parts of the SAP.

FIELD SAMPLING PLAN, ADDENDUM
FOR THE
PHASE I REMEDIAL INVESTIGATION
OF
HIGH PRIORITY AREAS OF CONCERN
AT THE
RAVENNA ARMY AMMUNITION PLANT
RAVENNA, OHIO

July 1996

96-054P/071196

FIELD SAMPLING PLAN
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ACRONYMS

AOC	Area of Concern
ARARs	applicable or relevant and appropriate requirements
BGS	below ground surface
CCQC	Contractor Chemical Quality Control
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
DNT	dinitrotoluene
DoD	United States Department of Defense
DQO	Data Quality Objective
EM	electromagnetic
EPA	United States Environmental Protection Agency
FID	flame-ionization detector
FS	Feasibility Study
FSP	Field Sampling Plan
HQ	Hazard Quotient
ID	inside diameter
IDW	investigation-derived waste
NFA	No Further Action
OD	outside diameter
OEPA	Ohio Environmental Protection Agency
OVA	organic vapor analyzer
PCB	polychlorinated biphenyls
PCOC	potential chain of custody
PID	photo-ionization detector
QA	quality assurance
QAPP	Quality Assurance Project Plan
QC	quality control
RCRA	Resource Conservation and Recovery Act
RFA	RCRA Facility Assessment
RVAAP	Ravenna Army Ammunition Plant
SAIC	Science Applications International Corporation
SAP	Sampling and Analysis Plan
SWMU	Solid Waste Management Units
TBD	to be determined
TNT	trinitrotoluene
TOC	total organic carbon
USACE	United States Army Corps of Engineers
USAEHA	United States Army Environmental Hygiene Agency

1. PROJECT DESCRIPTION

The Phase 1 Remedial Investigation (RI) of High Priority Areas of Concern (AOCs) at the Ravenna Army Ammunition Plant (RVAAP) will include the 11 AOCs listed in Table 1-1 that have been identified as high priority in the *Action Plan for the Ravenna Army Ammunition Plant, Ravenna, Ohio* (USACE 1996). Figure 1-1 shows the locations of all AOCs at RVAAP. Detailed maps for each of the 11 high priority AOCs are presented in Appendix A.

Table 1-1. High Priority AOCs at RVAAP

RVAAP Number	AOC Name
RVAAP-04	Demolition Area #2
RVAAP-05	Winklepeck Burning Grounds
RVAAP-08	Load Line 1 and Dilution/Settling Pond
RVAAP-09	Load Line 2 and Dilution/Settling Pond
RVAAP-10	Load Line 3 and Dilution/Settling Pond
RVAAP-11	Load Line 4 and Dilution/Settling Pond
RVAAP-12	Load Line 12 and Dilution/Settling Pond
RVAAP-13	Building 1200 and Dilution Settling Pond
RVAAP-18	Load Line 12 Pink Wastewater Treatment Plant
RVAAP-19	Landfill North of Winklepeck Burning Grounds
RVAAP-29	Upper and Lower Cobbs Ponds

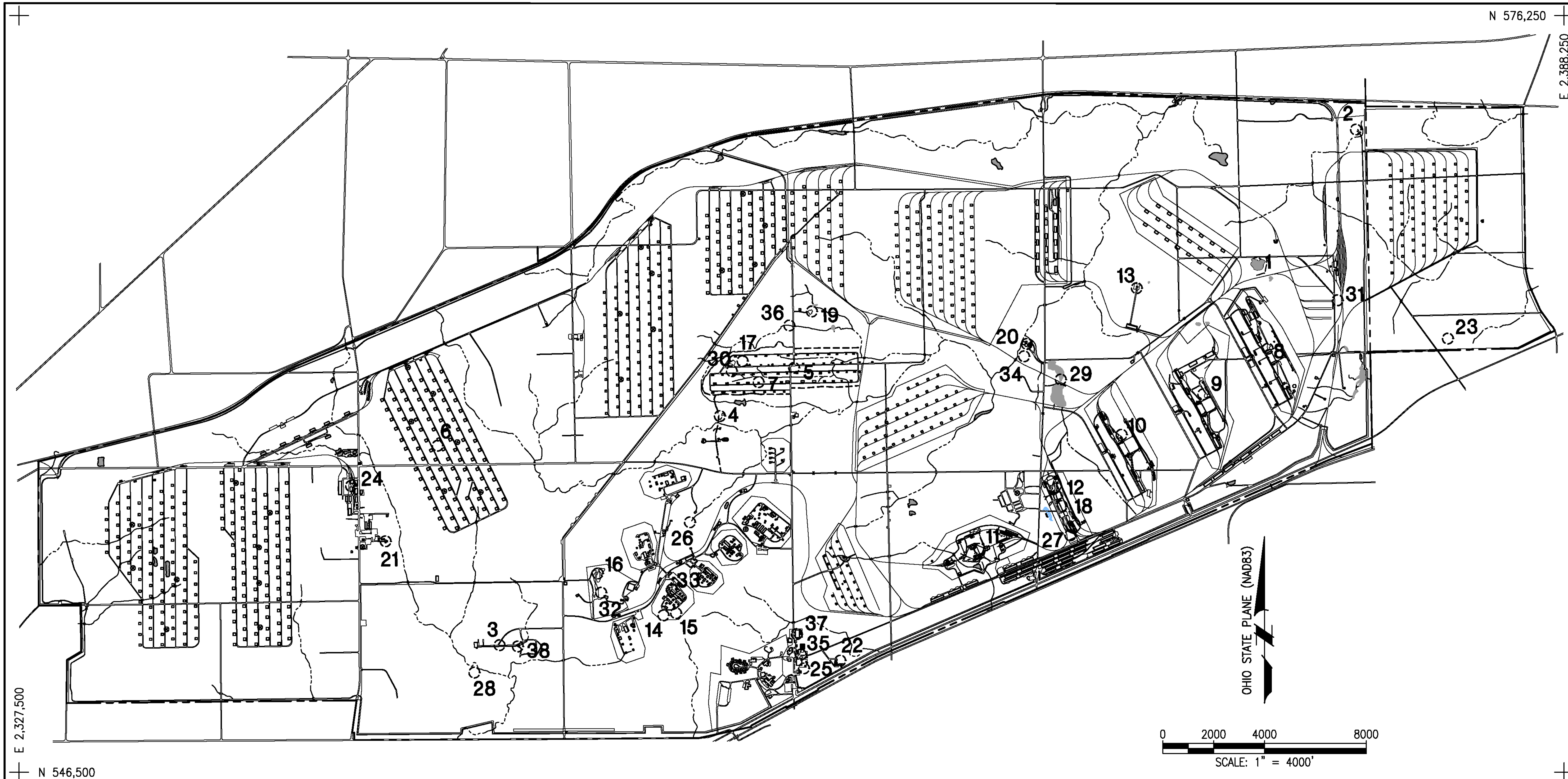
1.1 AOC HISTORY AND CONTAMINANTS

A detailed history of process operations and waste processes for each AOC at RVAAP is presented in the *Preliminary Assessment for the Ravenna Army Ammunition Plant, Ravenna, Ohio* (USACE 1996). The following is a summary of the history and related contaminants for the 11 high priority AOCs included in this Phase 1 RI.

Demolition Area 2 (RVAAP-04)

Demolition Area #2 is an elongated, horseshoe-shaped, cleared area approximately 8 hectares (20 acres) in size. This AOC was used from 1948 to detonate large caliber munitions and "off spec" bulk explosives that could not be deactivated or demilitarized by any other means of destruction (Halliburton NUS 1992). Within the boundaries of this site, there are five distinct areas:

- Open Detonation Area — an area in which detonation was accomplished in backhoe pits with a minimum depth of 1.2 m (4 ft). After detonation, metal parts were typically picked up and removed from the detonation site. The pits would be backfilled, mulched, and reseeded.



LEGEND OF SITES:

1 .... RAMSDELL QUARRY LANDFILL
2 .... ERIE BURNING GROUNDS
3 .... DEMOLITIONS AREA #1
4 .... **DEMOLITIONS AREA #2**
5 .... **WINKLEPECK BURNING GROUNDS**
6 .... C BLOCK QUARRY
7 .... BLDG 1601 HAZARDOUS WASTE STORAGE
8 .... **LOAD LINE 1 AND DILUTION/SETTLING POND**
9 .... **LOAD LINE 2 AND DILUTION/SETTLING POND**
10 .... **LOAD LINE 3 AND DILUTION/SETTLING POND**
11 .... **LOAD LINE 4 AND DILUTION/SETTLING POND**
12 .... **LOAD LINE 12 AND DILUTION/SETTLING POND**
13 .... **BLDG 1200 AND DILUTION/SETTLING POND**
14 .... LOAD LINE 6, EVAPORATION UNIT
15 .... LOAD LINE 6, TREATMENT PLANT QUARRY LANDFILL/FORMER
16 .... FUZE & BOOSTER BURNING PITS
17 .... DEACTIVATION FURNACE
18 .... **LOAD LINE 12 PINK WASTE WATER TREATMENT**
19 .... **LANDFILL NORTH OF WINKLEPECK BURNING GROUND**
20 .... SAND CREEK SEWAGE TREATMENT PLANT
21 .... DEPOT SEWAGE TREATMENT PLANT
22 .... GEORGE ROAD SEWAGE TREATMENT PLANT
23 .... UNIT TRAINING SITE WASTE OIL TANK
24 RESERVE UNIT MAINTENANCE AREA WASTE OIL TANK
25 .... BLDG 1034 MOTOR POOL WASTE OIL TANK
26 .... FUZE BOOSTER AREA SETTLING TANKS
27 .... BLDG 854-PCB STORAGE
28 .... MUSTARD AGENT BURIAL SITE
29 .... **UPPER AND LOWER COBBS POND COMPLEX**
31 .... ORE PILE RETENTION POND
32 .... 40 AND 60 MM FIRING RANGE
33 .... FIRESTONE TEST FACILITY
34 .... SAND CREEK DISPOSAL ROAD LANDFILL
35 ... 1037 BUILDING-LAUNDRY WASTEWATER SUMP
36 .... PISTOL RANGE
37 .... PESTICIDE BUILDING S-44S2
38 .... NACA TEST AREA

US Army Corps of Engineers Nashville District

U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
NASHVILLE, TENNESSEE

RAVENNA ARMY AMMUNITION PLANT
RAVENNA, OHIO
FACILITY MAP

DRAWN BY:	REV. NO./DATE:	CAD FILE:
R. BEELER	REV. E/03-26-98	95021/DWGS/19111X17

Fig. 1-1. Ravenna Army Ammunition Plant Facility Map

- Open Burning Area — [approximately 0.1 ha (0.25 acre)] the sludge from Load Line 6 Evaporation Unit from 1981 to 1986, was thermally destroyed in this location.

- Prototype Testing Range — an area where projectiles were fired into targets.

- Burial Site — an area where possible scrap bombs have been buried. This site is approximately 3 m (10 ft) wide, 61 m (200 ft) long and 1.2 m (4 ft) deep. The area lies along a swale in the northwest corner of the Demolition Area.

- Past Disposal Area — an area that is posted "Off Limits, Dangerous Material" and is located along a 21.3-m (70-ft) embankment overlooking Sand Creek.

Potential waste types at this AOC are unexploded ordnance, shrapnel, white phosphorus, explosive residues, and heavy metals. In 1983, an investigation of the RCRA part of the AOC revealed high concentrations of explosives and metals in surface soil samples collected from the horseshoe-shaped bermed area. In 1992, an investigation revealed low concentrations of explosives and metals in surface soils in the RCRA area outside of the bermed horseshoe area (Jacobs Engineering 1989). A RCRA permit application covering the 1.5 acres used for open burning and detonation was withdrawn on April 11, 1994. Closure plans are currently being prepared for the area defined in the permit application.

<u>Winklepeck Burning Grounds (RVAAP-05)</u>

The Winklepeck Burning Grounds have been in operation since 1941 and consist of approximately 80.9 ha (200 acres). Recent activities are limited to a RCRA area (Burning Pad #38) of about 0.4 ha (1 acre). Prior to 1980, the burning was carried out in four pits, pads, and sometimes on the roads. The pits consisted of areas bermed on three sides, approximately 15.2 × 22.9 m (50 × 75 ft) in size. Of the four pits, Pit #1 was used most frequently. The pads consisted of 6 × 12.2 m (20 × 40 ft) areas without berms. Burning was conducted on bare ground and the ash was abandoned on site. Scrap metal was reclaimed and taken to the Landfill North of Winklepeck (RVAAP-19). It is not known how many pads were contained within this 80.9 ha (200 acre) unit. Currently, 70 burning pads have been identified from historical drawings and aerial photographs. According to reports from several former employees at RVAAP, some heavy artillery projectiles were melted out by being placed point side down on 7.6-cm (3-in.) channel irons. The channel irons were placed in a train configuration in a ditch along Road E. Fires were built around the channel irons using scrap wood, straw, and No. 2 fuel oil. A train of projectiles up to 609.6 m (2000 ft) long would sometimes be used in a ditch parallel to the road. The fire would cause the explosives to melt and flow out of the projectile and be burned. Some of the projectiles would explode and be ejected into the nearby area as far as 152.4 to 182.9 m (500 to 600 ft), usually to the north side of the ditch. Many of the further flung projectiles are still in the field where they landed. In some instances, high energy material such as black powder and explosives were also laid out in a string along a road and burned (U.S. Army Toxic and Hazardous Materials Agency 1978). Burning is also known to have occurred along Road D.

Prior to 1980, wastes disposed included the burning of cyclonite (RDX), antimony sulfide, Composition B, lead oxide, TNT, propellant, black powder, sludge from load lines, and domestic wastes. Also, small amounts of laboratory chemicals were routinely disposed of during production periods. Shrapnel and other metallic munitions fragments were allowed to remain on the site after detonation as were possible residual explosives. Waste oil (hydraulic oils from machines and lubrication oils from vehicles) was disposed in the northeast corner of the burning ground until 1973. Ash from these areas was not collected (Jacobs Engineering 1989).

Since 1980, burns have been conducted in metal, refractory lined trays (with subsequent ash collection), set on top of a bed of slag. These activities took place at Burning Pad #38. The trays initially consisted of 1/4-inch boiler plate, 1.2 m × 18.3 m × 25.4 cm (4 ft × 60 ft × 10 in.) and refractory lined. The trays are set on a pad of crushed slag in an area approximately 30.5 × 30.5 m (100 × 100 ft) in size. Ash residues are drummed and stored in RVAAP-07 (Building 1601 Hazardous Waste Storage) until tested for waste determination. In 1994, four groundwater wells were installed at the active portion of the site (Jacobs Engineering 1989). A closure plan is currently being prepared for the area defined in the RCRA permit application.

Load Line 1 and Dilution/Settling Pond (RVAAP-08)

The Load Line 1 Dilution/Settling Pond was in operation from 1941 to 1971. Explosive residues that collected on the walls and floors of process buildings during assembly operations were periodically washed and wastewater (known as "pink water") from the plant was collected in concrete sumps located throughout the load line area. The wastewater was then pumped to a sawdust filtration unit for chlorofication and removal of nitro-compounds prior to discharge. The sawdust filtration unit consisted of a set of three parallel 3 × 9.1 × 0.9 m (10 × 30 × 3 ft) concrete settling tanks and a set of three 1.5 × 4.6 × 0.9 m (5 × 15 × 3 ft) filter blocks in the bottom of the filtration tanks. Plant effluent was introduced into the top of one end of the filtration unit and discharged to an earthen settling pond (Griggy's Pond) via an unlined ditch. The settling pond at Load Line 1 was an unlined earthen impoundment approximately 0.4 ha (1 acre) in size. The discharge from the impoundment immediately exited the installation. The sawdust from the filtration unit was disposed by open burning at the Winklepeck Burning Grounds (RVAAP-05) (Halliburton NUS 1992).

Waste constituents at this site include TNT, octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX), Composition B, lead, chromium, mercury, and arsenic. In 1981, wells were installed around the perimeter of the load line area. The location of these wells is not known; however, they reportedly were sampled for heavy metals. Arsenic was detected at a level of 0.063 mg/l in one of the wells near Load Line 1 (Jacobs Engineering 1989). Frost heaving has since destroyed the well. TNT and RDX were detected in sediments from the ditch receiving the discharge from the sawdust filtration unit. TNT was detected at a concentration of 0.30 μg/ml. The highest concentration of RDX was detected at a second sample location at a concentration of 1.60 μg/ml (Jacobs Engineering 1989).

Load Line 2 and Dilution/Settling Pond (RVAAP-09)

Similar in process, Load Line 2 was used to melt and load TNT and Composition B into large caliber shells and bombs. Pink water generated from cleaning process building walls and equipment and was collected in concrete sumps connected. After settling, the supernatant water was pumped by low-pressure steam ejectors to two tanks, approximately 26,220-L (6900-gal.) capacity, for cooling. When the water cooled to 80 degrees, the water was pumped through an overhead pipe to a sawdust filtration unit. The sawdust filtration unit consisted of a set of two parallel 3 × 9.1 × 0.9-m (10 × 30 × 3-ft) concrete settling tanks and a set of three 1.5 × 4.6 × 0.9-m (5 × 15 × 3-ft) filtration tanks. Filtration through the sawdust caused clarification and removal of nitro-compounds prior to discharge into the drainage system. The effluent from the sawdust filtration units was discharged into Kelly's Pond, a triangular shaped, unlined earthen settling impoundment, approximately 0.8 ha (2 acres) in size and 1.8 to 2.4 m (6 to 8 ft) deep. The discharge from the impoundment was channeled to a surface stream that immediately exits the installation south of the load line (Halliburton NUS 1992).

Load Line 2 operated for 30 years (1941 to 1971). Approximately 9,211 kilograms of Composition B and 3,192,000 liters of pink water per month were generated when the facility was at full capacity (Jacobs

Engineering 1989). Chromic acid waste (625 ppm hexavalent chromium) was also discharged from Building 802 into a ditch that ultimately empties into the West Branch of the Mahoning River (APCO, Ohio 1951). TNT and RDX were detected in sediment samples collected from the ditch receiving the discharge from the sawdust filtration unit. Concentrations ranged from 0.60 μg/ml TNT to 1.75 μg/ml RDX (U.S. Army Environmental Hygiene Agency 1988).

Load Line 3 and Dilution/Settling Pond (RVAAP-10)

The washdown process buildings and steam decontamination of equipment generated pink-water waste that was also collected in concrete sumps located throughout the load line area. After settling, the wastewater was then pumped to a set of three parallel 3 × 9.1 × 0.9 m (10 × 30 × 3 ft) settling tanks via steam ejectors. After cooling, the waste was discharged to a sawdust filtration unit, three 1.5 × 4.6 × 0.9-m (5 × 15 × 3-ft) concrete tanks. The sawdust filters remove nitro-compounds prior to discharge into an open earthen drainage system. The sawdust and the settled sludge was periodically removed to the Winklepeck Burning Grounds. The effluent from the sawdust filtration unit was discharged via an unlined land surface stream ditch emptied into Upper Cobbs Pond and ultimately Lower Cobbs Pond (RVAAP-29) for settling.

Load Line 3 operated from 1941 to 1971 (30 years). Approximately 9,173 kg of scrap and sludge and 304,800 L of pink water was generated per month when the facility was operating at full capacity. The waste consisted of TNT, HMX, Composition B, lead, chromium, mercury, and arsenic.

RDX at a concentration of 1.6 μg/ml was detected in a sediment sample collected from Upper Cobbs Pond during a soil and sediment investigation conducted in 1982 by The Mogul Corporation. Since Load Lines 3 and 12 discharged into Cobbs Pond, it is unknown if this contamination originated from Load Line 3 (Jacobs Engineering 1989).

Load Line 4 and Dilution/Settling Pond (RVAAP-11)

The Load Line 4 Wastewater Treatment System was in operation from 1941 to 1971. Washdown of process buildings and steam decontamination of equipment generated pink water from the plant and collected in concrete sumps located throughout the line area. The wastewater was then pumped to a sawdust filtration unit. The sawdust filtration unit consisted of a set of three parallel 3 × 9.1 × 0.9-m (10 × 30 × 3-ft) concrete settling tanks and a set of three 1.5 × 4.6 × 0.9-m (5 × 15 × 3-ft) filtration tanks. Sawdust was placed on top of vitreous clay filter blocks in the bottom of the filtration tanks. After passing through the settling tanks, plant effluent was introduced into the top of one end of the filter tanks and discharged to a surface ditch. Effluent from the sawdust filtration unit was ditched to a 0.8 ha (2 acres) settling pond within the Load Line 4 area. The Load Line 4 settling pond discharges to a surface stream that exits the RVAAP facility just south of the load line locations. Sludge and spent sawdust from the filtration unit was periodically removed and sent to the Winklepeck Burning Grounds for thermal destruction.

Approximately 11,930 kg of scrap, sludge, and dust; 14,900,000 m^3 of dust; and 3,390,000 L of pink water were generated per month when the facility was operating at full capacity. The waste consisted of TNT, RDX, Composition B, lead, chromium, mercury and some unknown constituents. Previous characterization data indicated that RDX was detected at a concentration of 0.54 μg/ml while TNT was detected at a concentration of 0.06 μg/ml in samples collected from the drainage ditch.

Load Line 12 and Dilution/Settling Pond (RVAAP-12)

Load Line 12 was primarily used for the demilitarization of munitions. The projectile and fuse assembly was removed from the bomb casing and the projectile was placed in a double-jacketed steam canister. Explosives were liquified into a tray, knocked out of the tray, packed, and shipped out. The building area was washed down weekly and the water was guttered and flowed through a pipe into a series of two stainless-steel tanks. One tank was used for settling and one for filtration. Prior to 1981, the tank effluent was ditched (from Building FJ-904) to a holding pond known as the Load Line 12 settling pond, where ultimately the water drained to Upper Cobbs and then Lower Cobbs Pond (RVAAP-29).

The Silas Mason Company of Shreveport, Louisiana was awarded a contract in 1946 to rehabilitate the ammonium plant and produce fertilizer grade ammonium nitrate to fulfill the U.S. Government's commitment for aid in rehabilitation of occupied foreign countries. A total of 518,264.1 tons of ammonium nitrate was produced before the contract was terminated in January 1950.

Approximately 324,000 L of pink water were generated per month when the plant was fully operational during the 1950s. The effluent contained TNT, HMX, Composition B, Ammatol (a mixture of ammonium nitrate and TNT), lead, chromium, mercury, and other explosives. The facility was housed in a steel girder, transite-sided building approximately 30.5 m × 18.3 m (100 ft × 60 ft). Dark, red-stained soil lies under and along the east and north edges of the building (FJ-904). In the vicinity of the red-stained soil are areas of absent vegetative growth. Sediment samples from Cobb Ponds were found to be contaminated with RDX at a concentration of 1.16 μg/ml and TNT at a concentration of 0.17 μg/ml. In the past, contaminated wastewater was allowed to drain into the environment. Overflow could have potentially gone into a drainage ditch approximately [30.5 m (100 ft)] east of this unit.

Building 1200 and Dilution Settling Pond (RVAAP-13)

Building 1200, the Ammunition Sectioning Area, is a half concrete, half transite-sided building approximately 9.1 m × 6.1 m (30 ft × 20 ft) with a 3.7-m (12-ft) peak. Building 1200 was used from 1941 to 1971 for ammunition demilitarization. Munition rounds were checked for flaws, steam cleaned, and the wastewater drained, via a pipe, through a crushed slag gravel bed and into a ditch and finally into a 0.2 ha (0.5 acre) sedimentation pond.

Effluent from the facility contained explosive-contaminated wastewater. The water may have contained TNT, HMX, Composition B, or other explosives as well as heavy metals such as lead, chromium, and mercury.

Load Line 12 Pink Waste Water Treatment Plant (RVAAP-18)

Load Line 12 Pink Water Treatment Plant consists of a dual mode activated carbon filtration system for filtering pink water. Twin 907.2-kg (2000-lb) carbon units are enclosed in a 6 × 13.2 m (20 × 40 ft) steel girder, metal-sided building (IWT01) on a concrete slab. The spent carbon is stored in Building 1601 (RVAAP-07) until transported off site for disposal.

The treatment plant was built in 1981, within the confines of Load Line 12, and was operational for two years. During operation, plant effluent was stored in a 38,000-L (10,000-gal.) stainless-steel holding tank. When processing, the effluent was pumped through a bag prefilter that removed the particulate matter. After the prefilter, the effluent was pumped through a series of two activated carbon units to another holding tank. Approximately 30 minutes of carbon bed contact time was maintained during the treatment process.

TNT wastewater with a maximum allowable concentration of 0.14 ppm was disposed. The site was designed to treat 76 L (20 gal.) of wastewater per minute and averaged 19,000 L (5000 gal.) per day. The treatment plant currently has an active NPDES Permit (#3I000000BD) granted by the state of Ohio.

Landfill North of Winklepeck Burning Grounds (RVAAP-19)

This AOC is an unlined 4-ha (10-acre) landfill site used for general refuse. The landfill was operational from 1969 to 1976. The general appearance of the landfill area suggests a trench and fill method of operation.

An unknown quantity of material was landfilled at this site, including booster cups, aluminum liners, sanitary waste, and possibly explosive and munition waste and ash from the Winklepeck Burning Grounds.

Upper and Lower Cobbs Ponds (RVAAP-29)

The Upper and Lower Cobbs Pond complex was active from 1941 to 1971 as sedimentation basins for explosive pink wastewater. The Upper and Lower Cobbs Ponds complex consisted of two unlined ponds that received the effluent from RVAAP-10 (Load Line 3) and RVAAP-12 (Load Line 12) sawdust filtration units and storm and surface water runoff. Overflow from Upper Cobbs Pond discharged to Lower Cobbs Pond and from there to a receiving stream prior to exiting the facility. Upper Cobbs Pond is approximately 2 ha (5 acres) in size and Lower Cobbs Pond is approximately 1.2 to 1.6 ha (3 to 4 acres) in size. Both ponds have been used for recreational purposes and support abundant fish and wildlife.

A ponded area known as the "backwater area," created by beavers, [about 0.4 ha (1 acre) in size] presently exists south of Upper Cobbs Pond. This area did not exist during plant operations; it also contains abundant fish and wildlife.

In 1966, a large fish kill occurred at Cobbs Pond. The fish kill was attributed to the improper handling of aluminum chloride during the manufacturing operations at RVAAP-12 (Load Line 12). The bulk of the aluminum chloride was collected and disposed of at the RVAAP-01 (Ramsdell Quarry Landfill).

Contaminants of concern include TNT, HMX, Composition B, lead, chromium, mercury, and aluminum chloride. RDX was detected (1.16 μg/ml) in the sediment samples collected from Upper Cobbs Pond during the investigation conducted by The Mogul Corporation in 1982. TNT and RDX were not detected in the sediments from Lower Cobbs Pond.

1.2 SUMMARY OF EXISTING AOC DATA

Available environmental analytical data for most of the high priority AOCs at RVAAP are sparse. Table 1-2 presents a summary of the previous investigations and analytical results for the high priority AOCs being addressed as a part of this RI. Existing analytical data are discussed in greater detail for each AOC in Sect. 4 of this Field Sampling Plan (FSP) where the sampling rationale is presented for each media to be investigated.

Table 1-2 presents a summary of existing analytical data for high priority AOCs.

Table 1-2. Summary of previous investigations of high priority AOCs

Table 1-2. Summary of previous investigations of high priority AOCs							
AOC	Date	Media	Investigation Results (Max. Concentrations)				Comments
			Soil	Sediment	Surface Water	Groundwater	
Demolition Area #2 (RVAAP-04)	1983	Soil	TNT (238.0 ug/g)	-	-	-	RCRA Horseshoe Area - Surface soil investigation
			RDX (535.0 ug/g)				
			HMX (19,598.0 ug/g)				
			DNT (2.4 ug/g)				
			Ba (25.3 mg/l)				
			Pb (535.0 mg/l)				
	1992	Soil	TNT (10.7 mg/kg)	-	-	-	RCRA Area (outside horseshoe) - Soil borings to 15 feet
			RDX (72.6 mg/kg)				Explosives found in surface soils only
			HMX (7.05 mg/kg)				Metals generally <2 x background
			Ba (170.0 mg/g)				
			Cd (3.4 mg/g)				
			Hg (0.28 mg/g)				
			Pb (69.0 mg/g)				
			As (42.0 mg/g)				
	1995	Groundwater	-	-	-	Indicator parameters exceeded	4 RCRA monitoring wells - Quarterly sampling for metals and SVOCs
						HMX & RDX detected in duplicate sample	is ongoing at DemolitionArea #2
						1,2-DCA detected	
Winklepeck Burning Grounds (RVAAP-05)	1983	Soil	TNT (2263.0 ug/g)	-	-	-	70 surface soil samples from 11 active burning pads
			HMX 2976.0 ug/g)				34 samples detected explosives
			HMX (686.1 ug/g)				12 samples detected metals
			Cd (3.6 mg/l)				
			Pb (5.1 mg/l)				
			Ba (197.0 mg/l)				
	1992	Soil/Groundwater	TNT (6.03 mg/kg)	COD (53,000 ug/g)	TNT (4.0 ug/l)	No contamination detected	RCRA Area (Pad #38)
			RDX (39.0 mg/kg)	TOC (17,000 ug/g)	RDX (120.0 ug/l)		4 RCRA monitoring wells - Sampled for metals and explosives
			HMX (2.65 mg/kg)		DNT (2.8 ug/l)		9 surface soil samples and 5 soil borings to 10 feet
			DNT (2.1 mg/kg)		Cd (0.016 mg/l)		Explosives detected in surface soil interval only
			Ba (350 ug/g)		Cu (0.05 mg/l)		All metals detected in soils <6 x background
			Pb (350 ug/g)		Pb (0.01 mg/l)		
			Cr (46 ug/g)		Zn (0.22 mg/l)		
			Se (3.1 ug/g)		Fe (4.6 mg/l)		
			As (53.0 ug/g)				
	1995	Groundwater	-	-	-	Indicator parameters exceeded	4 RCRA monitoring wells - Quarterly sampling for metals and SVOCs
						1,2-DCA detected	is ongoing at DemolitionArea #2
Load Line 1 and Dilution Settling Pond (RVAAP-08)	1981	Sediment/Groundwater	-	TNT (0.3 ug/ml)	-	As (0.063 mg/l)	Sampling locations unknown
				RDX (1.6 ug/ml)			
Load Line 2 and Dilution Settling Pond (RVAAP-09)	1981	Sediment	-	TNT (0.6 ug/ml)	-	-	Sampling locations unknown
				RDX (1.75ug/ml)			
Load Line 3 and Dilution Settling Pond (RVAAP-10)	1982	Sediment	-	TNT (0.17 ug/ml)	-	-	Upper Cobbs Pond
				RDX (1.16 ug/ml)			
Load Line 4 and Dilution Settling Pond (RVAAP-11)	1981	Sediment	-	TNT (0.06 ug/ml)	-	-	Sampling locations unknown
				RDX (0.54 ug/ml)			
Load Line 12 and Dilution Settling Pond (RVAAP-12)	1982	Sediment	-	TNT (0.17 ug/ml)	-	-	Upper Cobbs Pond
				RDX (1.16 ug/ml)			
Building 1200 and Dilution Settling Pond (RVAAP-13)	-	-	-	-	-	-	No known characterization data
Load Line 12 Pink Wastewater Treatment Plant (RVAAP-18)	-	-	-	-	-	-	No known characterization data
Landfill North of Winklepeck Burning Grounds (RVAAP-19)	-	-	-	-	-	-	No known characterization data
Upper and Lower Cobbs Ponds (RVAAP-29)	1982	Sediment	-	TNT (0.17 ug/ml)	-	-	Sampling locations unknown
				RDX (1.16 ug/ml)			

1.3 AOC SPECIFIC SAMPLING AND ANALYSIS PROBLEMS

No specific sampling and analysis problems are anticipated.

2. PROJECT ORGANIZATION AND RESPONSIBILITIES

The Phase 1 RI project organization and responsibilities are presented in Figure 2-1. The functional responsibilities of key personnel are described in Sect. 2 of the Facility-wide FSP and, therefore, are not presented here.

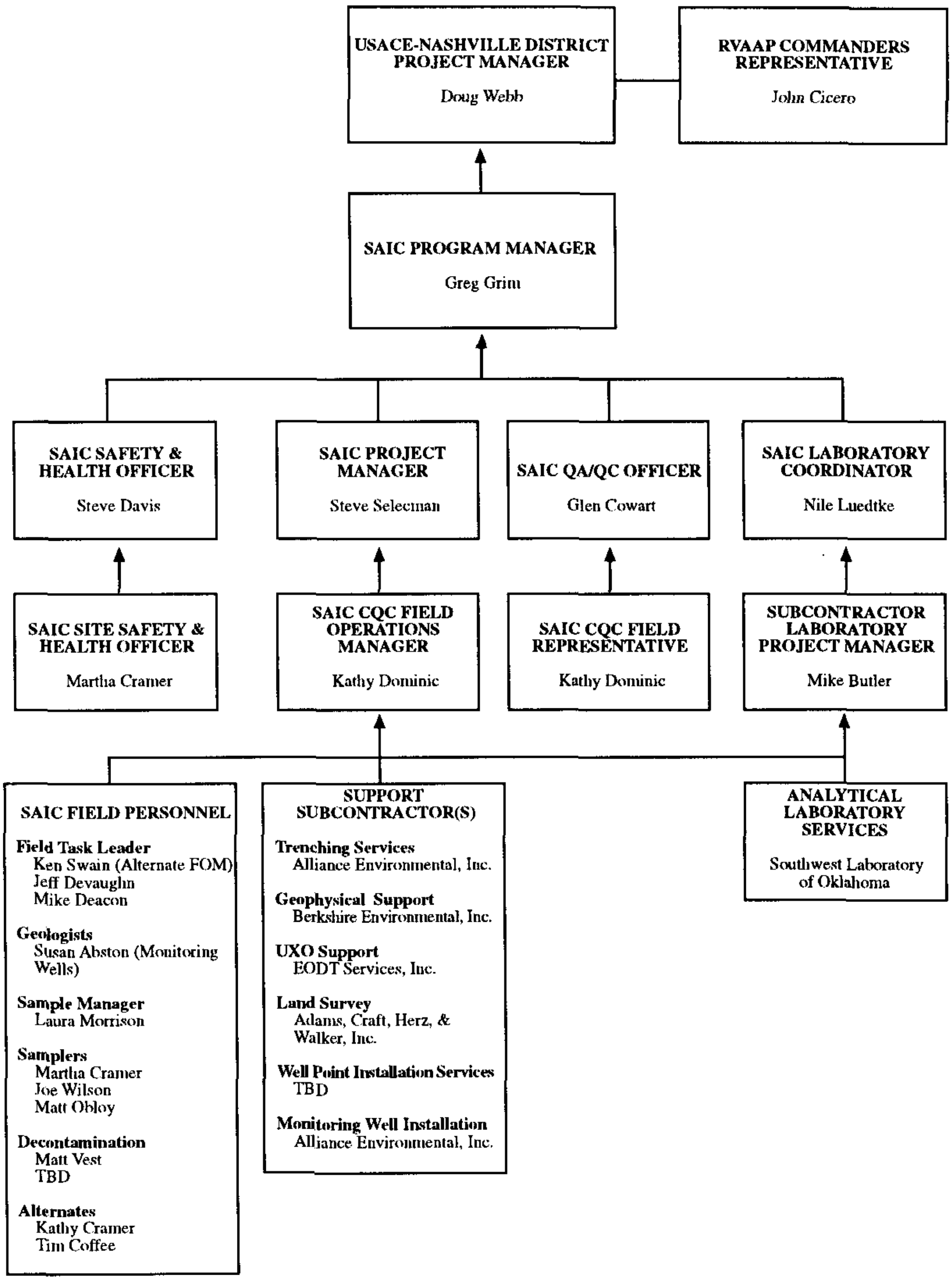


Figure 2-1. SAIC Project Organization Chart for the Phase I RI of High Priority AOCs at RVAAP.

3. SCOPE AND OBJECTIVES

3.1 PHASE 1 RI SCOPE AND OBJECTIVES

The scope of this investigation is to perform an initial assessment of the 11 high priority AOCs at RVAAP as identified in the *Action Plan for the Ravenna Army Ammunition Plant, Ravenna, Ohio* (USACE 1996). The primary objective of the Phase 1 RI of these AOCs is to collect environmental samples from potentially impacted media to confirm if contamination is present and is being released to the environment, and to determine the nature of the potential chemicals of concern (PCOCs). Investigation-specific objectives have been developed using the Data Quality Objectives (DQOs) approach presented in the Facility-wide FSP. AOC-specific sampling objectives are presented for each AOC by media in Sect. 4 of the Facility-wide FSP.

3.2 PHASE 1 RI DATA QUALITY OBJECTIVES

3.2.1 Conceptual Site Model

The conceptual site model presented in the Facility-wide SAP is applicable to the 11 AOCs being investigated during the Phase 1 RI, based on current information. Information collected during the Phase 1 RI will be used to refine the RVAAP site conceptual model.

3.2.2 Define the Problem

The problems to be addressed for each AOC are as follows:

Demolition Area #2 (RVAAP-04) - Soils are potentially contaminated from open detonation of munitions and bulk explosives in unlined earthen pits, and buried white phosphorous, bombs, and potentially hazardous materials. There is a potential for surface water runoff to adjacent Sand Creek. A 1983 United States Army Environmental Hygiene Agency (USAEHA) investigation of this RCRA area detected high concentrations of explosives and metals in surface soils in the horseshoe bermed area. A 1992 USAEHA investigation detected low concentrations of explosives and metals in surface soils in the RCRA area outside the horseshoe bermed area. The 1995 RCRA groundwater monitoring detected indicator parameters above statistical triggers in groundwater. In addition, 1,2-DCA was detected, and HMX and RDX were detected in one duplicate groundwater sample.

Winklepeck Burning Grounds (RVAAP-05) - Open burning of explosive wastes and munitions on earthen "burning pads" has potentially contaminated surface soils. There is potential for surface water runoff to drainage ditches and migration to groundwater. A 1983 USAEHA investigation of 11 active burning pads found significant concentrations of explosives and metals in surface soils and in one drainage ditch. The 1995 RCRA groundwater monitoring detected indicator parameters above statistical triggers. In addition, 1,2-DCA was detected.

Load Line 1 and Dilution/Settling Pond (RVAAP-08) - There is potential for surface soil contamination adjacent to process buildings from washout of explosive and metal residues. There is potential for surface soil, sediment, and surface water contamination from the release of large volumes of process effluent (pink water) containing explosive and metal constituents into unlined earthen ditches. There is potential for sediment, surface water, and shallow groundwater contamination from earthen settling ponds receiving process effluent. Previous sediment samples detected low concentrations of explosives. The settling pond is located in close proximity to the facility boundary. Previous groundwater monitoring detected low concentrations of arsenic.

Load Line 2 and Dilution/Settling Pond (RVAAP-09) - There is potential for surface soil contamination adjacent to process buildings from washout of explosive and metal residues. There is potential for surface soil, sediment, and surface water contamination from the release of large volumes of process effluent (pink water) containing explosive and metal constituents into unlined earthen ditches. There is potential for sediment, surface water, and shallow groundwater contamination from earthen settling pond receiving process effluent. Previous sediment samples detected low concentrations of explosives. The settling pond is located in close proximity to the facility boundary.

Load Line 3 and Dilution/Settling Pond (RVAAP-10) - There is potential for surface soil contamination adjacent to process buildings from washout of explosive and metal residues. There is potential for surface soil, sediment, and surface water contamination from the release of large volumes of process effluent (pink water) containing explosive and metal constituents into unlined earthen ditches. There is potential for sediment, surface water, and shallow groundwater contamination from earthen settling pond receiving process effluent. Sediment samples detected low concentrations of explosives in settling ponds (Cobbs Ponds).

Load Line 4 and Dilution/Settling Pond (RVAAP-11) - There is potential for surface soil contamination adjacent to process buildings from washout of explosive and metal residues. There is potential for surface soil, sediment, and surface water contamination from the release of large volumes of process effluent (pink water) containing explosive and metal constituents into unlined earthen ditches. There is potential for sediment, surface water, and shallow groundwater contamination from earthen settling pond receiving process effluent. Previous sediment samples detected low concentrations explosives. The settling pond is located in close proximity to the facility boundary.

Load Line 12 and Dilution/Settling Pond (RVAAP-12) - There is potential for surface soil contamination adjacent to process buildings from washout of explosive and metal residues. There is potential for surface soil, sediment, and surface water contamination from the release of large volumes of process effluent (pink water) containing explosive and metal constituents into unlined earthen ditches. There is potential for sediment, surface water, and shallow groundwater contamination from earthen settling pond receiving process effluent. Red surface soil stains indicate explosives adjacent to Building FJ-905. Sediment samples detected low concentrations of explosives in settling ponds (Cobbs Ponds).

Building 1200 and Dilution Settling Pond (RVAAP-13) - There is potential for surface soil, sediment, surface water, and groundwater contamination from process effluent (pink water) containing explosive and metal constituents from ammunition sectionalizing operations released to earthen ditch and settling pond.

Load Line 12 Pink Wastewater Treatment Plant (RVAAP-18) - There is potential for surface soil, sediment, surface water, and groundwater contamination from the processing of effluent (pink water) containing explosive and metal constituents. Red surface soil stains have been observed adjacent to Load Line 12 Building FJ-905.

Landfill North of Winklepeck Burning Grounds (RVAAP-19) - There is potential for soil and groundwater contamination from leaching of wastes buried in unlined trenches. Explosive waste residue from Winklepeck Burning Grounds are reported to be buried here. There is potential impact to adjacent surface water via groundwater migration and surface runoff. Location of burial trenches and waste inventory are un-documented.

Upper and Lower Cobbs Ponds (RVAAP-29) - There is potential for sediment, surface water, and groundwater contamination from process effluent containing explosive and metal constituents from Load Line #3 and #12. Low concentration of explosives were detected in sediment and a fish kill was reported in 1966.

3.2.3 Remedial Action Objectives

See Sect. 3.2.3 of the Facility-wide FSP.

3.2.4 Identify Decisions

The key decisions for all investigations at RVAAP have been identified in Table 3-1 in the Facility-wide FSP. Phase 1 RI data may or may not be sufficient to address these decisions. If the data collected during the Phase 1 RI are not sufficient, a Phase 2 RI may be necessary to collect the additional data to address these decisions.

3.2.5 Define Study Boundaries

The investigation area boundary for each AOC is shown as the AOC boundary on the figures presented in Appendix A of the Phase 1 RI SAP Addendum.

3.2.6 Identify Decision Rules

Decision rules used to guide remediation decisions are provided in Sect. 3 of the Facility-wide FSP. As stated in the Facility-wide FSP, Phase 1 RI decision rules are:

- if contamination is less than acceptable risk-based [10^{-6} risk level or hazard quotient (HQ) equals 1] and applicable or relevant and appropriate requirements (ARAR)-based concentrations, no additional action, including sampling, is required;

- if concentrations are greater than risk-based and ARAR-based action levels, then one of two actions may occur:

    1. if Phase 1 data are sufficient to characterize the nature and extent of contamination and to conduct a baseline risk assessment, then proceed to Feasibility Study (FS),

    2. if Phase 1 data are not sufficient to define nature and extent and risk, then proceed to Phase 2 sampling.

3.2.7 Identify Inputs to the Decisions

Input to the decisions are identified on an AOC by AOC basis, depending on the specific problem and specific migration pathways at each AOC. Inputs to the decisions are analytical data that can be used to estimate AOC-specific risk and that can be compared to ARARs.

3.2.8 Specify Limits on Decision Error

Limits on decision errors are addressed in Sect. 3.2.8 of the Facility-wide FSP.

3.2.9 Optimize Sample Design

The sample design for each AOC to be investigated as part of the Phase 1 RI is presented in Sect. 4 of the Facility-wide FSP.

4. FIELD ACTIVITIES

4.1 GEOPHYSICS

Geophysical surveys will be performed at the Landfill North of Winklepeck Burning Grounds (RVAAP-19). The objectives of these surveys are: (1) identify the location of buried materials and possible burial trenches, (2) identify the location of potentially buried ferrous materials, and (3) select locations for sampling buried materials and soils above and below the burials to determine the nature of the buried materials and their potential impact on adjacent soils because of leaching.

4.1.1 Rationales

The Landfill North of Winklepeck Burning Grounds is a 4-ha (10-acre) former landfill site used for the disposal of general plant refuge from 1966-1976. The volume of buried material is not known but is reported to consist of sanitary waste, booster cups, aluminum liners, and possibly explosive and munitions waste from the Winklepeck Burning Grounds. The suspected methods of disposal were elongated trench and fill burials throughout the area. The general orientation of the trenching activity is not known; however, the depth of burials are believed to be shallow-based on the current uneven ground surface at the former landfill area and the adjacent outcropping of bedrock to the north of the landfill area.

Based on the nature of buried materials and the suspected method of landfill operations, electromagnetic (EM) surveys will be performed over the former landfill area for the purpose of locating landfill materials and burial trenches. The results of the survey will be used as the basis for recommending locations in the landfilled area for the purpose of installing test trenches to characterize the nature of the buried materials and soils at this AOC. Subsurface soil sampling at this AOC is addressed in Sect. 4.4 of this SAP Addendum.

4.1.1.1 Methods

EM-31 and EM-61 surveys will be used to conduct continuous profile surveys over the former landfill area on a grid spacing. EM-31 will be used primarily to identify the location of the burial trenches boundaries, while, EM-61 will be used to primarily to identify potentially buried ferrous materials. Survey data will be collected continuously for both in-phase and quadrature measurements and stored electronically for subsequent data evaluation and interpretation. Survey anomalies will be marked along survey lines based on interpretation of field data, and final survey data will be evaluated and interpreted relative to the AOC grid in the form of contour mapping, profiling, and final reporting.

4.1.1.2 Study Area Definition and Measurement Spacing

The approximate boundaries of the former landfill area will define the limits of the EM surveys. Historical aerial photography and current site conditions will be used to approximate the limits of the former landfill area. A 10-ft survey grid will be established over the location of the 4-ha (10-acre) former landfill area, overlapping its approximate boundaries, prior to surveying. Permanent field markers will be installed, to which all surveys will be referenced. EM-31 and EM-61 surveys will be conducted continuously on 10-ft spacing along the established survey grid for the purpose of locating burial materials and trenches. Based on the reported trench and fill nature of the disposal, the 10-ft grid should be effective in locating burial areas for the purpose of locating trench sampling stations. Figure A-8 in Appendix A shows the landfill area and planned survey grid.

4.1.2 Procedures

Surface geophysical methods of remote sensing cover a wide range of techniques. The following guidelines and procedures will be applicable to geophysical surveys using EM profiling devices. During EM surveys, the absolute conductivity of the subsurface is measured to detect lateral and vertical changes in subsurface conductivity that may indicate buried debris or disturbance of the native soil. The geophysical investigation at the RVAAP will require the use of the Geonics EM-31 for frequency domain electromagnetic profiling and the Geonics EM-61 for time domain electromagnetic profiling.

4.1.2.1 Equipment

The Geonics EM-31 is a measurement tool consisting of a transmitter and a receiver in a single device coupled with recording instrumentation. The device is configured as a long pole with opposing ends containing the transmitter and receiver. The device is typically shoulder-carried by a single operator while walking the survey grid.

During operation, emission of a sinusoidal current waveform by the transmitter causes eddy currents (primary field) in the subsurface. These eddy currents cause a secondary EM field that is measured by the EM-31 receiver and displayed as a conductivity on the instrument readout. Ground conductivity is a function of the intensity of the eddy currents. The secondary magnetic field has an inphase and quadrature phase component with the current waveform emitted from the transmitter. Measuring both phases allows differentiation between wastes with and without metallic debris. The EM-31 is of limited usefulness in areas with metallic structures, such as buildings, buried utilities, etc., and in areas with extensive metallic debris on the surface.

The Geonics EM-61 is a time domain EM buried metal detector. The principles of operation for this instrument are similar to the EM-31 with an important exception being that a half-duty cyclic waveform is emitted by the transmitter and measurements are taken during the time the transmitter is off. The instrument consists of one transmitter and two receiver coils mounted within a portable wheeled metal frame. The bottom coil is a transmitter during current on time and a receiver during off time. Instrumentation for the EM-61 includes electronic controls and a data logger.

In contrast to the EM-31, in which measurements of the subsurface eddy current (secondary field) are taken during operation of the transmitter (i.e., generation of the primary field), EM-61 measurements are taken during the transmitter off time. The voltage measurement by the receivers occurs in a time gate during which the current response to buried objects is at the maximum and the response of the soil is at the minimum. Thus the interference of the primary field is eliminated and the signal due to buried objects is enhanced. The design of the EM-61 allows for a reduction in the influence of metallic objects in the survey, increased lateral resolution of buried objects, and detection of both ferrous and nonferrous metals.

Both devices include a data logging instrument displaying tool response. The data logger also allows the operator to input a survey grid line code and a station number for each measurement point along grid lines. Survey measurements are electronically paired and stored with a location code (line number, station number) as the survey progresses.

4.1.2.2 Preliminary Method Testing and Early Termination Procedure

A preliminary test of method will be performed by the geophysical subcontractor with results documented by the SAIC Field Operations Manager (FOM) prior to initiation of the full site investigation survey. This two-part test will be specific to each geophysical instrument and will be completed to ensure satisfactory tool operation in the RVAAP investigation area and allow the tool operator(s) to ascertain the influence on tool response from sources of possible interference (e.g., adjacent metal structures). The test will consist of:

Step 1) The survey of a strip of land adjacent to the site investigation area in which no buried debris is believed to exist. This area will be selected by the SAIC FOM in consultation with the geophysical tool operator(s) and will serve as a baseline determination area for the site survey. The survey will be performed after the tool calibration sequence, as described in Sect. 4.1.2.3. The tool operator will ensure complete tool functionality and response during both Step 1 and Step 2 tests with documentation of the same by the SAIC FOM.

Step 2) The traversing of two survey grid lines within the area of investigation. These lines of survey will be selected by the SAIC FOM in consultation with the geophysical tool operator(s) and should duplicate lines to be surveyed during the site investigation survey. If possible, one selected grid line should be within an area where influence from a metallic structure is likely (e.g., metal building, overhead power lines, etc.) with a second grid line within an area where interference from extraneous sources is not likely. The tool operator will ensure complete tool functionality and response during the survey of and note the influence of metallic structures. Deviation from the line of survey may be required to determine the extent of the area of influence. After completion of Step 2, the survey of the baseline determination area (Step 1) will be repeated to check for response/measurement repeatability. Repeat measurements will be within the tolerance of the specific instrument as specified by the manufacturer or the tool will be considered nonfunctional.

Failure of a tool to respond appropriately during the Steps 1 and 2 tests will be documented by the SAIC FOM. If after determination that anomalous tool response is the result of the site setting and not a tool malfunction, the USACE will be consulted to determine if early termination of the survey is required. If the tool response is sporadic, highly variable, or unreliable based on undisturbed subsurface conditions, the termination of the survey will be recommended to the USACE. If during the course of the site investigation a survey tool must be replaced, a repeat of the tests as outlined in Steps 1 and 2 must be completed with the replacement instrument.

4.1.2.3 Instrument Calibration and Quality Control

Instrument Calibration. Geophysical instruments will be calibrated to manufacturer specifications at the subcontractor's shop prior to mobilization to the RVAAP site. Written documentation of shop calibrations will be furnished to the SAIC FOM upon arrival at the RVAAP site.

Instruments will be calibrated daily in the field as per manufacturer's specifications and documented in writing by the geophysical contractor in a bound field logbook. Information recorded daily during calibration routines will include but not be limited to

- instrument type, identification number, and date of last manufacturer calibration;
- before and after calibration adjustments;
- verification of instrument functionality.

An instruments failing calibration routines will be removed from further service at the RVAAP site. The survey instruments will be tested after calibration by placing a metal body within the area of tool measurement to confirm the system is working properly. In the absence of metal, the EM-61 will read an approximate constant baseline level, usually approximately zero.

Quality Control. The performance of repeat measurements to check precision (repeatability) and accuracy (closeness to the truth) for quality control will be the responsibility of the geophysical tool operator during all phases of surveying. In addition, quality assurance will be maintained by performing

- daily measurements within the baseline determination area to check for consistency in tool measurement;
- repeat measurements of 10% of the survey area to ensure precision in tool measurement;
- surveys at a consistent rate of travel during traverses along each grid to reduce spatial variations in data;
- documentation of spurious responses with description in the field logbook regarding location, possible sources of interference, and results during a repeat survey of the area(s);
- documentation of activities in the survey area that may have an impact on subsequent evaluation of the data;
- a daily downloading of stored survey data to a PC computer with backup of data to removable disk; and
- daily review of recorded data to determine accuracy and quality of measurements.

4.1.2.4 Field Progress/Interpretation Reporting

A requirement of the geophysical survey personnel will be the maintenance of accurate and complete field records, including logbooks and appropriate field data forms. Field logbooks will be of hardcover construction with all entries in permanent ink. All pertinent information will be recorded in these records during all phases of the site survey and will include at a minimum

- the names and affiliations of field personnel;
- a general description of the day's field activities;
- current weather conditions;
- field equipment and instrument numbers;
- field readings from personnel safety instruments (if applicable); and
- field data measurements not recorded electronically.

All logbook entries will be written clearly and legibly. Corrections to entries will be made by lining through the error with a single line such as not to obliterate the correction, and dating and initialing the correction. Unused logbook pages will be identified by drawing a line from corner to corner of the page. Subcontractor logbooks will be reviewed frequently by the SAIC FOM.

Survey progress will be monitored by the SAIC FOM to ensure full and timely completion of all survey grid lines. Surveys may be started after calibrations and operational checks, determination of a base station reference marker for location coordinates, and a walkover of survey grid to locate possible obstacles to traversing of survey lines. Documentation of completion of each of these activities will be made in the field logbook.

It is anticipated the EM-31 and EM-61 will be used for surveying along all survey grid lines at equally spaced measurement stations to take advantage of each tool's capabilities. During the geophysical survey, tool operators will note tool responses indicative of buried waste or a trench. All suspect areas will be marked using high visibility flagging coordinates recorded in the field logbook. During the survey of a suspect area, the area of maximum anomaly (as indicated by tool response) should be determined and noted in the field logbook.

Areas of suspected buried waste or trenches will be reported to the SAIC FOM to determine if a further surveying is required. Upon completion of the survey, the SAIC FOM will be briefed by the tool operator(s) as to survey results, recommendations, and quality of data. All concerns should be resolved with the SAIC Project Manager and FOM prior to demobilization.

4.1.2.5 Measurement Point/Grid Surveying

A grid coordinate system of the entire area to be surveyed will be established prior to the start of geophysical surveying. The survey grid will be marked with stakes and flags for high visibility and subsequent relocation of the survey lines during sampling and land surveying. One corner of the grid will be designated as a base reference station. Survey lines will be spaced 10 ft apart and oriented by the geophysical subcontractor as directed by the SAIC FOM. The measurement points and endpoints of each grid line are to be staked and flagged. A coding system for the grid will be designed for the site by the SAIC FOM in consultation with the geophysical personnel. Accurate and descriptive notes regarding the grid system are to be made in the field logbook for later reference when the grid is located by a land surveying subcontractor.

4.1.2.6 Data Processing

The EM-31 and EM-61 require minimal processing of survey data. Processing will be performed after a complete duplication (backup) of recorded survey data is made. The presentation of collected data will be completed to allow identification, orientation, location, and if possible, depth and shape of buried objects or trenches.

Prior to processing, a quality check of each day's recorded data will be performed. Tool position, as documented in field notes, will be compared against data logger readouts of grid system coordinates to ensure positioning data in data logger (as recorded) are correct and aligned. Each day's recorded survey data will be quality checked against each day's measurements taken in the baseline survey area before merging of entire recorded data sets. Following quality checks, the data processing flow will first merge positioning data (grid location coordinates) to the recorded EM-31 and EM-61 survey measurements, if not automatically merged in the field. All processing steps (e.g., data concatenation, removal of spurious signals, etc.) will be documented in the survey report.

4.1.2.7 Interpretation Techniques

The final survey report will be a complete, thorough discussion of the field survey with emphasis on results. The report will include at a minimum

- a summary description of the survey performed, including any unusual and/or noteworthy findings;
- a procedures section with a discussion of data collection methods and grid layout;
- a Results and Findings section listing or discussing
  - coordinates of the area surveyed,
  - consolidated grid reference maps of the area,
  - contour maps of EM-31 and EM-61 values,
  - a definitive discussion detailing the location, and if possible, size and shape of buried objects (metallic and nonmetallic) accompanied by a map indicating the same;
- a Quality Control section that includes a narrative addressing calibration frequency and background determinations of the survey area and lists of results of all calibrations;
- a Conclusions section; and
- an Appendix with copied pages of field logbook(s).

4.2 SOIL GAS SURVEYS

There will be no soil gas surveys as part of the Phase I RI.

4.3 GROUNDWATER

Groundwater will be investigated during the Phase 1 RI to preliminarily evaluate the potential impact occurring as a result of former operations at Load Lines 1, 2, 3 (Cobbs Ponds Complex), 4, and 12, and the Landfill North of Winklepeck Burning Grounds. Table 4-1 summarizes the Phase 1 RI groundwater investigation activities. Groundwater samples will be collected from the shallow water table at locations immediately downgradient from the load line settling ponds receiving process effluent and the former landfill operations receiving general plant refuge and munitions waste. Based on the site conceptual model, these locations are considered to be the most probable areas to have released contaminants to groundwater because of the consolidated nature of the waste streams they received (i.e., convergence of all load line process effluent drainage ditches to settling ponds and buried waste material). In addition, the nature (i.e., low solubility) of the primary chemicals of potential concern (e.g., nitro-aromatics and metals) and the hydrogeology of the area (i.e., shallow water table and low permeability surficial material), suggest that shallow groundwater would be most likely impacted by a release of these chemicals. Currently, no substantative analytical data exists confirming that groundwater has been impacted by the former operations at these AOCs, and, furthermore, little or no hydrogeologic information exists with regard to the exact depth of groundwater and the general configuration of the potentiometric surface at these locations.

Temporary well points will be installed using direct push techniques in the shallow water table at locations downgradient of these areas to screen for potential contamination and collect preliminary hydrogeologic data. Water level measurements and groundwater samples will be collected from each temporary well point. In addition, four monitoring wells will be installed in the water table zone at the Load Line 1 AOC. Three monitoring wells will be installed adjacent to the facility boundary to monitor for potential migration of contamination outside of the facility and one monitoring well will be located within the load

Table 4-1. Summary of Phase 1 RI Groundwater Investigation

AOC/Sampling Location	Temporary Well Points	Monitoring Wells	Samples/ Station	Total Envrn. Samples	Analytical Parameters: Explosives 8330 Modified	Metals TAL	VOCs 8260A	SVOCs 8270B	Pest/PCB 8081	Cyanide 9013
Load Line 1 (RVAAP-08)	0	4	1	4	4	4	4	4	4	4
Load Line 2 (RVAAP-09)	3	0	1	3	3	3	3	3	3	3
Load Line 3 (Cobbs Ponds Complex) (RVAAP-10 and 29)	3	0	1	3	3	3	3	3	3	3
Load Line 4 (RVAAP-11)	3	0	1	3	3	3	3	3	3	3
Load Line 12 (RVAAP-12 and 18)	3	0	1	3	3	3	3	3	3	3
Landfill North of Winklepeck Burning Ground (RVAAP-19)	6	0	1	6	6	6	6	6	6	6
Total	18	4		22	22	22	22	22	22	22

Metal TAL - Ag, Ba, Cd, Cr, Pb, Al, Mn, Zn, Be, Co, Cu, Fe, K, Mg, Na, Ni, Sb, Ti, V, Se, As
Explosives - HMX, RDX, TNB, DNB, Tetryl, Nitrobenzene, TNT, DNT, and Nitrotoluene

line complex. Groundwater samples will be collected from each monitoring well and in-situ permeability tests will be performed to evaluate the water table zone. Groundwater samples from temporary well points and monitoring wells will be submitted to a fixed-base laboratory for analysis of the analytical parameters identified in Table 4-1.

The objectives of the Phase 1 RI groundwater investigation are to (1) evaluate the potential impact to groundwater downgradient from the most likely release points by screening for the presence or absence of potential groundwater contamination, (2) evaluate the nature and concentration of any potential contamination occurring in shallow groundwater, (3) collect preliminary hydrogeologic information for future characterization of these areas, if necessary, and (4) evaluate the potential for migration of contamination outside of the RVAAP facility via groundwater. The following sections present the sampling rationale and locations for the Phase 1 RI groundwater investigation.

4.3.1 Rationales

4.3.1.1 Well Point and Monitoring Well Locations and Installation

Shallow groundwater will be evaluated using temporary well points at Load Lines 2, 3 (Cobbs Ponds Complex), 4, and 12, and the Landfill North of Winklepeck Burning Grounds. Three temporary well points will be installed at each of the settling ponds at Load Lines 2, 3 (Cobbs Ponds Complex), 4, and 12, and six temporary well points at the former landfill area at the Landfill North of Winklepeck Burning Grounds. Eighteen total temporary well points will be installed as a part of the Phase 1 RI groundwater investigation. Temporary well points will not be installed at Load Line 1 in lieu of the four shallow monitoring wells being installed at this AOC, and the Load Line 3 well points will be installed at the Cobbs Ponds Complex because it served as the settling ponds for Load Lines 3 and 12. Load Line 12 also has separate settling ponds within the load line complex. The load line settling ponds are considered to be the most probable release points to groundwater of explosive compounds and related chemicals from process effluent discharged to the settling ponds. Transport of these chemicals to groundwater from surface water and sediment via percolation has potentially resulted in shallow groundwater contamination. At the load line settling ponds, temporary well point locations are positioned to form a crescent array along the downgradient side of each settling pond to evaluate the potential for a contaminant plume emanating from these locations. The general shallow groundwater flow direction at each settling pond is inferred based on the local topography and surface drainage in each area. Figures A-2, A-3, A-4, and A-5 in Appendix A show the location of the load line settling pond well point stations.

The Landfill North of Winklepeck Burning Grounds is also a probable release point of potential contamination to shallow groundwater from chemical wastes potentially associated with general plant refuge and munitions wastes reported to be buried in the landfill. The transport of chemicals associated with buried wastes via percolation of precipitation and groundwater movement in the vadose zone has potentially resulted in shallow groundwater contamination at this location. Well point locations are positioned to evaluate the potential for a contaminant plume emanating downgradient from the landfilled materials. Based on surface topography, the shallow groundwater flow direction appears to be radial and potentially flowing locally to the north, east, and south from the landfill area. Well point locations are planned in a crescent array along the east and south sides of the landfill area; however, because the former landfill area is bounded on the north by a bedrock bluff outcrop followed by steep local topography leading down to surface water stream, well points are not planned along the north side of the landfill area because of the steep topography and anticipated shallow occurrence of bedrock. Potential groundwater transport of contaminants from the landfill to the north of the area will be evaluated based on sediment samples collected from the stream during the Phase 1 RI (Sect. 4.5). In addition, three temporary well points will be installed within the former landfill area to determine the location of the water table prior to trenching operations and to evaluate potential source leachate from the burials. Figure A-8 shows the location of the landfill area well point stations.

Temporary well points will be installed using a retractable probe hydraulically pushed to the first occurrence of groundwater or refusal, whichever is encountered first, using a truck-mounted rig. It is anticipated that the depth to the water table will range between 0.6 m (2 ft) and 4.57 m (15 ft) below the ground surface across the AOCs to be investigated, and that groundwater will likely be encountered above the bedrock surface in these areas. Based on the nature of the primary chemicals of potential concern (low solubility of explosives and associated metals) and the hydrogeology (shallow occurrence of groundwater, low hydraulic conductivity of surficial glacial till, and no evidence of strong vertical groundwater gradients) at the RVAAP, contamination occurring in groundwater as a result of these AOCs will likely exist in the shallow water table and have a predominant horizontal transport component. Consequently, the maximum depth of each well point will be limited to 4.57 m (15 ft) below ground surface (BGS).

Four monitoring wells will be installed in the shallow water table zone at Load Line 1 (Figure A-1). Three monitoring wells (LL1mw-064, LL1mw-065, and LL1mw-066) will be located in a crescent array downgradient from the Load Line 1 settling pond complex (Griggy's Pond) adjacent to the facility boundary along the inside of the perimeter fence. The objective of the perimeter wells is to evaluate the potential contaminant migration outside of the facility boundary. Because of the long operating history and closeness of Load line 1 to the facility boundary, it is considered to be an optimum location for evaluating the potential for contaminant migration off of the RVAAP facility via groundwater. One monitoring well (LL1mw-063) will be located within the load line complex adjacent to the concrete settling tanks. The objectives of this monitoring well are to evaluate groundwater quality adjacent to a potential major source of contaminant release within the load line complex and provide upgradient hydrogeologic information.

Monitoring wells will be installed using conventional drilling techniques (hollow-stem auger and air rotary) as described in Sect. 4.3.2 and will be installed to screen across the top of the water table. It is anticipated that the depth to the water table will range between 1.5 m (5 ft) and 5.5 m (18 ft) below the ground surface based on existing water well information in the Load Line 1 vicinity. The maximum depth of each monitoring well is expected to be ~9.1 m (30 ft) BGS or less. It is anticipated that the depth to bedrock will range between 1.5 m (5 ft) and 8 m (26.5 ft).

4.3.1.2 Sample Collection and Field and Laboratory Analysis

Temporary well points will be field screened for VOCs using a hand-held photo-ionization detector (PID) or flame ionization detector (FID) organic vapor analyzer (OVA) during groundwater sample collection. Screening will be accomplished by monitoring the headspace vapors at the open end of the well point tools. No samples will be collected for additional field analysis. Water level measurements will also be collected immediately prior to groundwater sampling.

One unfiltered groundwater sample will be collected from each temporary well point and monitoring well and submitted for laboratory analysis. Groundwater samples will be analyzed for explosive compounds, VOCs, SVOCs, pesticides/polychlorinated biphenyls (PCBs), and cyanide. One filtered groundwater sample will be collected and submitted for laboratory analysis for metals [total analyte list (TAL)]. Table 4-1 summarizes the analytical parameters and methods that will be used during the Phase 1 RI. Analytical laboratory methods, analytes, and procedures are further discussed in Sect. 3 of the Phase 1 RI QAPP.

4.3.1.3 Upgradient, Quality Assurance (QA)/Quality Control (QC), and Blank Samples and Frequency

No upgradient groundwater samples will be collected during the Phase 1 RI because of the preliminary screening nature of the Phase 1 RI groundwater investigation. QA/QC duplicate and split groundwater samples, equipment rinsate samples, and trip blanks will be collected during the total Phase 1 RI groundwater investigation. Duplicate and equipment rinsate samples will be selected based on a random statistical basis and analyzed for parameters consistent with the groundwater samples. Duplicate groundwater samples will be collected at frequency of 10% of environmental samples. Split groundwater samples and equipment rinsate samples will be collected at a frequency of 5% of environmental samples. Trip blanks will also be used to accompany shipment of all VOC groundwater samples to the laboratory and will be analyzed for VOCs only.

One source blank will be collected from the potable water source located at Building #1038, which will be used as a central decontamination facility for all Phase 1 RI sampling activities and analyzed for parameters consistent with the groundwater samples. Section 8 in the Phase 1 RI FSP summarizes QA/QC sampling.

4.3.2 Monitoring Well Installation

4.3.2.1 Drilling Methods and Equipment

4.3.2.1.1 Equipment Condition and Cleaning

Requirements for the condition and cleaning of equipment used for well installation are described in Sect. 4.3.2.1.1 of the Facility-wide FSP. These requirements, as applicable, will apply for equipment used to install temporary well points and monitoring wells.

4.3.2.1.2 Drilling Methods

Temporary Well Points. A Geoprobe or equivalent well point installation system will be used to collect groundwater samples, which will allow the collection of groundwater samples without installing permanent monitoring wells. In this method, a screened groundwater sampler is mounted on probe rods and is hydraulically pushed to the sample depth. The groundwater sample is collected in the sampler and brought to the surface through the inside of the probe rods.

Prior to beginning the well point installation, the groundwater sampler is assembled and all fittings and connections are checked for tightness. An expendable drive point is then attached to the leading end of the sampler. A 30.48 cm (12 in.) probe rod will be attached to the upper end of the sampler and topped with the drive cap. Pushing of the assembly will begin using the hydraulically-powered drive unit. Once the sampler is pushed below the surface, the 30.48 cm (12 in.) probe rod will be replaced with a 91.44 cm (36 in.) probe rod. Additional 91.44 cm (36 in.) probe rods will be added as the sampler is advanced in depth. At each 60.96 cm (2 ft) interval from the surface, the driving of the rod will stop and it will be determined if groundwater has been encountered at that depth. This will be done by attaching a vacuum gauge to the rods and applying a vacuum to the inside rod string from the surface. A line pressure gauge will monitor the applied vacuum. In most cases, an unsaturated zone can be identified by a rapid dissipation of pressure in the line. A steady pressure maintained in the line may indicate the presence of water.

If it is believed that groundwater has been encountered at a given depth, the probe rods will be advanced 60.96 cm (2 ft) below that point. The probe rods will then be pulled 45.72 cm (1.5 ft), releasing the groundwater sampler and creating a space for groundwater to enter the boring. A groundwater level measurement will be taken prior to sampling. A stainless steel bailer or tubing connected to a peristaltic pump is then lowered down through the center of the rods and used to collect a groundwater sample. A bailer must be used to collect all VOC groundwater samples.

If the well point does not yield water, it will be allowed to recover for 12 hours and a second attempt to sample will be made. If the well point does not yield water on the second attempt, the boring will be abandoned and an evaluation made as to whether the determination that groundwater had been encountered was valid. Based on this evaluation, additional attempts to obtain groundwater samples at a specific sample location can be made by repeating the procedure. Prior to suspending attempts to collect groundwater samples from well points, attempts should be made to consult the OEPA.

Each well point will be advanced to the shallowest encounter of groundwater or probe refusal. The sampler will not be pushed into bedrock or other impenetrable layers. Precautions should be taken so as not to breach any potentially groundwater confining layers. If groundwater is not encountered prior to probe refusal, the probe rods will be pulled 45.72 cm (1.5 ft) from refusal depth and the boring allowed to recover for 12 hours. An attempt to sample will be made before abandonment. The installation of well points will be scheduled so that sampling and water level measurements for all well points within any AOC can be completed within a 12 hour interval.

Monitoring Wells. Conventional drilling techniques (hollow stem auger and air rotary) will be used to install monitoring wells as described in Sect. 4.3.2.1.2 of the Facility-wide SAP. It is anticipated that the third drilling scenario described under Sect. 4.3.2.1.3 will be applicable for the installation of all four monitoring wells to be installed as a part of this investigation. Monitoring well boreholes will be drilled to a depth sufficient to install the bottom of a 3 m (10 ft) well screen [with a 0.6 m (2 ft) sediment trap] ~2.1 m (7 ft) below the current water table elevation. It is anticipated that the depth to the water table will range between 1.5 m (5 ft) and 5.5 m (18 ft) below the ground surface based on existing water well information in the Load Line 1 vicinity. The anticipated maximum depth of each monitoring well will be ~9.1 m (30 ft) BGS or less. It is anticipated that the depth to bedrock will range between 1.5 m (5 ft) and 8 m (26.5 ft).

The unconsolidated surficial material in each borehole will be drilled using hollow stem auger. If bedrock is encountered before borehole termination, the bedrock interval in each borehole will be drilled using air rotary with a tricone roller bit. A single drill rig capable of both hollow stem auger and air rotary drilling will be used. Precautions should be taken so as not to breach any potentially groundwater confining layers.

4.3.2.2 <u>Materials</u>

4.3.2.2.1 Casing/Screen

Temporary Well Points. The Geoprobe groundwater sampling system is designed for temporary use and, therefore, traditional well construction materials (sand pack, bentonite seal, etc.) are not used. The main components of the Geoprobe system include a sampler and extension (or probe) rods. The sampler is typically 91.44 cm (36 in.) long, with a 2.54 cm (1 in.) outside diameter (OD). It consists of a sampler sheath; stainless steel, slotted screen sleeve; and a stainless steel, 0.145 mm (0.0057 in.) pore size screen. Extension rods, typically 30.48 cm (12 in.) and 91.44 cm (36 in.) in length are both used to drive the sampler to depth.

Monitoring Wells. The casing and screen materials for monitoring wells will be as presented in Sect.4.3.2.2.1 of the Facility-wide FSP.

4.3.2.2.2 Filter Pack, Bentonite, Grout

Temporary Well Points. No filter pack, bentonite, and grout materials will be utilized for temporary well point installation.

Monitoring Wells. The filter pack, bentonite, and grout materials for monitoring wells will be as presented in Sect. 4.3.2.2.2 of the Facility-wide FSP.

4.3.2.2.3 Surface Completion

Temporary Well Points. No surface completions will be utilized for temporary well point installation.

Monitoring Wells. All monitoring wells will be constructed as above ground installations as described in Sect. 4.3.2.2.3 of the Facility-wide FSP.

4.3.2.2.4 Water Source

Potable water from Building #1038 will be used during this investigation for monitoring well and decontamination purposes. The collection and evaluation of the water source sample will follow Sect. 4.3.2.2.4 of the Facility-wide FSP.

4.3.2.2.5 Delivery, Storage, and Handling of Materials

All monitoring well construction materials will be delivered, stored, and handled following Sect. 4.3.2.2.5 of the Facility-wide FSP.

4.3.2.3 Installation

Temporary Well Points. The installation of temporary well points is described in Sections 4.3.2.1.2. and 4.3.2.1.2. Due to the screening level nature of well point groundwater data and the minimal volume of water which can be produced in well points, development of well points will not be conducted prior to sampling.

Monitoring Wells. All monitoring well installation will be in accordance with the procedures for above ground installations presented in Sect. 4.3.2.3 of the Facility-wide FSP. The unconsolidated surficial material in each borehole will be drilled using a 16.5 cm (6.5 in.) inside diameter (ID) hollow stem auger. Soil samples will be collected continuously from the surface to bedrock refusal or borehole termination using a split barrel sampler for lithologic evaluation only. If bedrock is encountered before borehole termination, the bedrock interval in each borehole will be drilled using air rotary with a 15.8 cm (6.25 in.) to 16.5 cm (6.5 in.) tricone roller bit. Samples of bedrock will be collected continuously to borehole termination from drill cuttings for lithologic evaluation only. Soil samples will be collected for lithologic purposes only and no core drilling is planned.

4.3.2.5 Documentation

Temporary Well Points

4.3.2.5.1 Logs and Well Installation Diagrams

4.3.2.5.1.1 Boring Logs

Because the well point installation procedure produces few or no lithologic returns, boring logs will not be completed. Boring logs will be completed for all monitoring well boreholes following Section 4.3.2.5.1.1 of the Facility-wide SAP.

4.3.2.5.1.2 Well Construction Diagrams

Information pertaining to the installation of the temporary well points will be documented on specially formatted field forms. Additionally, a narrative of each process including the sequence of events, special problems, and observations will be documented in a field logbook. This format for documentation will be used in lieu of standard forms specified in Sect. 4.3.2.4. of the Facility-wide FSP because of the numerous differences in monitoring well and well point construction. As required in Sect. 4.3.2.4.1.1 of the Facility-wide FSP, completed original forms will be submitted to the USACE-Nashville district Project Manager. The temporary well point installation form will include at least the following information:

- Unique well point number and location denoted on a sketch map as part of the log.
- Depths or height recorded in feet and decimal fractions thereof (tenths of feet).
- Description of drilling equipment, including such information as drive rod and sampler dimensions (inner and outer diameter) joint descriptions, drive equipment including make and model.
- Dates and times for the start and completion of the borehole along with notation by depth for drill crew shifts and individual days.
- The depth of first-encountered free water with method of determination.
- Any subsequent water level measurements with method of determination.
- The depth interval of well point sampler emplacement (sampling depth).
- Total depth the Geoprobe is driven.
- Definition of any special abbreviations used at the first occurrence of their usage.
- Completion depth/refusal criteria.
- Drilling and sampling personnel.
- Screen length.
- Screen type, screen pore size, and sleeve slot type.

- Screen and sleeve material type.

- Results of organic vapor readings at the borehole with notation as to current drilling depth. A general note on the log indicating the manufacturer, model, and serial number of all monitoring instruments used.

As discussed in Sect. 4.3.2.3, development of well points will not conducted. Photographs will not be taken to document temporary well point field activities.

Monitoring Wells. All monitoring well activities will be documented according to the procedures presented in Sect. 4.3.2.4 of the Facility-wide FSP.

4.3.2.5 Well Abandonment

Temporary Well Points. Well points will be removed immediately after the required samples are collected. Boreholes remaining after well point removal will be abandoned following the requirements specified in Sect. 4.3.2.5 of the Facility-wide FSP.

Monitoring Wells. All monitoring wells will be abandoned according to the procedures presented in Sect. 4.3.2.5 of the Facility-wide FSP.

4.3.2.6 Water Level Measurement

Temporary Well Points. Water level measurements will be obtained twice during the well point installation and sampling process. A water level will first be obtained upon reaching the sampling depth and will again be obtained immediately prior to sampling of the well point. Water level measurements will be made using an electronic water level indicator specially designed for use inside the small diameter well point drive rods and sampler, using the procedure specified in Sect. 4.3.3.1 of the Facility-wide FSP. Measurements will be made to the nearest 0.003 m (0.01 ft) and recorded in depth below the ground surface.

Monitoring Wells. Water level measurements for monitoring wells will follow the procedure presented in Sect. 4.3.3.6 of the Facility-wide FSP.

4.3.3 Field Measurement Procedures and Criteria

Temporary Well Points. All field measurement procedures and criteria will follow the procedures presented in Sect. 4.3.3 of the Facility-wide FSP.

Monitoring Wells. All field measurement procedures and criteria will follow the procedures presented in Sect. 4.3.3 of the Facility-wide FSP.

4.3.4 Sampling Methods for Groundwater - General

Temporary Well Points. Groundwater sampling from well points will be conducted after the well point sampler has been advanced to the sampling depth. Samples will may be collected using a combination of bailing and pumping methods. The analytes for each well point and the total number of well point samples for each AOC are presented in Table 4-1.

After the pre-sampling water level has been measured, groundwater sampling will begin using a decontaminated, stainless steel bailer. Sampling with the bailer will follow the applicable requirements for this activity presented in Sect. 4.3.4 of the Facility-wide FSP. In all cases, a bailer will be used to collect the VOC fraction of the groundwater samples. Use of the bailer will continue until insufficient water volume exists within the well point for its use to be efficient. If the use of a bailer is discontinued, the remaining sample fractions will be collected using a peristaltic pump. When a peristaltic pump is used, new, disposable Teflon or polyethylene sample tubing is slowly placed down the well point probe rods to a position within the well point sampler. Samples are drawn with the peristaltic pump and dispensed to the remaining sample bottles. In the event that a peristaltic pump cannot be used to obtain the sample, a bottom check valve may be placed on the end of the tubing and the tubing may be used as a bailer. Any tubing used for sampling will be discarded after sampling at a well point.

Monitoring Wells. *Groundwater sampling from monitoring wells will follow the procedures presented* in Sect. 4.3.4 of the Facility-wide FSP.

4.3.5 Sampling Methods for Groundwater - Filtration

Groundwater samples collected for dissolved metals will be filtered by negative pressure utilizing a hand-operated pump, collection flask, polytetrafloutoethylene (PTEE) tubing, and a presterilized, disposable, 0.45 μm pore size filter assembly. Before collecting the water sample, the pump and filter apparatus will be assembled. A bailer will then be lowered into the monitoring well, filled with groundwater, and raised to the surface. The groundwater will be transferred from the bailer to a decontaminated collection flask and poured into the filter funnel portion of the filtration assembly. Care will be taken to avoid transferring solids that may have settled to the bottom of the collection flask. The hand-operated pump will be used to create a vacuum in the assembly to start filtration. Sample bottles will be filled with discharged water exiting from the disposable filter. Filters will be replaced as they become restricted due to solid buildup and also between sample collection sites. For highly turbid samples, a prefilter with a large pore size may be used.

Temporary Well Points. Filtered groundwater samples will be collected from well points for metals analysis only. All other groundwater samples collected will be unfiltered.

Monitoring Wells. Filtered groundwater samples will be collected from monitoring wells for metals analysis only. All other groundwater samples collected will be unfiltered.

4.3.6 Sample Containers and Preservation Techniques

Requirements for sample containers and preservation techniques for groundwater samples are presented in Sect. 4.3.6 of the Facility-wide FSP and in Sect. 4.0 of the Phase 1 RI QAPP.

4.3.7 Field Quality Control Sampling Procedures

Quality control samples for well point and monitoring well groundwater sampling activities will include duplicates and split groundwater samples, equipment rinsates, and trip blanks. Section 8 in the Phase 1 RI FSP summarizes the QA/QC samples that will be collected during this investigation. Duplicate and split groundwater samples will be collected at a frequency of 10% (1/10 environmental samples). Split groundwater samples will be collected at a frequency of 10%. Duplicate and split samples will be collected randomly and will be submitted to the analytical laboratory for the same analyses as the environmental samples. Split samples will be submitted to a USACE laboratory for independent analysis.

Equipment rinsate blanks will be collected from equipment used for well point and monitoring well sampling. Equipment rinsate blank samples will be collected at a frequency of 5% (1/20 environmental samples). Equipment rinsate blank samples will be collected randomly and will be submitted to the analytical laboratory for the same analyses as the environmental samples.

One trip blank will be included in each cooler containing environmental samples delivered to the analytical laboratory for VOC analysis. Trip blanks will be analyzed for VOCs only.

4.3.8 Decontamination Procedures

Decontamination of equipment associated with groundwater sampling will be in accordance with the procedure presented in Sect. 4.3.8 of the Facility-wide FSP.

4.3.9 In-Situ Permeability Testing

A slug test will be conducted in each the four monitoring wells installed as part of the Phase 1 RI to determine the hydraulic conductivity of the geologic material surrounding each well. The slug test method involves the lowering or raising of the static water level in a well bore by the removal or insertion of a cylinder (slug). The return of the water to a pretest static level is then monitored over time. The change in water level over time is plotted on a logarithmic scale to determine hydraulic conductivity (K). K is a function of the formation permeability and formation fluid, with the determination of K influenced by well construction. The slug removal (rising head) method will be used for this investigation.

If possible, the slug test method used will be conducted to prevent the water level in the monitoring well from dropping below the top of the screened interval when the slug is removed. These tests will be conducted following groundwater sampling as described in Sect. 4.3.4 and will be contingent upon a monitoring well containing sufficient water to allow testing.

Slug tests in monitoring wells will only be initiated after the well has recovered from groundwater sampling or a minimum of 12 hours has elapsed since sampling. The pressure transducer and decontaminated slug will be inserted into the well and the water level allowed to equilibrate to static conditions or at least six hours. A slug that displaces 0.3 m (1 ft) of water should be sufficient to provide an adequate recovery response for the analysis.

Prior to the start of the test, plastic sheeting will be placed around the well in a manner to minimize water contact with the ground surface. The static water level will be measured with an electronic water level indicator and recorded to the nearest 0.003 m (0.01 ft) below the top of casing. The total depth of the well will be measured with an electronic water level indicator and recorded to the nearest .003 m (0.01 ft). These measurements will be used to calculate the water column height in the well. Use of the electronic water level meter will follow procedures outlined in Sect. 4.3.3.1.

To begin the test, the slug will be withdrawn quickly from the monitoring well, but without surging the well. The time of the test will begin as soon as the slug leaves the water column. Water level measurements will be measured to within 0.003 m (0.01 ft) with a pressure transducer and data logger programmed to record measurements to a logarithmic time interval. Water level change will be recorded for a period of six hours or until the well re-equilibrates to 90% of the pretest water level, whichever occurs first.

The test data will be evaluated by the Bouwer and Rice Method (1976, 1989) or the Cooper et al. method (1967). If the test geometry is not conducive to analysis by the Bouwer and Rice or Cooper methods, an alternate method that more closely models the test geometry will be used.

4.4 SUBSURFACE SOIL

Subsurface soil samples will be collected during the Phase 1 RI at the Demolition Area #2 (RVAAP-04) and the Landfill North of Winklepeck Burning Grounds (RVAAP-19) to investigate potential subsurface contamination occurring as result of open detonation of explosives and munitions in earthen pits and landfilling of general plant refuse, including explosive wastes, at these AOCs. Based on historical records and process knowledge, these are the only AOCs being investigated during the Phase I RI where potential subsurface release mechanisms are documented. Potential sources of contamination and release mechanisms at the other AOCs being investigated are at or above the ground surface media at these AOCs during the Phase I RI. Table 4-2 summarizes the planned Phase 1 RI subsurface soil investigation activities.

Subsurface soils in the Open Detonation Area #2 are potentially contaminated from the detonation of munitions and off-specification bulk explosives in unlined pits excavated to a minimum of 0.6 to 1.2 m (2 to 4 ft) at this AOC. The detonation pits are believed to be randomly located in the cleared part of the AOC north of Sand Creek. Reports by former employees indicate that most detonation pits were located in close proximity to the road traversing through the AOC. Burial areas containing white phosphorus, bombs, and other potentially hazardous materials are also reported to exist at this AOC; however, their exact locations are uncertain. One potential burial site [61 m (200 ft) long × 3 m (10 ft) wide × 1.2 m (4 ft) deep] is reported to be located in the topographic swale in the northwest part of the AOC, and another burial site (dimensions unknown) is reported to be located along the north embankment of Sand Creek where an "Off-Limits, Dangerous Materials" sign is posted. The locations of these potential burial sites are based on visual observations of exposure of buried material at the surface.

A 1983 investigation (USAEHA 1983) consisting of 10 surface soil samples collected from the RCRA part [0.6 ha (1.5 acres) with 0.1 ha (0.25 acre) bermed horseshoe area] of Open Detonation Area #2 detected explosives (TNT, RDX, and HMX) ranging from 1.2 μg/g to 19,598 μg/g and metals (barium and lead) ranging from 1.8 mg/L to 535 mg/L. A 1992 investigation (USAEHA 1992) installed nine soil borings to bedrock refusal [<4.5 m (15 ft)] and collected subsurface soil samples from the RCRA area immediately adjacent to the east of the horseshoe area. Low concentrations (< 10 μg/g) of explosives (TNT, ROX, and Harx) were detected in the surface interval [0-0.6 m (0-2 ft)] in six of the nine soil borings with one surface sample showing 72.6 μg/g RDX. No explosives were detected below the surface interval. Low concentrations (generally <2 × background concentrations) of metals (barium, cadmium, mercury, lead, and arsenic) were also detected in soils.

The objectives of the subsurface soil sampling at the Open Detonation Area #2 are to (1) confirm the presence or absence of soil contamination and (2) characterize the nature of potential contamination occurring as a result of the former detonation pits and munitions burials located north of Sand Creek. Characterization of the RCRA area is not a objective of the Phase 1 RI.

Subsurface soils at the Landfill North of Winklepeck Burning Grounds are potentially contaminated as a result of disposing general plant refuse, including explosive wastes, in a 10 acre unlined burial area at this AOC. Landfilled materials are reported as booster cups, aluminum liners, sanitary waste, explosive

Table 4-2. Summary of Phase 1 RI Subsurface Soil Investigation

AOC/Sampling Location	Soil Borings	Trenches	Samples/ Station	Total Envrn. Samples	Analytical Parameters EXPLs 8330	Site-Related Metals	Metals TAL	VOCs 8260A	SVOCs 8270B	Pest/PCB 8081	Cyanide 9013
Demolition Area #2 (RVAAP-0	30	0	2	60	60	55	5	3	3	3	3
Landfill North of Winklepeck Burning Ground (RVAAP-19)	0	10	3	30	30	5	25	27	27	27	27
Total	30	10		90	90	60	30	30	30	30	30

Metals TAL - Ag, Ba, Cd, Cr, Pb, Al, Mn, Zn, Be, Co, Cu, Fe, K, Mg, Na, Ni, Sb, Ti, V, Se, As
Site-related metals - Ag, Ba, Cd, Cr, Pb, Al, Mn, Zn, As, Hg, Se
Explosives - HMX, RDX, TNB, DNB, Tetryl, Nitrobenzene, TNT, DNT and Nitrotoluene

and munitions waste and ash, and scrap metal from the Winklepeck Burning Grounds. No burial inventory records exist. Subsurface soils are potentially impacted as a result of leaching of contaminants from these burials.

The objectives of subsurface soil sampling at the Landfill North of Winklepeck Burning Grounds are to (1) evaluate the nature of the buried materials, (2) confirm the presence or absence of contamination in the soils adjacent to the burials, and (3) characterize the nature of potential contamination occurring as a result of the former landfill operations.

The following sections present the sampling rationale and locations for the subsurface soil investigation planned for each of the AOCs during the Phase 1 RI.

4.4.1 Rationales

4.4.1.1 Soil Boring and Trench Locations

Demolition Area #2. Subsurface soil at the Open Detonation Area #2 will be investigated by installing 30 shallow soil borings to a depth of 1.2 m (4 ft) using a hand-operated power auger. Because of the potential for UXO at this AOC, each soil boring location will be surveyed prior to drilling by UXO-certified technician using a magnetometer at the ground surface to detect potential UXO. If UXO is suspected, the boring location will be moved and UXO surveying continued until a clear area is located. While drilling, each soil boring will be surveyed down-hole at 0.6 m (2 ft) intervals using a magnetometer to detect potential UXO. If UXO is suspected, the soil boring will be terminated without advancing further. All potential UXO will be avoided.

Soil borings are planned in the area north of Sand Creek adjacent to areas of suspected munitions burials (northwest and along Sand Creek embankment) and in the areas reported to contain former detonation pits. Former detonation pits were reported by former employees to have been in close proximity to the roads traversing the AOC and sketch drawings on maps (USAEHA 1983) show six elongated areas (two west of the road and four east of the road) parallel to the RCRA horseshoe area; therefore, soil boring locations have been concentrated in these areas and space outwardly from these areas on ~30.5 m (100 ft) centers to evaluate potentially unknown detonation pits. The location of all soil borings will be field checked, in addition to UXO screening, based on a visual survey of AOC conditions to ensure their optimum placement prior to drilling. The planned soil boring locations are shown in Fig. A-9 in Appendix A.

Landfill North of Winklepeck Burning Grounds. A geophysical survey of the former landfill area will be conducted as presented in Sect. 4.1 of the Phase 1 RI FSP to locate probable burial trenches. Based on the results of the geophysical survey, 10 sampling trench locations will be selected to intersect former burial trenches (geophysical anomalies) to characterize the nature of the buried wastes and the soils adjacent to the burial grounds across the AOC. Prior to initiating any trenching activities, three well points (Sect. 4.3 of the Phase 1 RI FSP) will be installed within the landfill area to determine the elevation of the water table so all trench excavations can be terminated above the water table elevation. The dimension of each trench will be ~4.5 m (15 ft) long × 0.6 m (2 ft) wide × 3 m (10 ft) deep but will not intersect the water table. The planned trench locations are arbitrarily shown on Fig. A-8 in Appendix A because the geophysical survey has not currently been conducted; however, the planned geophysical survey grid and well point locations are shown at their planned locations.

4.4.1.2 Soil Sampling Requirements

Demolition Area #2. Two composite soil samples (60 total samples from 30 soil borings) will be collected from each soil boring using hand auger techniques from 0-0.6 m (0-2 ft) and 0.6-1.2 m (2-4 ft).

Landfill North of Winklepeck Burning Grounds. Three composite soil samples will be collected from each trench location. One soil sample will be collected from the surface interval [0-0.6 m (0-2 ft)], one sample from the within the waste material, and one sample from the soil 0.6 m (2 ft) beneath the buried waste. Field observations will be used to select the final sample intervals.

4.4.1.3 Sample Collection and Field and Laboratory Analysis

All soil borings and trenches will be field screened for VOCs using a hand-held PID or FID OVA during installation and sample collection. No samples will be collected for additional field analysis.

Each soil sample collected will be submitted for laboratory analysis as presented on Table 4-2. Subsurface soil samples from the Demolition Area #2 will be analyzed for explosives and metals (90% site-related metals and 10% TAL metals). Subsurface soil samples from the Demolition Area #2 will be additionally analyzed at a frequency of 5% (1/20) for VOCs, SVOCs, pesticides/PCBs, and cyanide. Subsurface soil samples from the Landfill North of Winklepeck Burning Grounds will be submitted for explosive compounds, metals (10% site-related and 90% TAL metals), VOCs, SVOCs, pesticides/PCBs, and cyanide. Analytical methods, analytes, and procedures are discussed further in Sect. 3 of the Phase I RI QAPP.

4.4.1.4 Background, QA/QC, and Blank Samples and Frequency

No background soil samples will be collected from these AOCs during the Phase 1 RI. Background soil sampling is presented in Sect. 4.5.1.6. Subsurface soil QA/QC samples (duplicate and split) will be collected during the Phase 1 RI. Duplicate soil samples will be collected at a frequency of 10% (1/10 environmental samples) the total Phase 1 RI subsurface soil investigation. Split samples will be submitted to USACE laboratory for independent analysis. Duplicate and split samples will be selected based on a random statistical basis and submitted for similar laboratory analysis. Split samples will be collected at 5% (1/20 environmental samples). Section 8 in the Phase 1 RI FSP summarizes QA/QC sampling.

4.4.2 Procedures

4.4.2.1 Drilling Methods

4.4.2.1.1 Equipment Condition and Cleaning

Requirements for the condition and cleaning of equipment used for subsurface soil sampling are defined in Sect. 4.3.2.1.1 of the Facility-wide FSP. Augers will be free of paint. Additional information regarding the decontamination of drilling and sampling equipment used for soil sample collection is presented in Sect. 4.4.2.8 of the Facility-wide SAP.

4.4.2.1.2 Hollow Stem Auger Drilling Method

The Hollow Stem Auger Drilling Method will not be used during subsurface soil sampling activities.

4.4.2.1.3 Trenching Method

The procedure for trenching is presented in Sect. 4.4.2.1.3 of the Facility-wide FSP.

4.4.2.1.4 Bucket Hand Auger Method

The use of the bucket hand auger will follow the procedure outlined in Sect. 4.4.2.1.4 of the Facility-wide FSP. For this investigation, all stainless steel auger buckets will be used, with samples cylinders ~16.5 cm (6.5 in.) long and 8.9 cm (3.5 in.) in diameter. Overall length of the bucket, including the cutting edges, will be ~30.5 (12 in.) Extensions will be of lengths appropriate to obtain samples from the required depth intervals and will be fit with compatible cross handles. The extensions and cross handles will be composed of chrome molybdenum steel.

Hand-operated Power Auger. A hand-operated power auger will be used in conjunction with bucket hand augers to create the borings at the Demolition Area 2 AOC. Combining the use of the hand-operated power auger with bucket hand augers allows the collection of subsurface soil samples to greater depths than outlined in Sect. 4.4.2.1.4 in the Facility-wide FSP.

The hand-operated power auger consists of a gasoline engine powered hydraulic drive, torque tube, and handle attachment. Auger flights are attached to and rotated by the handle attachment assembly and borings produced by advancing the auger into the subsurface. The dimensions of each auger flight will be 1.9 m (3 ft) in length and 15.2 cm (6 in.) in diameter and composed of plain steel. To auger the borings to a total depth of greater than 1.9 m (3 ft), multiple auger flights are required.

At the Demolition Area 2 AOC, the total depth of each boring is to be 1.2 m (4 ft). Subsurface soil will be sampled from the 0 to 0.6 m (0 to 2 ft) and 0.6 to 1.2 m (2 to 4 ft) intervals in each boring. Once the boring has been advanced to the top of a specific sample interval with the hand-operated power auger, the collection of subsurface soil samples will be performed with bucket hand augers (Sects. 4.4.2.4.2 and 4.4.2.5.2, Facility-wide FSP). Use of the hand-operated power auger in this manner assures the auger flight will not advance into a sample depth interval prior to sampling of that interval.

4.4.2.2 Boring Logs

No boring logs will be completed during subsurface soil sampling activities.

4.4.2.3 Field Measurement Procedures and Criteria

Field measurement procedures and criteria are presented in Sect. 4.4.2.3 of the Facility-wide FSP.

4.4.2.4 Sampling for Physical/Geotechnical Analyses

4.4.2.4.1 Hollow Stem Auger Drilling Method

Sampling for physical/geotechnical analyses will not be completed using the Hollow Stem Auger Drilling Method.

4.4.2.4.2 Bucket Hand Auger Method

Procedures for sampling for physical/geotechnical analyses using the Bucket Hand Auger Method are presented in Sect. 4.4.2.4.2 of the Facility-wide FSP.

4.4.2.5 Sampling for Chemical Analyses

4.4.2.5.1 Hollow Stem Auger Drilling Method

Sampling for chemical analyses will not be completed using the Hollow Stem Auger Drilling Method.

4.4.2.5.2 Bucket Hand Auger Method

Procedures for sampling for chemical analyses using the Bucket Hand Auger Method are presented in Sect. 4.4.2.5.2 of the Facility-wide FSP.

4.4.2.6 Sample Containers and Preservation

Requirements for sample containers and preservation techniques for subsurface soil samples are presented in Sect. 4.4.2.6 of the Facility-wide FSP and Sect. 4.0 of the Phase 1 RI QAPP.

4.4.2.7 Field Quality Control Sampling Procedures

Quality control samples for subsurface soil sampling activities will include duplicates and split samples. Section 8 in the Phase 1 RI FSP summarizes the QA/QC samples that will be collected during this investigation. Duplicate subsurface soil samples will be collected at a frequency of 10% (1/10 environmental samples). Split samples will be collected at a frequency of 5% (1/20 environmental samples). Duplicate and split samples will be collected randomly and will be submitted to the analytical laboratory for the same analyses as the environmental samples. Split samples will be submitted to a USACE laboratory for independent analysis.

4.4.2.8 Decontamination Procedures

The decontamination procedure for subsurface soil sampling activities is presented in Sect. 4.4.2.8 of the Facility-wide FSP.

4.5 SURFACE SOIL AND SEDIMENT

Surface soil and sediment samples will be collected during the Phase 1 RI to evaluate residual soil and sediment contamination potentially occurring as a result of former operations at these AOCs. Surface soil samples will be collected at and/or adjacent to former operational locations (process buildings, burning pads, and detonation areas) within the AOCs, and sediment samples will be collected from drainage ditches and settling ponds associated with process effluent discharge and surface water runoff from these areas. Table 4-3 summarizes the Phase 1 RI planned surface soil and drainage sediment investigation, and Table B-1 in Appendix B summarizes the planned pond and stream sediment sampling activities at each of the AOCs.

Based on process information and documented reports from former RVAAP workers, the processing of explosives into munitions and the demilitarization of munitions at Load lines 1, 2, 3, 4, and 12, and Building 1200 resulted in the release of explosive compounds onto surface soils adjacent to process buildings and into drainage ditches flowing to earthen settling ponds. Based on the operational process, releases of explosive materials into the environment occurred at the surface adjacent to process buildings from wash-out operations and as process effluent was discharged from buildings through concrete settling tanks to surface drainage ditches and earthen settling ponds. Surface soil and sediment from these areas

Table 4-3. Summary of Phase I RI Surface Soil and Drainage Sediment Investigations

AOC/Sampling Location	Sample Stations	Sampling Method	Depth (ft)	Samples/Station	Total Samples	Analytical Parameters (Methods): EXPLs (8330)	Site-related Metals	Metals (TAL)	VOCs (8260A)	SVOCs (8270B)	Pests/PCB (8081)	Cyanide (9013)	TOC	Grain Size
Load Line 1 (RVAAP-08)														
Melt Pour Bldgs. (2)	16	HA/Comp	0-2	1	16	16	14	2	2	2	2	2		
Concrete Settling Tanks	8	HA/Comp	0-2	1	8	8	7	1	1	1	1	1		
Truck Service Bldgs.	2	HA/Comp	0-2	1	2	2		2	2	2	2	2		
Paint & Oil Bldg.	1	HA/Comp	0-2	1	1	1		1	1	1	1	1		
Truck Washout Bldg.	3	HA/Comp	0-2	1	3	3	2	1	1	1	1	1		
Drilling & Boostering Bldg.	7	HA/Comp	0-2	1	7	7	6	1	1	1	1	1		
Propellent Charge Bldg.	1	HA/Comp	0-2	1	1	1		1	1	1	1	1		
H.E. Prep. Bldgs.	2	HA/Comp	0-2	1	2	2	2							
Drainage Ditches	7	HA/Comp	0-2	1	7	7	6	1	1	1	1	1	7	7
TBD	2	HA/Comp	0-2	1	2	2	1	1	1	1	1	1		
Background	3	HA/Comp	0-3	1	3		3							
TOTAL	52				52	49	41	11	11	11	11	11	7	7
Load Line 2 (RVAAP-09)														
Melt Pour Bldgs. (2)	16	HA/Comp	0-2	1	16	16	14	2	2	2	2	2		
Concrete Settling Tanks	8	HA/Comp	0-2	1	8	8	7	1	1	1	1	1		
Truck Service Bldg.	2	HA/Comp	0-2	1	2	2		2	2	2	2	2		
Paint & Oil Bldg.	1	HA/Comp	0-2	1	1	1		1	1	1	1	1		
Truck Washout Bldg.	3	HA/Comp	0-2	1	3	3	2	1	1	1	1	1		
Drilling & Boostering Bldg.	7	HA/Comp	0-2	1	7	7	6	1	1	1	1	1		
H.E. Prep Bldgs.	2	HA/Comp	0-2	1	2	2	2							
Drainage Ditches	6	HA/Comp	0-2	1	6	6	5	1	1	1	1	1	6	6
TBD	3	HA/Comp	0-2	1	3	3	2	1	1	1	1	1		
Background	3	HA/Comp	0-3	1	3		3							
TOTAL	51				51	48	41	10	10	10	10	10	6	6
Load Line 3 (RVAAP-010)														
Melt Pour Bldgs. (2)	16	HA/Comp	0-2	1	16	16	14	2	2	2	2	2		
Concrete Settling Tanks	6	HA/Comp	0-2	1	6	6	5	1	1	1	1	1		
Truck Service Bldg.	2	HA/Comp	0-2	1	2	2		2	2	2	2	2		
Paint & Oil Bldg.	1	HA/Comp	0-2	1	1	1		1	1	1	1	1		
Truck Washout Bldg.	3	HA/Comp	0-2	1	3	3	2	1	1	1	1	1		
Drilling & Boostering Bldg.	7	HA/Comp	0-2	1	7	7	6	1	1	1	1	1		
H.E. Prep Bldgs.	2	HA/Comp	0-2	1	2	2	2							
Drainage Ditches	8	HA/Comp	0-2	1	8	8	7	1	1	1	1	1	8	8
TBD	5	HA/Comp	0-2	1	5	5	4	1	1	1	1	1		
Background	3	HA/Comp	0-3	1	3		3							
TOTAL	53				53	50	43	10	10	10	10	10	8	8

HA = Hand Auger Comp = Composite Sample

Table 4-3. (continued)

AOC Site Location	Sample Stations	Sampling Method	Depth (ft)	Samples/Station	Total Samples	Analytical Parameters (Methods)							TOC	Grain Size
						EXPLs (8330)	Site-Related Metals	Metals (TAL)	VOCs (8260A)	SVOCs (8270B)	Pests/PCB (8081)	Cyanide (9013)		
Load Line 4 (RVAAP-011)														
Melt Pour Bldg.	13	HA/Comp	0-2	1	13	13	11	2	2	2	2	2		
Concrete Settling Tanks	10	HA/Comp	0-2	1	10	10	9	1	1	1	1	1		
Service Bldgs. (4)	4	HA/Comp	0-2	1	4	4		4	4	4	4	4		
Ammunition Cooling	9	HA/Comp	0-2	1	9	9	8	1	1	1	1	1		
Transfer & Weighing Bldg.	4	HA/Comp	0-2	1	4	4	3	1	1	1	1	1		
H.E. Prep. Bldg.	2	HA/Comp	0-2	1	2	2	2							
Drainage Ditches	4	HA/Comp	0-2	1	4	4	3	1	1	1	1	1	4	4
TBD	2	HA/Comp	0-2	1	2	2	1	1	1	1	1	1		
Background	3	HA/Comp	0-3	1	3		3							
TOTAL	51				51	48	40	11	11	11	11	11	4	4
Load Line 12 (RVAAP-12)														
Bomb Disassembly Bldg. FA-900	3	HA/Comp	0-2	1	3	3	2	1	1	1	1	1		
Bomb Melt-Out & Packing Bldg. F-104	8	HA/Comp	0-2	1	8	8	7	1	1	1	1	1		
Waste Water Treatment	2	HA/Comp	0-2	1	2	2		2	2	2	2	2		
TNT Reclamation	8	HA/Comp	0-2	1	8	8	7	1	1	1	1	1		
Drainage Channels	15	HA/Comp	0-2	1	15	15	13	2	2	2	2	2	15	15
Neutral Liquor Building	2	HA/Comp	0-2	1	2	2	1	1	1	1	1	1		
TBD	9	HA/Comp	0-2	1	9	9	8	1	1	1	1	1		
Background	3	HA/Comp	0-3	1	3		3							
TOTAL	50				50	47	41	9	9	9	9	9	15	15
Building 1200 (RVAAP-013)														
Building 1200	2	HA/Comp	0-2	1	2	2	1	1	1	1	1	1		
Drainage Ditch	5	HA/Comp	0-2	1	5	5	4	1	1	1	1	1	5	5
TOTAL	7				7	7	5	2	2	2	2	2	5	5
Winklepeck Burning Ground (RVAAP-03)														
Burning Pad	86	HA/Comp	0-2	1	86	86	77	9	9	9	9	9		
Ditches	13	HA/Comp	0-2	1	13	13	11	2	2	2	2	2	13	13
TOTAL	90				99	99	88	11	11	11	11	11	13	13
SOIL INVESTIGATION TOTAL	363				363	348	299	64	64	64	64	64	58	58

Site-related metals - Ag,Ba,Cd,Cr,Pb,Al,Mn,Zn: 3005A/6010A; As: 7060A; Hg: 7471A; Se: 7740
Explosives - HMX, RDX, TNB, DNB, Tetryl, Nitrobenzene, TNT, DNT, and Nitrotoluene

Metals TAL - Ag,Ba,Cd,Cr,Pb,Al,Mn,Zn,Be,Ca,Co,Cu,Fe,K, Mg,Na,Ni,Sb,Ti,
V: 3005A/6010A; As: 7060A; Se: 7740

are of greatest concern at these AOCs. The open burning and detonation of munitions and explosive wastes at the Winklepeck Burning Grounds and the Open Detonation Area No. 2 also resulted in the release of explosive compounds and associated chemicals (primarily metals) at the surface in areas where these activities occurred. The surface soils and adjacent drainage ditches are of greatest concern at these AOCs. In addition, landfilling operations at the former Landfill North of Winklepeck Burning Grounds are a potential source of chemical release to the environment from buried general plant refuge and explosive wastes. Sediment occurring in the surface water drainage adjacent to the former landfill site is of concern.

Because of the low solubility nitro-aromatic and metal compounds associated with the munitions processes, it is expected that any residual contamination associated with these AOCs will likely remain in the near surface soils and drainage sediments associated with these areas. Consequently, the objective of the Phase 1 RI surface soil investigation is to evaluate surface soil adjacent to process buildings and former operational locations at each AOC to determine: (1) if releases of explosive compounds and associated chemicals have occurred, and (2) characterize the nature and current levels of any potential residual contamination. The objectives of the Phase 1 RI sediment investigation are to (1) determine if residual explosive compounds and associated chemicals currently exist in the drainage ditches and settling ponds receiving surface water runoff and past process effluent, and (2) characterize the nature and current levels of any potential residual contamination.

The following sections present the sampling rationale and locations for surface soil and sediment investigations planned for each of the AOCs during the Phase 1 RI.

4.5.1 Rationales

4.5.1.1 Surface Soil Sampling Locations

Surface soils will be evaluated during the Phase 1 RI at Load Lines 1, 2, 3, 4, and 12, Building 1200, and the Winklepeck Burning Grounds. The Phase 1 RI surface soil investigation will focus on biased sampling of surface soils in and/or adjacent to suspected releases and potential source areas (process buildings and former operational locations) to determine (1) if releases of explosive compounds and associated chemicals have occurred, and (2) the nature and current levels of any potential contamination. Potential source areas have been identified based on process knowledge, operational history, aerial photography, and site walk-overs. Table B-1 in Appendix B shows the planned sampling locations and the potential sources of contamination identified for each AOC along with the rationale for each sampling location and the corresponding sample identification(s). The exact location of each sampling station will be finalized prior to sampling based on observed field conditions (e.g., staining, effluent pipes, drainage, etc.) to ensure the best representative location is sampled. A number of sample locations are included for each AOC for which a location has yet to be determined (TBD). These are included to provide flexibility in the surface soil investigation by allowing sampling of areas of interest at each AOC that may be identified as a potential concern based on observation (e.g., surface staining) while conducting the field investigation.

The rationale for the surface soil sampling at each of the AOCs to be investigated as a part of the Phase 1 RI are presented in the following paragraphs along with figures showing the proposed location of each sampling location. Table B-1 in Appendix B summarizes the rationale and location for the planned surface soil and sediment sampling.

Load Lines 1, 2, 3, 4, and 12

The rationale for biased surface soil sampling locations at the load line areas is based on areas of suspected releases and potential sources of contamination. Because of the similarity in the facility design and process operations for each load line, the potential areas containing residual contamination are similar for each of the load lines. The surface soil sampling strategy focuses on biased sampling in and/or adjacent to the former process buildings to evaluate the potential for residual soil contamination occurring near buildings and former process operations. Operational history indicates that the potential for surface soil contamination exists from wash-down operations of buildings and equipment that resulted in pink waste water containing explosive and metal constituents being washed out of the buildings onto the ground surface. The buildings formally associated with processing raw explosives into munitions are of primary concern in these regards, they are the Melt/Pour, Washdown, Drilling and Boostering, Propellent Charge, and High Explosive buildings. Vacuum pumps associated with process wastes (Drilling and Boostering and Melt/Pour Buildings) and concrete settling tanks associated with process building effluent (Melt/Pour, Washdown, and High Explosive Buildings) are also of primary concern. In addition, ancillary process support buildings such as the Paint and Oil Storage and Mixing Building and the Truck Service Building are of primary concern because of the nature of the operations in these buildings. Figures A-1, A-2, A-3, A-4, and A-5 in Appendix A show the proposed surface soil sampling locations for each load line. The TBD sampling locations are not shown on these figures as their locations will be determined in the field as needed based on field observations.

Building 1200

The rationale for biased surface soil sampling locations at Building 1200 is based on identified areas of potential releases based on a walkover of this facility. The surface soil sampling strategy focuses on biased sampling adjacent to the former process building to evaluate the potential for residual soil contamination. One surface soil sampling location is proposed at the location of a former vent or drain line exiting the building on the west side. The primary concern for Building 1200 is from process effluent discharged into the adjacent drainage ditch, which is addressed as sediment sampling from drainage channels (Sect. 4.5.1.2). Figure A-6 in Appendix A shows the proposed surface soil sampling locations for Building 1200.

Winklepeck Burning Grounds

The rationale for biased surface soil sampling locations at the Winklepeck Burning Grounds is based on evaluating known or suspected open burning pads where releases of contamination are likely to have occurred through the burning of explosive wastes and munitions. The location of the former burning pads have been determined using historical aerial photography and engineering drawings of the former burning ground layout. Seventy individual burning pads have been identified. Each burning pad measures ~6.1 m (20 ft) × ~12 m (40 ft) and was constructed of fill material. Reports by former employees indicate that most of the open burning operations took place along the Road "E" burning pads and that the burning operations were generally confined to an area known as the "Burning Pad." The top layers of the burning pads were sometimes scraped to remove burn residue and piled on the sides of the burn pads. It is reported that residual material from the burning pads was disposed of in the Landfill North of Winklepeck Burning Grounds. Rocket motor burn-out operations are reported to have occurred along the shoulder of Road D, East (USAEHA 1983), and munitions melt-out operations are reported to have occurred in a ditch along Road E, East (USAEHA 1988).

A 1983 investigation (USAEHA 1983) collected 70 surface [0-15 cm (0-6 in.)] soil samples from 11 recently active (burning operations within 5 years) burning pads and along Road D, East. The samples were collected from actual burn areas on the pad and from the ditch along Road D, East. Table 4-4 summarizes the results of this investigation. Explosives were detected in 34 samples ranging from 1.4 - 686.1 μg/g HMX, 20.0 - 2976.0 μg/g RDX, 2.1 - 2263.0 μg/g TNT. Metals were detected in 12 samples ranging from 0.1 - 3.6 mg/L cadmium, 0.5 - 5.1 mg/L lead, and 32.6 - 197.0 mg/L barium.

A 1992 investigation (USAEHA 1992) collected nine surface [0-15 cm (0-6 in.)] soil samples and installed five soil borings to a depth of ~3 m (10 ft) at Burning Pad #38. The sampling stations were located adjacent [~3.0 m (10 ft)] to and encompassed the metal burning trays at this location. Explosives were detected in five soil samples, all from the surface interval, ranging from <1.0 - 6.03 mg/kg TNT, <1.0 - 39.0 mg/kg RDX, <1.0 - 2.65 mg/kg HMX, and, <1.0 - 2.1 mg/kg dinitrotoluene (DNT). Metals were detected above background in all samples for barium (maximum concentration ~6 × background), lead (maximum concentration ~18 × background), and chromium (maximum concentration ~2.7 × background). Five samples contained concentrations above background of selenium (maximum concentration ~4.5 × background) and one sample contained arsenic (maximum concentration <2 × background). The highest concentrations of all chemicals were detected in the surface interval.

Eighty-seven surface sampling locations are proposed to cover the currently identified former burning pads. One surface soil sampling location is planned in the center or burn area of each burning pad to confirm the presence or absence of potential contamination. Where the results of the USAEHA 1983 or historical information (i.e., reports of former employees) suggests potential contamination is present, two surface soil samples will be collected from each of these burning pads. Surface soil/sediment samples will be collected from the ditches adjacent to Road D, East and Road E, East. Based on the USAEHA 1992 investigation of Burning Pad #38, four surface soil samples will be collected from the area immediately adjacent to the burning pad outside of RCRA permit area.
The final location of all surface soil sampling stations will be selected prior to sampling based on field observations to ensure the expanse of the pads are evaluated. Figure A-7 in Appendix A shows the planned locations for the Winklepeck Burning Grounds.

4.5.1.2 Sediment Sampling Locations from Drainage Channels

Sediment in drainage channels associated with Load Lines 1, 2, 3, 4, and 12, Building 1200, and the Winklepeck Burning Grounds will be evaluated as a part of the Phase 1 RI. Table 4-5 summarizes the Phase 1 RI proposed drainage channel sediment sampling activities. The Phase 1 RI sediment investigation will focus on biased sampling of drainage channels receiving process effluent, surface water runoff, and groundwater discharge from these AOCs to (1) determine if residual explosive compounds and associated chemicals are present and (2) evaluate the nature and current levels of potential contamination. Drainage channels associated with Load Lines 1, 2, 3, 4, and 12, and Building 1200 received direct discharge of pink water effluent from former process operations as well as surface water runoff from the operating locations. At these AOCs, drainage channel sediment sampling stations have been located in each of the major drainage ditches exiting the AOCs as identified from engineering drawings and site walk-overs. Sediment sampling stations are located in each drainage channel at known discharge points, at the point where the drainage exits the former operating facility, and along the upstream reaches of the ditches prior to their outfall to settling ponds (Fig. A-1, A-2, A-3, A-4, A-5, and A-6 in Appendix A). This sampling design is intended to evaluate known potential release points and characterize the nature of any residual explosive and associated contamination that may exist along the drainage channel.

Table 4-4. Summary Results of USAEHA 1983 Winklepeck Burning Grounds Investigation.

Burning Pad #	# of Samples/ Total Samples	Explosive Results (Max. μg/g)	Metals Results (Max. mg/L)
Road D Ditch	7/10	TNT(49.1) HMX(4.4)	None detected
37	6/7	TNT(22630.0) HMX(2.8) RDX(10.5)	None detected
38	3/6	TNT(165.7) HMX(19.4) DNT(10.6)	Cd(1.3) Pb(0.5)
39	0/7	None detected	None detected
40	0/5	None detected	None detected
52	1/2	RDX(2.0)	None detected
58	0/4	None detected	None detected
59	5/7	TNT(27.2) RDX(5.0) HMX(2.7)	Cd(1.2) Pb(5.1)
60	4/7	TNT(36.0) HMX(3.1)	Cd(3.6) Pb(3.1)
65	0/4	None detected	None detected
66	7/7	TNT(98.5) RDX(137.8) HMX(25.2) DNT(2.7)	Ba(197.0)
67	4/4	TNT(1516.0) RDX(2976.0) HMX(686.1)	None detected

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Table 4-5. Summary of Phase I RI Pond and Stream Sediment Investigations

						Analytical Parameters (Methods)								
AOC/Sampling Location	Sample Stations	Sampling Method	Depth (ft)	Samples/Station	Total Samples	EXPLs (8330)	Site-related Metals	Metals (TAL)	VOCs (8260A)	SVOCs (8270B)	Pests/PCB (8081)	Cyanide (9013)	TOC	Grain Size
Load Line 1 (RVAAP-08)														
Settling Ponds (3)	6	Composite	0-2	1	6	6	5	1	1	1	1	1	6	6
Downstream of Settling Pond Outfalls	4	Composite	0-2	1	4	4	4	0	0	0	0	0	4	4
TOTAL	10				10	10	9	1	1	1	1	1	10	10
Load Line 2 (RVAAP-09)														
Settling Ponds (1)	2	Composite	0-2	1	2	2	1	1	1	1	1	1	2	2
Downstream of Settling Pond Outfalls	2	Composite	0-2	1	2	2	2	0	0	0	0	0	2	2
TOTAL	4				4	4	3	1	1	1	1	1	4	4
Load Line 3 (RVAAP-10)														
(Cobbs Pond Complex)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Load Line 4 (RVAAP-011)														
Settling Ponds (1)	4	Composite	0-2	1	4	4	3	1	1	1	1	1	4	4
Downstream of Settling Pond Outfalls	3	Composite	0-2	1	3	3	3	0	0	0	0	0	3	3
TOTAL	7				7	7	6	1	1	1	1	1	7	7
Load Line 12 (RVAAP-12 & RVAAP-18)														
Settling Pond	3	Composite	0-2	1	3	3	2	1	1	1	1	1	3	3
Downstream of Settling Pond Outfalls	2	Composite	0-2	1	2	2	2	0	0	0	0	0	2	2
TOTAL	5				5	5	4	1	1	1	1	1	5	5
Landfill N. Winklepeck (RVAAP-19)														
Adjacent Creek	6	Composite	0-2	1	6	6	5	1	1	1	1	1	6	6
TOTAL	6				6	6	5	1	1	1	1	1	6	6
Demolition Area 2 (RVAAP-04)														
Adjacent Creek	3	Composite	0-2	1	3	3	2	1	1	1	1	1	3	3
TOTAL	3				3	3	2	1	1	1	1	1	3	3
Upper & Lower Cobbs Ponds (RVAAP-29)														
Upper Cobbs Pond	5	Composite	0-2	1	5	5	4	1	1	1	1	1	5	5
Lower Cobbs Pond	3	Composite	0-2	1	3	3	2	0	0	0	0	0	3	3
Downstream of Lower Cobbs Pond	2	Composite	0-2	1	2	2	2	0	0	0	0	0	2	2
TOTAL	10				10	10	9	1	1	1	1	1	10	10
Building 1200 (RVAAP-013)														
Settling Pond	2	Composite	0-2	1	2	2	1	1	1	1	1	1	2	2
TOTAL	2				2	2	1	1	1	1	1	1	2	2
INVESTIGATION TOTAL	47				47	47	38	9	9	9	9	9	47	47

Site-related metals - Ag, Ba, Cd, Cr, Pb, Al, Mn, Zn: 3005A/6010A; As: 7060A; Hg: 7471A; Se: 7740
Metals TAL - Ag, Ba, Cd, Cr, Pb, Al, Mn, Zn, Be, Ca, Co, Cu, Fe, K, Mg, Na, Ni, Sb, Ti, V, As, Se
Explosives - HMX, RDX, TNB, DNB, Tetryl, Nitrobenzene, TNT, DNT, and Nitrotoluene

Drainage channels associated with the Winklepeck Burning Grounds received surface water runoff from the burning pad operations. Sediment sampling stations are located in drainage channels exiting the burning ground area to characterize the nature of explosive and related contamination that may exist as a result of former burning operations (Fig. A-7 in Appendix A).

4.5.1.3 Sediment Sampling Locations from Ponds and Streams

Sediment from earthen settling ponds receiving pink water effluent from former process operations associated with Load Lines 1, 2, 3 (Cobbs Ponds Complex), 4, 12, and Building 1200, and the Cobbs Ponds Complex will be evaluated as a part of the Phase 1 RI. In addition, sediment from streams adjacent to the Landfill North of Winklepeck Burning Grounds and Demolition Area No. 2 will be evaluated as a part of the Phase 1 RI. Table B-1 in Appendix B presents the Phase 1 RI pond and stream sediment sampling activities. Eight settling ponds have been identified as receiving process effluent and surface water runoff via open drainage ditches from former operations at these facilities based on engineering drawings of surface drainage features, process knowledge, and site walk-overs. Table 4-5 indicates the settling pond and stream sampling rationale. The sediment sampling strategy is collect samples from locations at the receiving end and discharge end along the main drainage axis of the ponds to evaluate the residual effects from off-site discharge of process effluent (pink water). Three sediment sample stations are planned for each settling pond except for the larger Lower Cobbs Pond and the Load Line settling pond complex where additional sampling stations are planned to cover the larger areas. In addition, sediment sampling stations are planned immediately downstream of each settling pond outfall to evaluate potential contaminant discharge from the settling ponds. Settling pond sediment sampling stations are shown for each AOC on Figs. A-1, A-2, A-3, A-4, A-5, and A-6 in Appendix A.

Sediment from surface water streams adjacent to the Landfill North of Winklepeck Burning Grounds and Demolition Area No. 2 received surface water runoff and shallow groundwater discharge from the these areas. Sediment sampling stations are located in the streams at locations upstream, adjacent, and downstream of each of these AOCs to characterize the nature of explosive and related contamination that may exist as a result of surface water runoff and shallow groundwater discharge (Figs. A-8 and A-9 in Appendix A).

4.5.1.4 Discrete/Composite Soil and Sediment Sampling Requirements

Surface soil and dry sediment samples will be collected using a bucket hand auger to a depth from 0 to 0.6 m (2 ft) below the ground surface. Soil/dry sediment will be collected in continuous increments over this interval and composited, except for VOC samples which will be collected from the 0.3 m (1 ft) depth.

Subaqueous sediment samples will be collected from 0 to 0.3 m (1 ft) using a trowel in shallow water <15.2 cm (6 in.) and using a hand core sampler where water depths are >15.2 cm (6 in.).

4.5.1.5 Sample Collection Field and Analytical Analysis

All surface soil and sediment samples will be field screened for VOCs using a hand-held PID or FID OVA during collection. No samples will be collected for additional field analysis.

All surface soil and sediment samples will be submitted for fixed-base laboratory analysis. Tables 4-4 and 4-5 summarize the analytical parameters and methods that will be used during the Phase 1 RI. Surface soil and sediment samples will be analyzed for explosive compounds and metals, with 10% of the samples being additionally analyzed for VOCs, SVOCs, pesticides/PCBs, and cyanide. Samples submitted for the full analytical suite will be selected at sites or source areas based on process knowledge (e.g., Oil and Paint Storage and Mixing Buildings, Truck Service Buildings, etc.) or on a random statistical basis where no process knowledge exists to guide biased sampling. This translates to ~20% of the total environmental samples being analyzed for the full suite of analytical parameters. Analytical laboratory methods analytes, and procedures are further discussed in Sect. 3 of the Phase 1 RI QAPP.

4.5.1.6 Upgradient, QA/QC, and Blank Samples, and Frequency

Three background soil sampling stations are planned at each of Load Lines 1, 2, 3, 4, and 12, and Building 1200 (18 total sampling stations) to assess background concentrations of explosive and metal compounds at each AOC. One composite soil sample will be collected using a bucket hand auger from 0 - 0.9 m (3 ft) from each background sample station for laboratory analysis. The background sampling stations were selected at biased locations in areas believed to represent native soil conditions at each AOC. Background soil sampling stations were selected at locations within AOC boundaries clear of known process operations, and at locations upgradient of surface water runoff, process effluent discharge, and prevailing wind directions. Background soil sampling stations are shown on Table B-1 in Appendix B and Figs. A-1, A-2, A-3, A-4, and A-5 in Appendix A.

Surface soil and sediment field QA/QC samples (duplicates and splits) will be collected during the Phase 1 RI. Section 8 in the Phase 1 RI FSP summarizes QA/QC sampling. Field duplicate samples will be collected at a frequency of 10% (1/10 environmental samples). Duplicate and split samples will be submitted for analysis consistent with environmental surface soil and sediment. Split samples will be collected at a frequency of 5% (1 per 20 environmental samples) of environmental samples. Duplicate and split samples will be submitted to a laboratory for analysis for parameters consistent with the environmental samples. Split samples will be submitted to a USACE fixed-base laboratory for an independent analysis.

4.5.2 Procedures

4.5.2.1 Sampling Methods for Surface Soil/Dry Sediments

4.5.2.1.1 Bucket Hand Auger Method

Surface soil and dry sediment samples will be collected with a bucket hand auger in accordance with Section 4.5.2.5 of the Facility-wide FSP. In this investigation, auger buckets 15.24 cm (6.0 in.) in length and 7.62 cm (3.0 in.) in diameter will be used. At each location, an auger will be advanced in four, 15.24 cm (6.0 in.) intervals to a total depth of 60.96 cm (2.0 ft) BGS. Material collected from each 15.24 cm (6.0 in.) interval will be placed in a common stainless steel bowl, mixed, and composited to form a single sample.

At sample locations where VOC sample fractions are to be collected, the auger bucket will first be advanced to a depth of 30.48 cm (1 ft) BGS, with material filling the bucket collected in a stainless steel bowl. Material collected from the 30.48 cm (1 ft) to 45.72 cm (1.5 ft) interval will be used to fill the VOC sample fraction container(s). Excess material not used to fill VOC containers will be added to the bowl containing material from the 0 to 30.48 cm (1 ft) interval. Augering will then continue to 60.96 cm (2 ft) BGS with that material also used in the sample.

4.5.2.1.2 Trowel Method

Surface soil and dry sediment samples may also be collected using the trowel method as presented in Sect. 4.5.2.1.2 of the Facility-wide FSP. The trowel will be used to manually obtain sediment to a depth of 15.2 cm (6 in.) below sediment surface. At sample locations where VOC fractions are to be collected, the VOC containers are filled with the first sediment obtained. Sample containers for remaining analytes will be filled with sediment that has been mixed and composited from the entire interval as described in Sect. 4.4.2.5.1 of the Facility-wide FSP.

4.5.2.2 Sampling Methods for Underwater Sediment from Ponds, Lakes, and Lagoons

4.5.2.2.1 Trowel Method

Sediment samples, in locations where water depth does not exceed 15.24 cm (6.0 in.), will be collected with a stainless steel trowel. The trowel will be used to manually obtain sediment to a depth of 15.2 cm (6 in.) below the sediment surface. At sample locations where VOC fractions are to be collected, the VOC containers are filled with the first sediment obtained. Sample containers for remaining analytes will be filled with sediment that has been mixed and composited from the entire interval as described in Sect. 4.4.2.5.1 of the Facility-wide FSP.

4.5.2.2.2 Hand Core Sampler Method

A sludge sampler will be used to collect sediment at locations where the depth of the surface water exceeds 15.24 cm (6 in.). Samples will be collected following the guidelines presented in Sect. 4.5.2.5. of the Facility-wide FSP.

The sludge sampler consists of a stainless steel, 8.26 cm (3.25 in.) OD, 30.48 cm (12 in.) long capped tube which can be fitted with either an auger- or core-type sampler end. Each sampler end is equipped with a butterfly valve to prevent loss of sample upon retrieval. In this investigation, the core-type end will be preferentially used. The auger-type sampler end will be used only in the event that the sediment becomes too gravelly or consolidated for the efficient use of the core type-end. The sludge sampler will be extended to the sampling depth by connecting 60.96, 91.44, 121.92, or 152.40 cm (2, 3, 4, or 5 ft) stainless steel extension rods to the sampler. The extension rods will be attached to a cross handle and will be pushed or augered by hand.

4.5.2.3 Field Measurement Procedures and Criteria

Field measurement procedures and criteria are presented in Sect. 4.5.2.3 of the Facility-wide FSP.

4.5.2.4 Sampling for Physical/Geotechnical Analyses

Sediment samples will be analyzed for grain size and total organic carbon (TOC) as shown on Table 4.5.

4.5.2.5 Sampling for Chemical Analyses

The general requirements presented in Sect. 4.5.2.5 of the Facility-wide FSP will be followed for the collection of surface soil and sediment samples.

4.5.2.6 Sample Containers and Preservation Techniques

Sample container selection and preservation techniques will follow the requirements of Sect. 4.5.2.6 of the Facility-wide FSP and Sect. 4.0 of the Phase 1 RI QAPP.

4.5.2.7 Field Quality Control Sampling Procedures

Quality control samples for surface soil and sediment sampling activities will include duplicates and trip blanks. Section 8 in the Phase 1 RI FSP summarizes the QA/QC samples to be collected during this investigation. Duplicate surface soil and sediment samples will be collected at a frequency of 10% (1/10 environmental samples). Split samples will be collected at a frequency of 5% (1/20 environmental samples). Duplicate and split samples will be selected on a random statistical basis and submitted for similar laboratory analysis as environmental samples. Split samples will be submitted to a USACE laboratory for independent analysis.

4.5.2.8 Decontamination Procedures

All equipment used for the collection of surface soil and sediment samples will be decontaminated prior to and after sampling at each location. Decontamination will follow the procedures specified for nondedicated sampling equipment in Sect. 4.4.2.8 of the Facility-wide FSP.

5. SAMPLE CHAIN OF CUSTODY/DOCUMENTATION

5.1 FIELD LOGBOOK

All field logbook information will follow structures identified in Sect. 5.1 of the Facility-wide FSP.

5.2 PHOTOGRAPHS

Information regarding the documentation of photographs for these High Priority AOC investigations is presented in Sect. 4.3.2.4.3 of the Facility-wide FSP.

5.3 SAMPLE NUMBERING SYSTEM

The sample numbering system that will be used to identify samples collected during the Phase 1 RI is explained conceptually in Sect. 5.3 of the Facility-wide FSP. The specific identifying information that will be used to implement this system during the Phase 1 RI is presented in Fig. 5-1 of this Addendum.

Examples of the Phase 1 RI location/sample identification system are as follows:

- Load Line 1, Sediment Location No. 1, Drainage Channel, Sample No. 1, and Sample Type = LL1sd-001(d)-0001-SD
- Load Line 1, Sediment Location No. 7, Settling Pond, Sample No. 7, and Sample Type = LL1sd-007(p)-007-SD
- Load Line 1, Surface Soil Location No. 51, Background, Sample No. 61, and Sample Type = LL1ss-051(b)-0061-SO

5.4 SAMPLE DOCUMENTATION

All sample label, logbook, field record, and field form information will follow structures identified in Sect. 5.4 of the Facility-wide FSP.

5.5 DOCUMENTATION PROCEDURES

Documentation and tracking of samples and field information will follow the series of steps identified in Sect. 5.5 of the Facility-wide FSP.

5.6 CORRECTIONS TO DOCUMENTATION

Any correction to documentation will follow guidance established in Sect. 5.6 of the Facility-wide FSP.

Sample Station Location Identification: XXXmm-NNN(n)

<u>XXX = Area Designator</u>
Load Line 1 = LL1
Load Line 2 = LL2
Load Line 3 = LL3
Load Line 4 = LL4
Load Line 12 = L12
Building 1200 = B12
Landfill North of Winklepeck Burning Ground = LNW
Winklepeck Burning Ground = WBG
Demolition Area No. 2 = DA2
Load Line 12 Waste Water Treatment Plant = L12*
Upper and Lower Cobbs Pond = CPC
* Combined with LL12 because proximity of AOCs

<u>mm = Sample Location Type</u>
ss = Surface Soil Location
so = Soil Boring Location
sd = Sediment Sampling Location
tr = Trench Location
wp = Well Point Location

<u>NNN = Sequential Sample Number Location</u>
Unique sequence for each area designator

<u>(n) = Special Identifier</u>
d = Drainage Channel Sample
p = Pond Sample
b = Background Sample

Sample Identification: XXXmm-NNN(n)-####-tt

<u>#### = Sequential Sample Number</u>
Unique to each Phase 1 RI Sample

<u>tt = Sample Type</u>
GW = Unfiltered Groundwater Sample
SO = Soil Sample
SD = Sediment Sample
TB = Trip Blank
FB = Field Blank
ER = Equipment Rinsate

Fig. 5-1. Phase 1 RI Location/Sample Identification.

5.7 MONTHLY REPORTS

Monthly report information will follow structures identified in Sect. 5.7 of the Facility-wide FSP.

6. SAMPLE PACKAGING AND SHIPPING REQUIREMENTS

Sample packaging and shipping will follow Sect. 6 of the Facility-wide FSP.

7. INVESTIGATION-DERIVED WASTE

The Phase 1 RI investigation-derived waste (IDW) will be managed in accordance with Sect. 7 of the Facility-wide FSP.

8. CONTRACTOR CHEMICAL QUALITY CONTROL

The Contractor Chemical Quality Control (CCQC) program will follow direction provided in Sect. 8 of the Facility-wide FSP. The SAIC CQC representative responsible for implementation and documentation of the program is identified in the organizational chart found in Sect. 2 of this Addendum.

Field QC sample numbers and QA sample numbers are identified in Tables 8-1 through 8-3. Figure 8-1 is a general field equipment checklist for the Phase 1 RI, and Fig. 8-2 is a general listing of the supporting materials needed.

Table 8-1. Soil Field QC and QA Samples

Location	Analysis	Field Samples	Field Duplicate Samples	Field Blanks	Field QA Split Samples
Load Line 1	Explosives	49	5	0	3
	Metals (11)	41	4	0	1
	Metals (23)	11	1	0	1
	VOC	11	1	0	1
	SVOC	11	1	0	1
	Pest/PCB	11	1	0	1
	Cyanide	11	1	0	1
	TOC	7	0	0	1
	Grain Size	7	0	0	1
Load Line 2	Explosives	48	5	0	2
	Metals (11)	41	4	0	2
	Metals (23)	10	1	0	1
	VOC	10	1	0	1
	SVOC	10	1	0	1
	Pest/PCB	10	1	0	1
	Cyanide	10	1	0	1
	TOC	6	0	0	1
	Grain Size	6	0	0	1
Load Line 3	Explosives	50	5	0	2
	Metals (11)	43	4	0	2
	Metals (23)	10	1	0	0
	VOC	10	1	0	0
	SVOC	10	1	0	0
	Pest/PCB	10	1	0	0
	Cyanide	10	1	0	0
	TOC	8	0	0	0
	Grain Size	8	0	0	0
Load Line 4	Explosives	48	5	0	2
	Metals (11)	40	4	0	2

Table 8-1 (continued)

Location	Analysis	Field Samples	Field Duplicate Samples	Field Blanks	Field QA Split Samples
	Metals (23)	11	1	0	0
	VOC	11	1	0	0
	SVOC	11	1	0	0
	Pest/PCB	11	1	0	0
	Cyanide	11	1	0	0
	TOC	4	-	0	-
	Grain Size	4	-	0	-
Load Line 12	Explosives	47	5	0	2
	Metals (11)	41	4	0	2
	Metals (23)	9	1	0	0
	VOC	9	1	0	0
	SVOC	9	1	0	0
	Pest/PCB	9	1	0	0
	Cyanide	9	1	0	0
	TOC	15	0	0	0
	Grain Size	15	0	0	0
Building 1200	Explosives	7	1	0	1
	Metals (11)	5	1	0	1
	Metals (23)	2	-	0	0
	VOC	2	-	0	0
	SVOC	2	-	0	0
	Pest/PCB	2	-	0	0
	Cyanide	2	-	0	0
	TOC	5	-	0	0
	Grain Size	5	-	0	0
Winklepeck Burning Grounds	Explosives	99	10	0	5
	Metals (11)	88	9	0	4
	Metals (23)	11	1	0	1

Table 8-1 (continued)

Location	Analysis	Field Samples	Field Duplicate Samples	Field Blanks	Field QA Split Samples
	VOC	11	1	0	1
	SVOC	11	1	0	1
	Pest/PCB	11	1	0	1
	Cyanide	11	1	0	1
	TOC	13	0	0	0
	Grain Size	13	0	0	0
Landfill North of Winklepeck BG	Explosives	30	3	0	2
	Metals (11)	5	-	0	0
	Metals (23)	25	3	0	2
	VOC	30	3	0	2
	SVOC	30	3	0	2
	Pest/PCB	30	3	0	2
	Cyanide	30	3	0	2
	TOC	-	-	0	-
	Grain Size	-	-	0	-
Demolition Area #2	Explosives	60	6	0	3
	Metals (11)	55	5	0	2
	Metals (23)	5	1	0	1
	VOC	3	-	0	-
	SVOC	3	-	0	-
	Pest/PCB	3	-	0	-
	Cyanide	3	-	0	-
	TOC	-	-	0	-
	Grain Size	-	-	0	-

Table 8-2. Sediment Field QC and QA Samples

Location	Analysis	Field Samples	Field Duplicate Samples	Field Blanks	Field QA Split Samples
Load Line 1	Explosives	10	1	0	1
	Metals (11)	9	1	0	1
	Metals (23)	1	1	0	1
	VOC	1	1	0	1
	SVOC	1	1	0	1
	Pest/PCB	1	1	0	1
	Cyanide	1	1	0	1
	TOC	10	1	0	-
	Grain Size	10	1	0	-
Load Line 2	Explosives	4	1	0	1
	Metals (11)	3	1	0	1
	Metals (23)	1	-	0	-
	VOC	1	-	0	-
	SVOC	1	-	0	-
	Pest/PCB	1	-	0	-
	Cyanide	1	-	0	-
	TOC	4	1	0	-
	Grain Size	4	1	0	-
Load Line 3	Explosives	-	-	0	-
	Metals (11)	-	-	0	-
	Metals (23)	-	-	0	-
	VOC	-	-	0	-
	SVOC	-	-	0	-
	Pest/PCB	-	-	0	-
	Cyanide	-	-	0	-
	TOC	-	-	0	-
	Grain Size	-	-	0	-
Load Line 4	Explosives	7	1	0	1
	Metals (11)	6	1	0	1

Table 8-2 (continued)

Location	Analysis	Field Samples	Field Duplicate Samples	Field Blanks	Field QA Split Samples
	Metals (23)	1	-	0	-
	VOC	1	-	0	-
	SVOC	1	-	0	-
	Pest/PCB	1	-	0	-
	Cyanide	1	-	0	-
	TOC	7	1	0	-
	Grain Size	7	1	0	-
Load Line 12	Explosives	5	1	0	1
	Metals (11)	4	1	0	1
	Metals (23)	1	-	0	-
	VOC	1	-	0	-
	SVOC	1	-	0	-
	Pest/PCB	1	-	0	-
	Cyanide	1	-	0	-
	TOC	5	1	0	-
	Grain Size	5	1	0	-
Building 1200	Explosives	2	1	0	1
	Metals (11)	1	1	0	1
	Metals (23)	1	-	0	-
	VOC	1	-	0	-
	SVOC	1	-	0	-
	Pest/PCB	1	-	0	-
	Cyanide	1	-	0	-
	TOC	2	1	0	-
	Grain Size	2	1	0	-
Cobbs Ponds	Explosives	10	1	0	1
	Metals (11)	9	1	0	1
	Metals (23)	1	1	0	1
	VOC	1	1	0	1

Table 8-2 (continued)

Location	Analysis	Field Samples	Field Duplicate Samples	Field Blanks	Field QA Split Samples
	SVOC	1	1	0	1
	Pest/PCB	1	1	0	1
	Cyanide	1	1	0	1
	TOC	10	1	0	-
	Grain Size	10	1	0	-
Landfill North of Winklepeck BG	Explosives	6	1	0	1
	Metals (11)	5	1	0	1
	Metals (23)	1	-	0	-
	VOC	1	-	0	-
	SVOC	1	-	0	-
	Pest/PCB	1	-	0	-
	Cyanide	1	-	0	-
	TOC	5	1	0	-
	Grain Size	5	1	0	-
Demolition Area #2	Explosives	3	1	0	1
	Metals (11)	2	1	0	1
	Metals (23)	1	-	0	-
	VOC	1	-	0	-
	SVOC	1	-	0	-
	Pest/PCB	1	-	0	-
	Cyanide	1	-	0	-
	TOC	2	1	0	1
	Grain Size	2	1	0	1

Table 8-3. Groundwater Field QC and QA Samples

Location	Analysis	Field Samples[1]	Field Duplicate Samples[2]	Field Blanks[3]	Field QA Split Samples[4]
All	Explosives	22	3	6	2
	Metals (23)	22	3	6	2
	VOC	22	3	10	2
	SVOC	22	3	6	2
	Pest/PCB	22	3	6	2
	Cyanide	22	3	6	2

[1] Field samples include 18 groundwater samples from well points and 4 from monitoring wells.
[2] Duplicates are collected for groundwater samples only at a frequency of 10%.
[3] Blanks include: source water; equipment rinsate blanks; and VOC trip blanks.
[4] Split samples are collected at a frequency of 5%.

FIELD EQUIPMENT CHECKLIST

Soil and Groundwater Sampling

- Hand Augers (Buckets, Extensions, Handles)
- Backhoe
- Power Auger (Little Beaver)
- Hollow-stem auger drill rig
- Split-spoon samplers
- Hydro-Punch II or equivalent samplers
- Stainless steel knife
- Stainless steel scoop/bowls
- 100 ft fiberglass tape measure
- Laboratory sample containers
- Ice
- Coolers for sample storage
- Personal protective equipment
- Teflon bailer and nylon cord
- Groundwater development pump
- In-situ Test Equipment

Field Parameter Measurements

- Water level meter
- Calibrated organic vapor analyzer
- Calibrated cond.-temp.-pH meter
- Mercury thermometer
- Aluminum foil/plastic cling wrap
- Containers for groundwater sample field testing
- Cooler

Equipment Decontamination

- Buckets and brushes
- Phosphate-free detergent
- Steam cleaner
- Plastic sheeting
- ASTM Type I or equivalent water
- Methanol
- HCL (2% solutions)
- Aluminum foil
- Personal protective equipment

Waste Management

- Drum labels
- Waste storage drums
- Waste storage drum liners
- Plastic sheeting
- Poly-funnel
- Personal protective equipment

Fig. 8-1. Checklist of Field Equipment for the Phase 1 RI.

SUPPORTING MATERIAL CHECKLIST

- SDS sheets
- Facility-wide SAP and Phase 1 RI SAP Addendum
- Facility-wide Safety and Health Plan and Phase 1 RI Site Safety and Health Plan Addendum
- EM 385-1-1 "U.S. Army Corps of Engineers Safety and Health Requirements Manual"
- Field logbooks and black permanent ink pens
- First aid kits
- Example tables and/or forms for recording all project data
- Base maps for documenting sampling locations
- QA sample tracking table to match up field and QA/QC samples collected
- Technical reference books for the identification of chemical hazards
- Calibration gases and standard solutions
- Operating manuals for all instruments used for measurement of field parameters
- Examples of completed sample shipping documents
- Chain of custody forms and seals
- Strapping tap for sealing of coolers
- Sample packing materials including plastic bags and bubble or vermiculite packing material
- Laboratory information including the following:
  - laboratory name and shipping address
  - laboratory point of contact and telephone number
  - laboratory information management system (LIMS) number for government laboratory samples
  - documentation that the laboratory has been notified that the samples will be shipped, and confirmation that the samples will be accepted
- Monitoring well construction materials

Fig. 8-2. Checklist of Supporting Materials for the Phase 1 RI.

9. DAILY CHEMICAL QUALITY CONTROL REPORTS

Procedures will follow Sect. 9 of the Facility-wide QAPP.

10. CORRECTIVE ACTIONS

10.1 SAMPLE COLLECTION AND FIELD MEASUREMENTS

Procedures will follow Sect. 10.1 of the Facility-wide FSP.

In addition, one QA field surveillance will be performed for each media (i.e., surface soil, sediment, subsurface soil, groundwater) sampled during the Phase I RI. The field surveillances will be scheduled during the first work cycle (10 days) of the Phase I RI field investigations. They will be performed by an SAIC QA representative independent of the project team. The field surveillances will be conducted in accordance with SAIC Procedure QAAP 18.3.

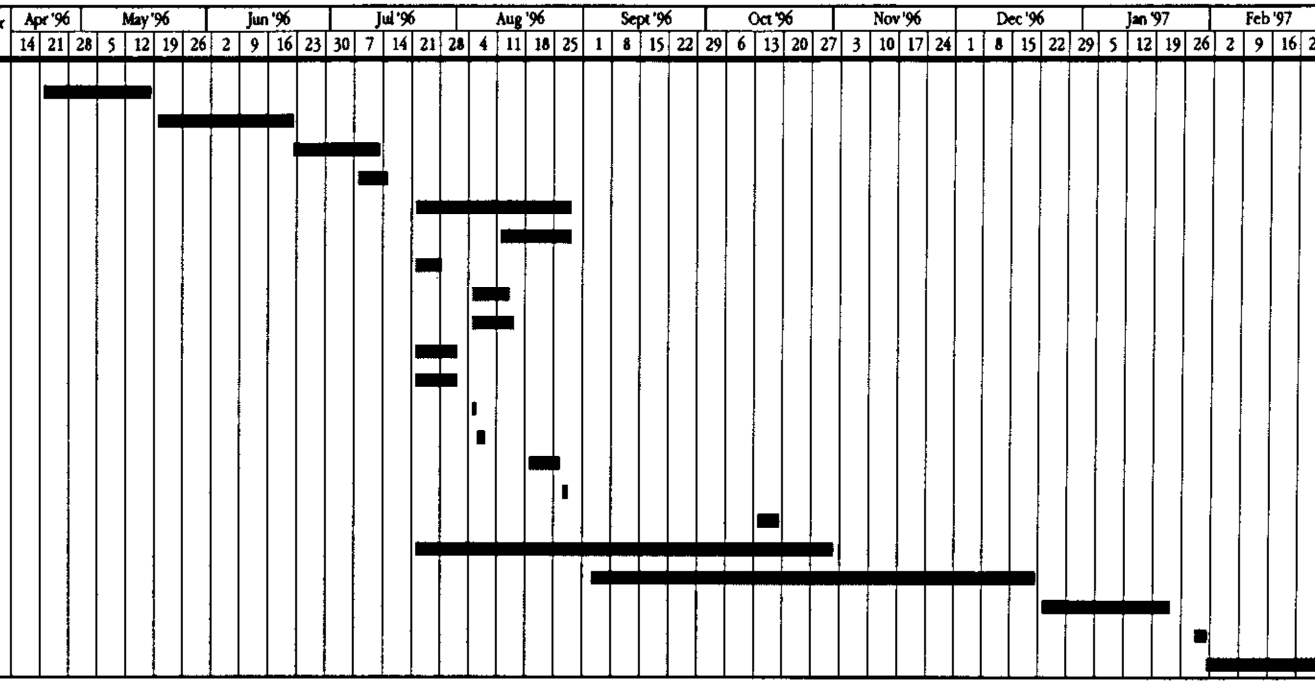
10.2 LABORATORY ANALYSES

Laboratory activity corrective action protocol will follow directions provided in Sect. 13.2 of the Facility-wide QAPP and Chapter 11 of the Southwest Laboratory QA Manual.

11. PROJECT SCHEDULE

The Phase 1 RI project schedule is shown on Fig. 11-1.

Activity Name	Start Date	Finish Date	Work Days	Calendar Days
Draft Work Plan	4/22/96	5/17/96	20	26
Work Plan Review	5/20/96	6/21/96	24	31
Final Work Plan	6/22/96	7/12/96	22	16
Mobilization	7/8/96	7/14/96	10	12
Soil Sampling	7/22/96	8/28/96	30	38
Sediment Sampling	8/12/96	8/28/96	13	17
Geophysical Surveys	7/22/96	7/28/96	7	7
Trenching	8/5/96	8/13/96	9	9
UXO Support	8/5/96	8/14/96	10	10
Well Point Installation/Groundwater Sampling	7/22/96	7/31/96	10	10
Monitoring Well Installation/Development	7/22/96	7/31/96	10	10
Goundwater Sampling	8/5/96	8/5/96	1	1
In-situ Permeability Testing	8/6/96	8/7/96	2	2
Topographic Surveying	8/19/96	8/26/96	7	7
Demobilization	8/27/96	8/28/96	2	2
IDW Disposal	10/14/96	10/18/96	5	5
Sample Analysis, Data Assessment/Validation	7/22/96	11/1/96	74	103
Draft RI Report	9/3/96	12/20/96	77	111
RI Report Review	12/23/96	1/22/97	21	31
Draft RI Report Meeting	1/29/97	1/31/97	5	5
Final RI Report	2/1/97	2/28/97	20	28



96-003MS/070996

Figure 11-1. Schedule for the Phase 1 RI of High Priority AOCs at RVAAP

12. REFERENCES

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APPENDIX A

AOC MAPS

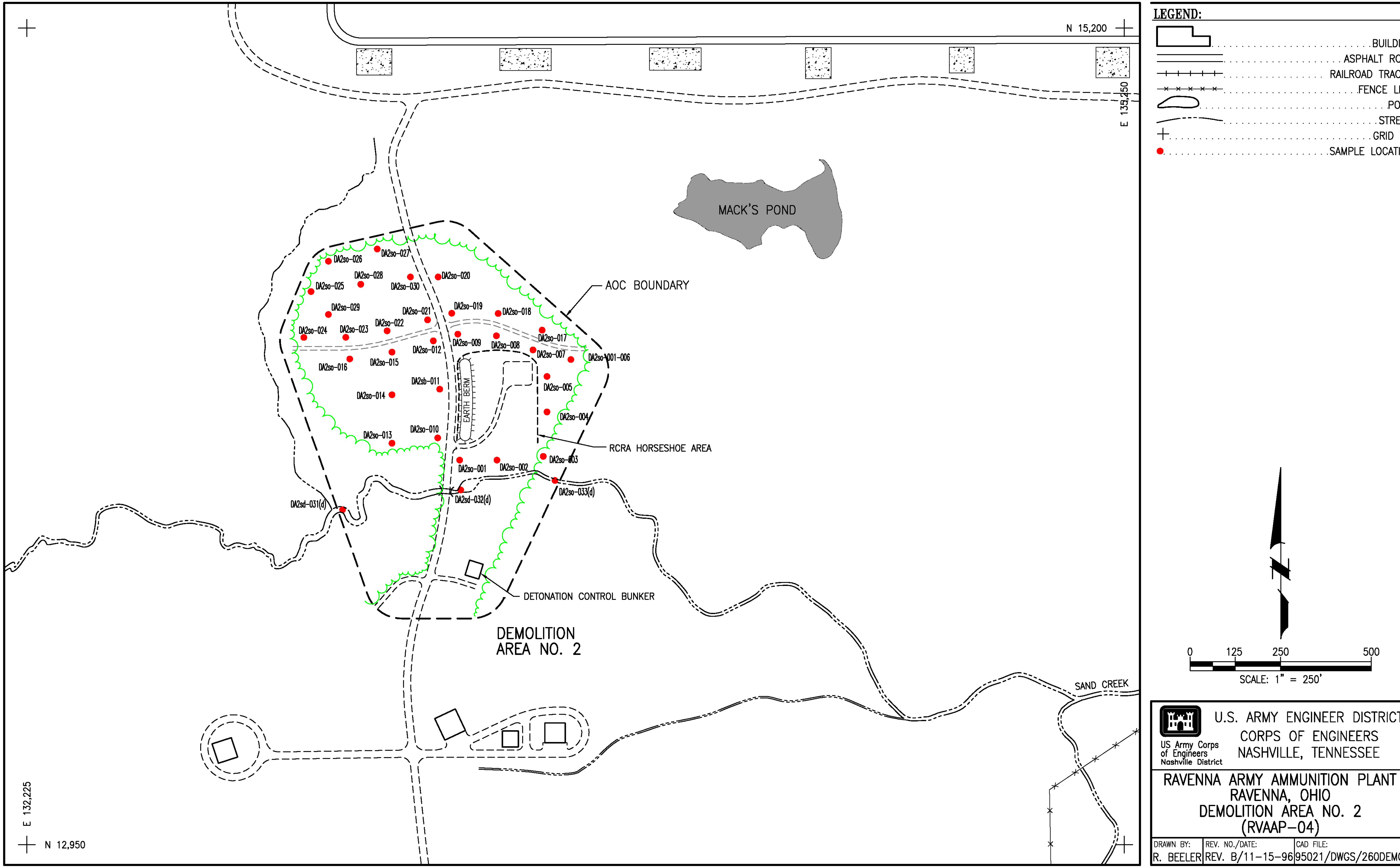


Fig. A-1. Demolition Area No. 2 (RVAAP-04)

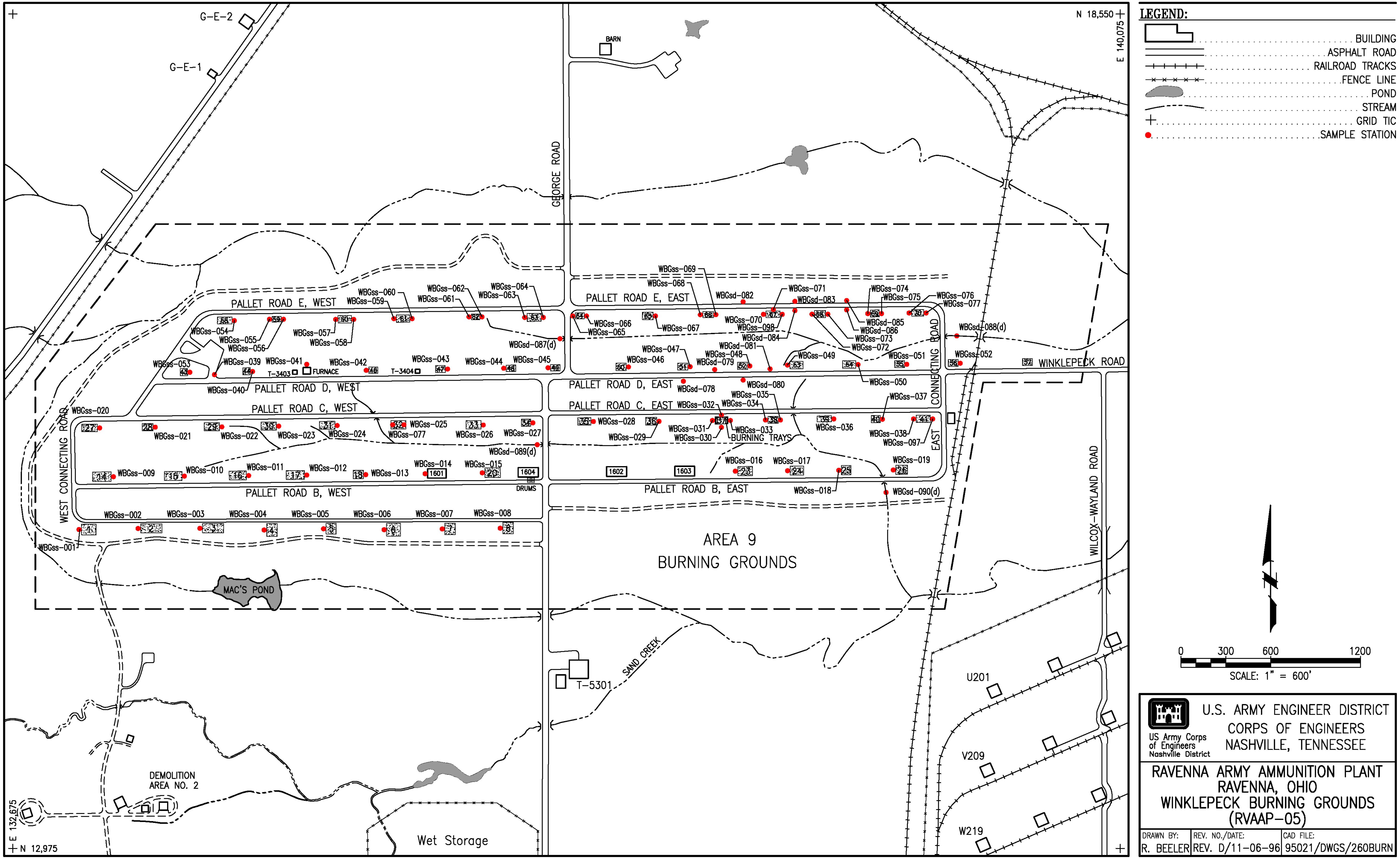


Fig. A-2. Winklepeck Burning Grounds (RVAAP-05)

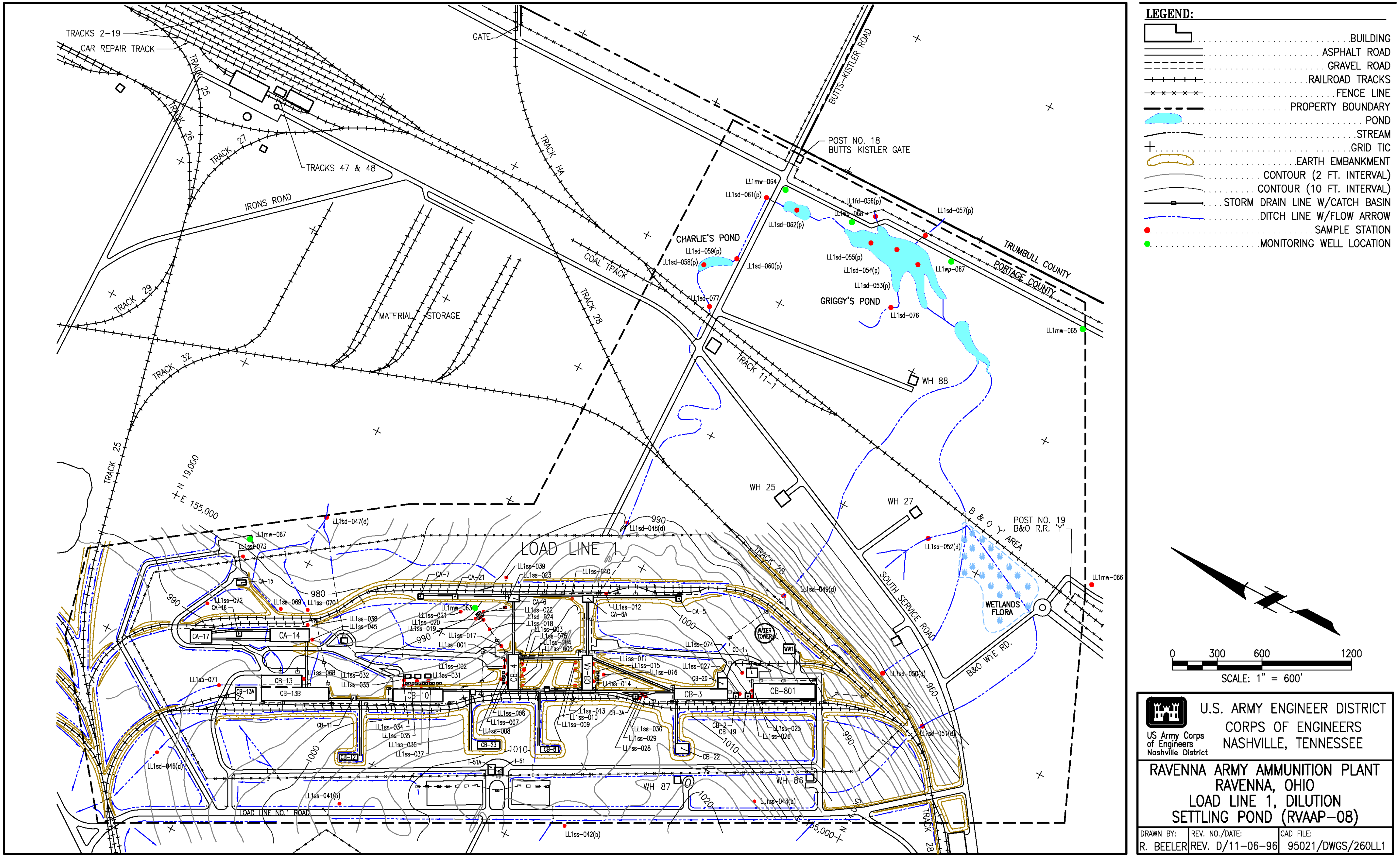


Fig. A-3. Load Line 1, Dilution Settling Pond (RVAAP-08)

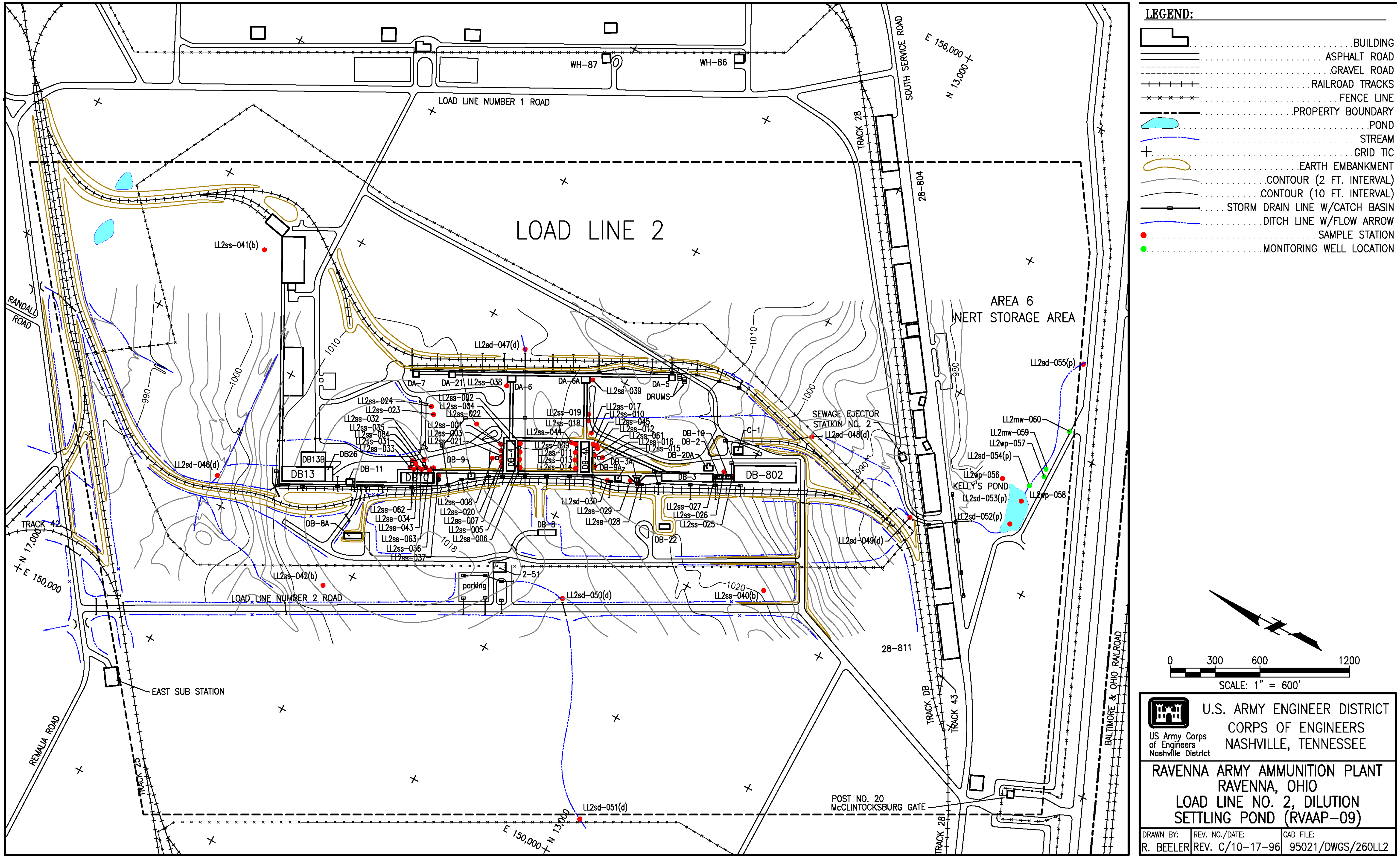


Fig. A-4. Load Line 2, Dilution Settling Pond (RVAAP-09)

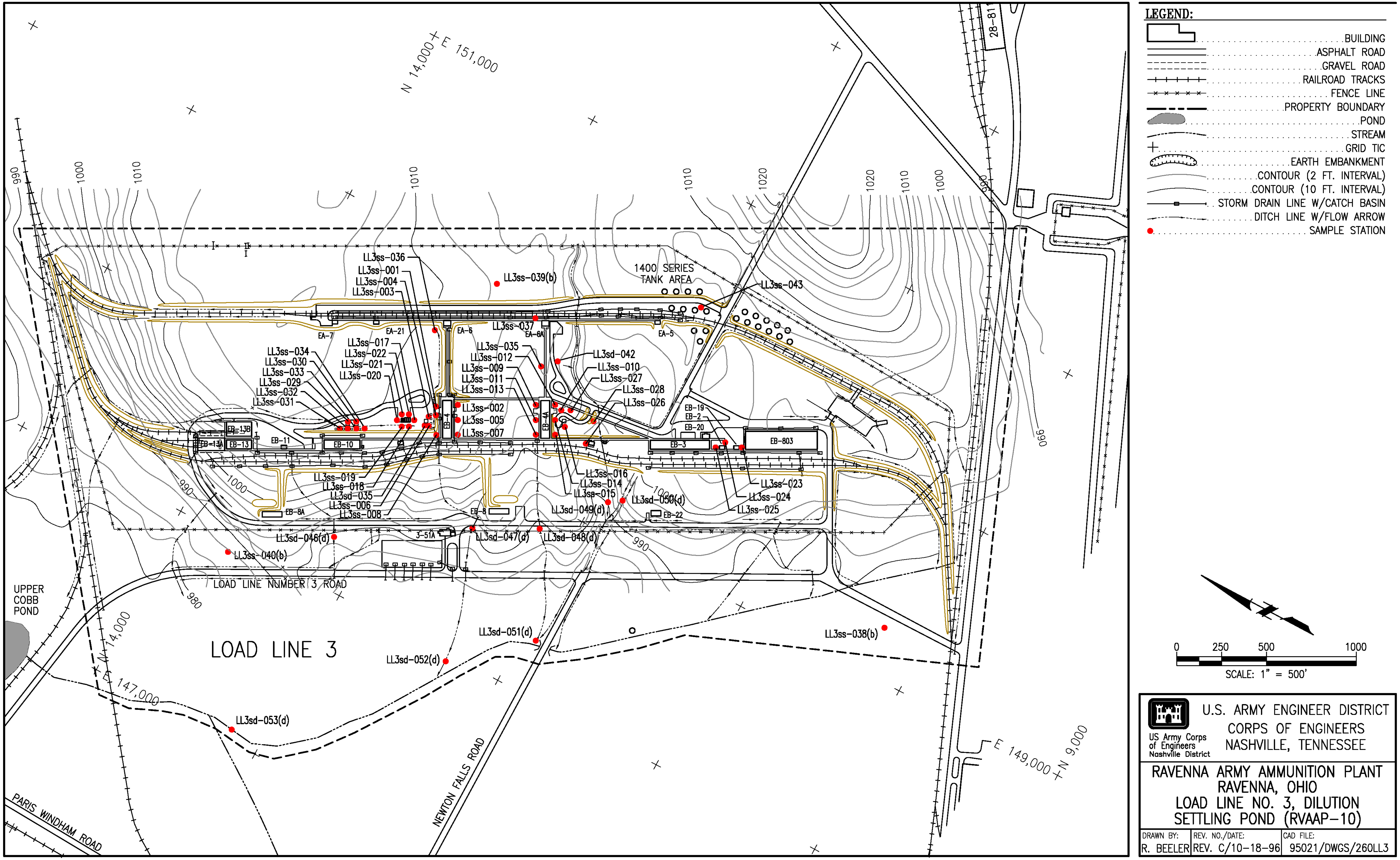


Fig. A-5. Load Line 3, Dilution Settling Pond (RVAAP-10)

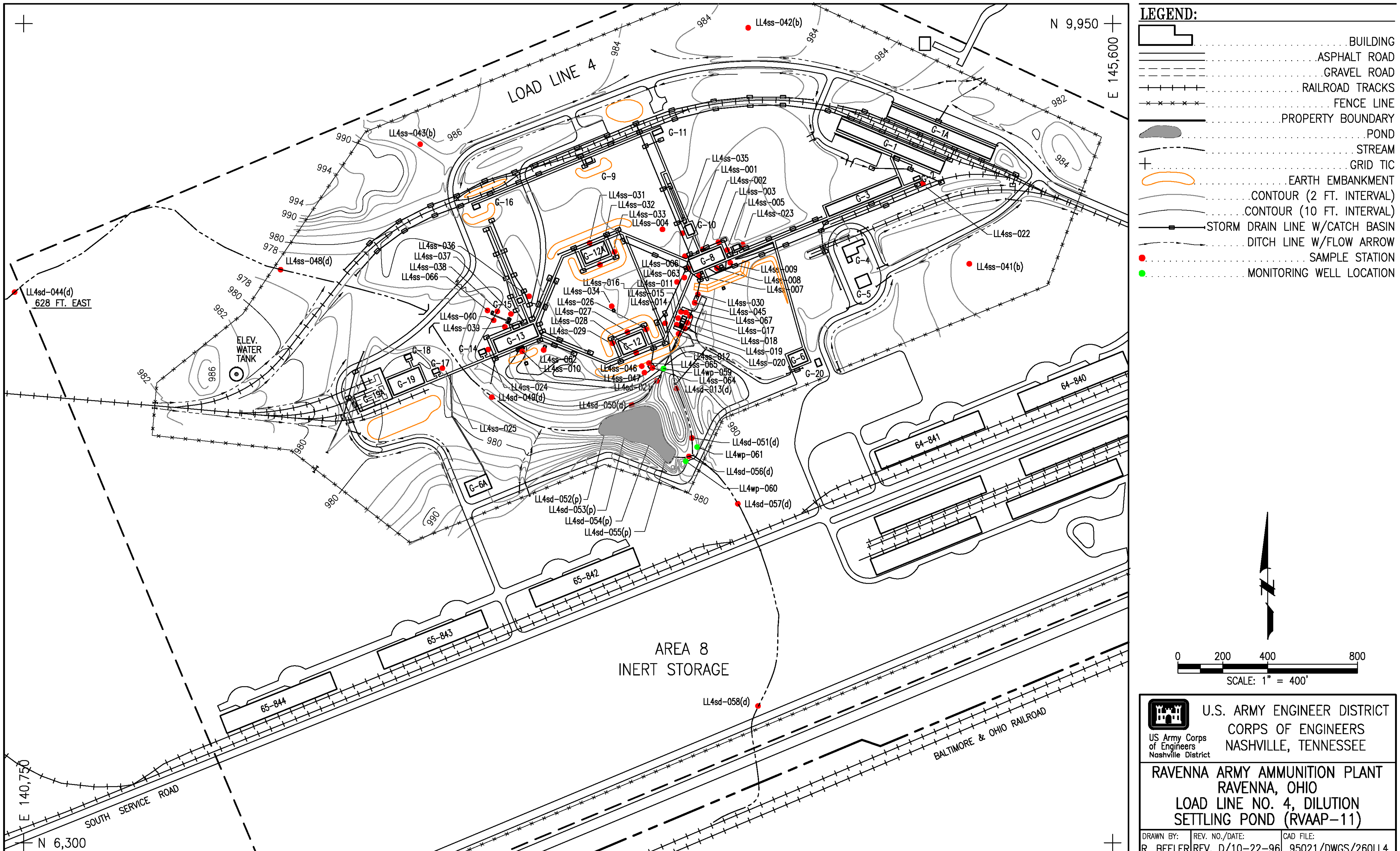


Fig. A-6. Load Line 4, Dilution Settling Pond (RVAAP-13)

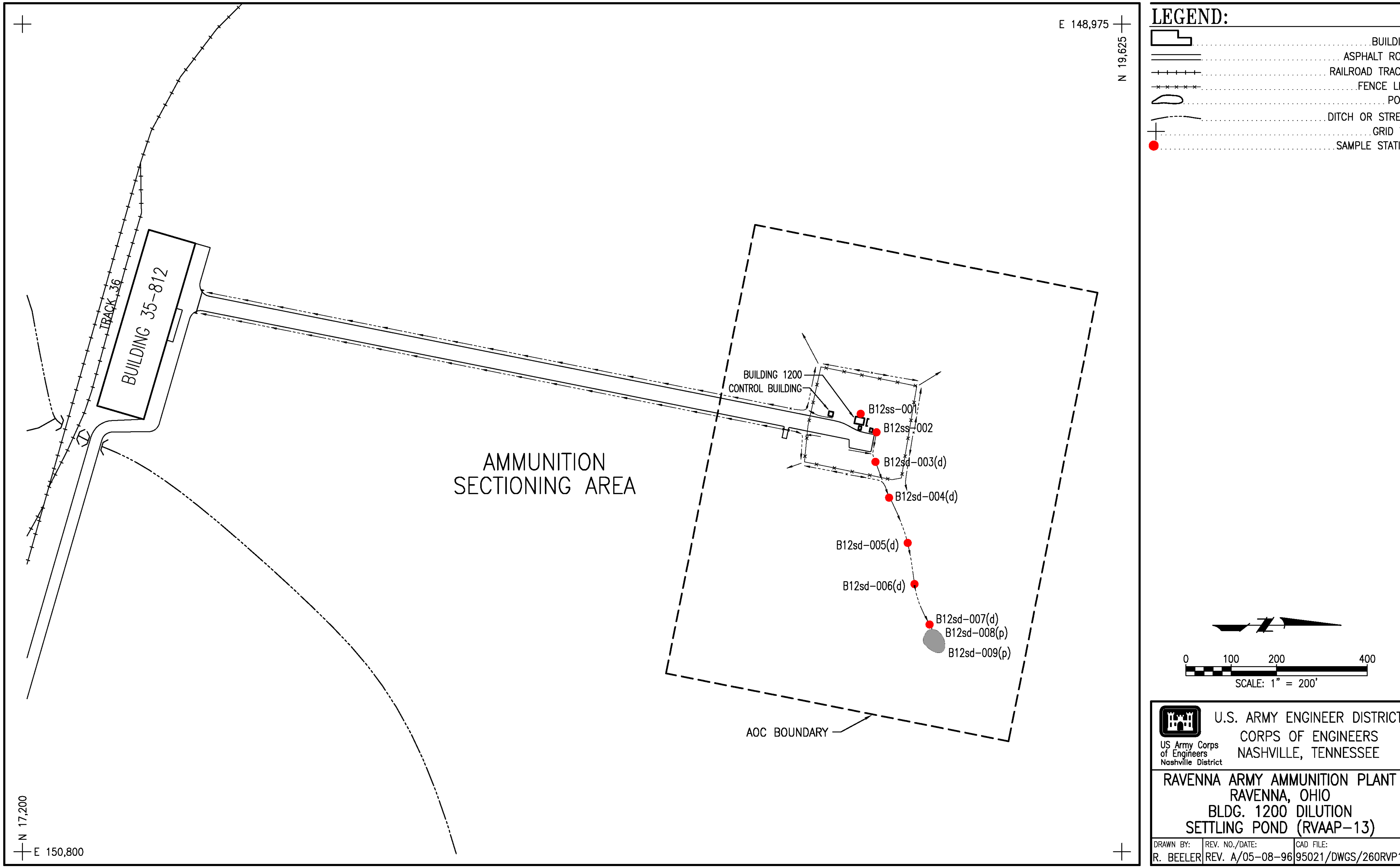


Fig. A-7. Bldg. 1200 Dilution Settling Pond (RVAAP-13)

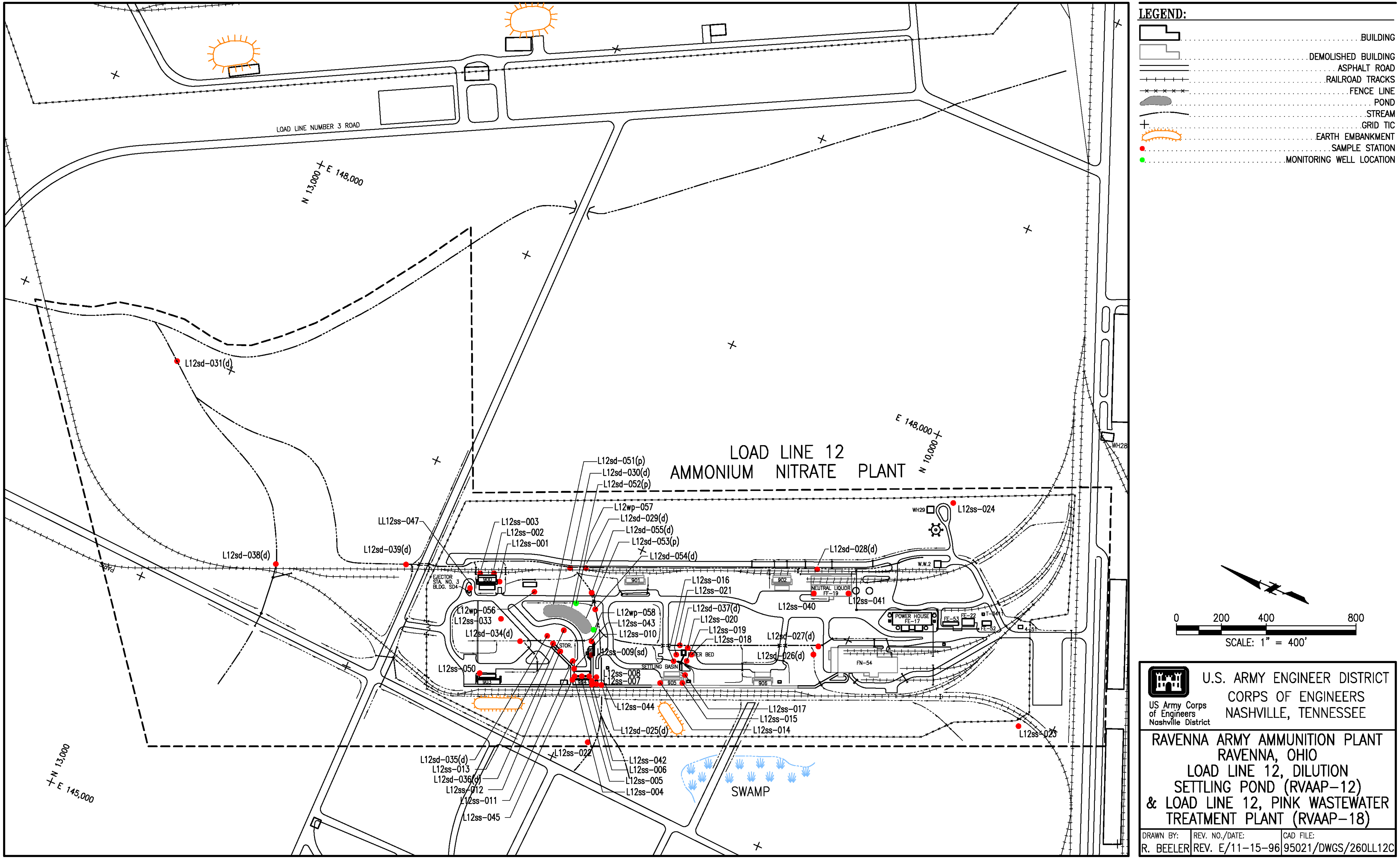
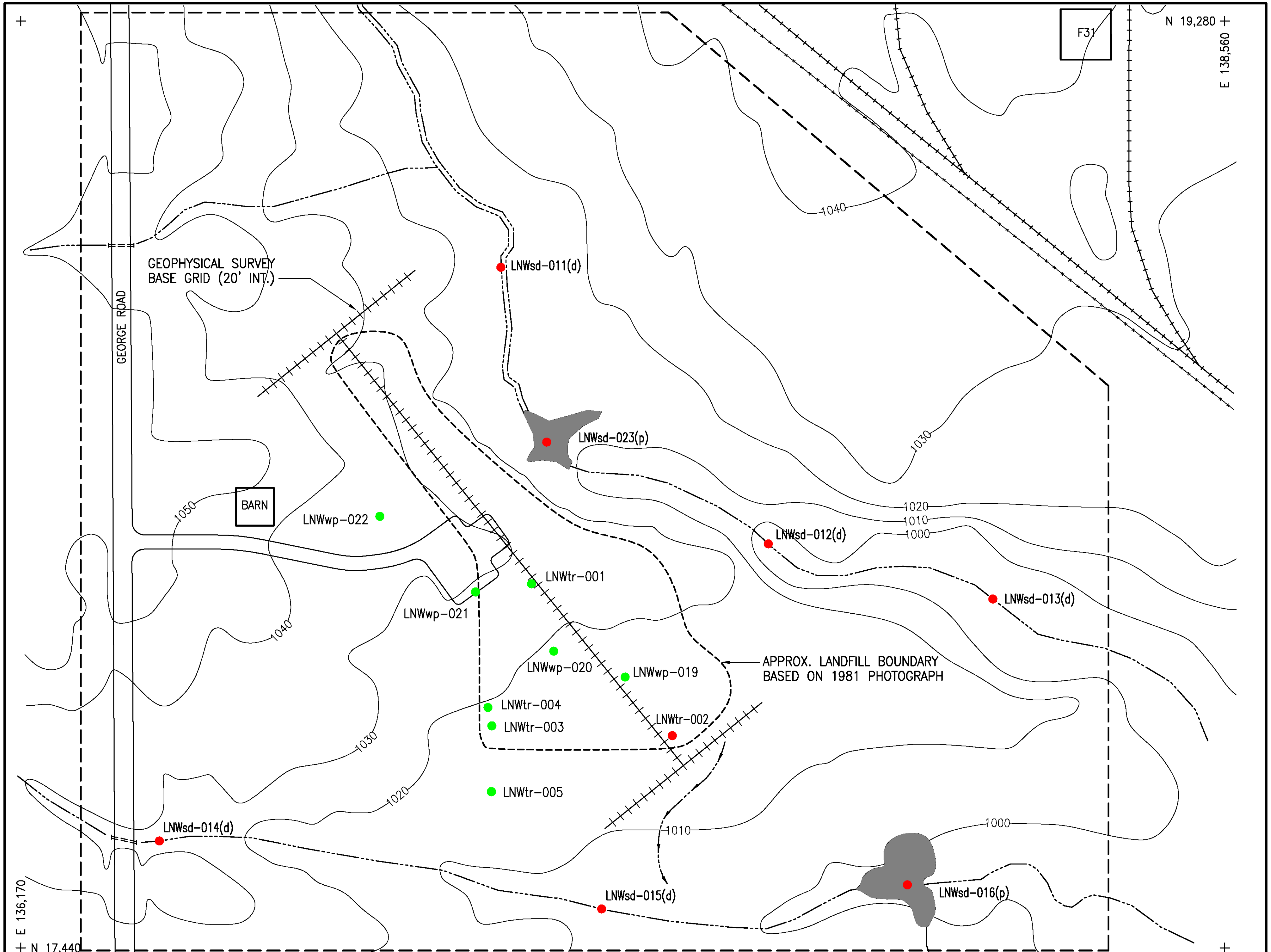


Fig. A-8. Load Line 12, Dilution Settling Pond (RVAAP-12) & Load Line 12, Pink Wastewater Treatment Plant (RVAAP-18)



LEGEND:

BUILDING
ASPHALT ROAD
RAILROAD TRACKS
FENCE LINE
SAMPLE STATION
GEOPHYSICAL GRID
LANDFILL BOUNDARY

0 100 200 400

SCALE: 1" = 200'

US Army Corps of Engineers
Nashville District

U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
NASHVILLE, TENNESSEE

RAVENNA ARMY AMMUNITION PLANT
RAVENNA, OHIO
LANDFILL NORTH OF WINKLEPECK
BURNING GROUND (RVAAP-19)

DRAWN BY:	REV. NO./DATE:	CAD FILE:
R. BEELER	REV. D /11-06-96	95021/DWGS/260RVP19

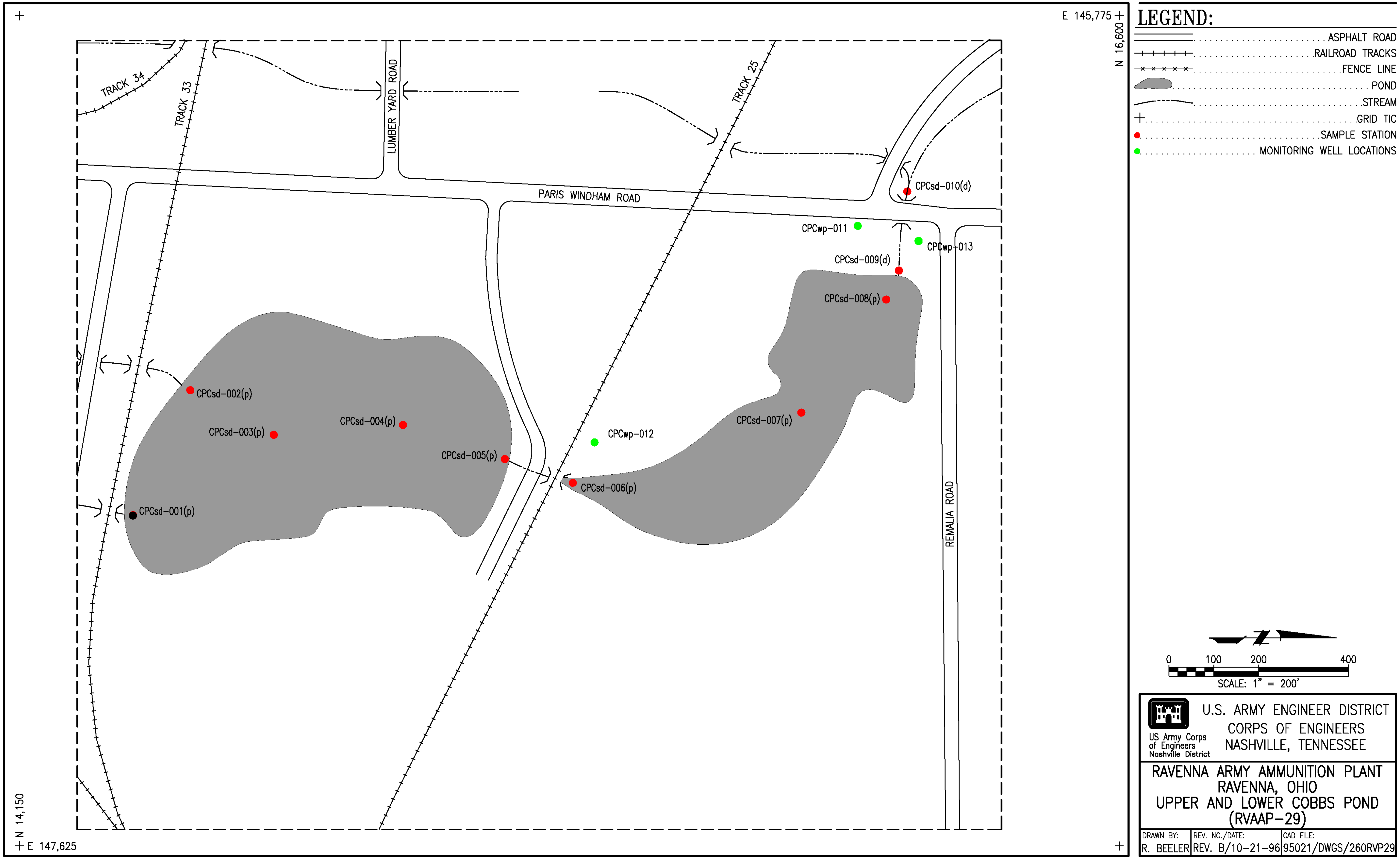


Fig. A-10. Upper & Lower Cobbs Pond (RVAAP-29)

APPENDIX B

SOIL SEDIMENT SAMPLING RATIONALE

Table B-1. Phase 1 RI Surface Soil and Sediment Sampling Locations and Rationale

AOC	Site/Location	Map Identification	Sample Stations	Sample Station Identification	Sample Station Rationale Rationale
			Surface Soil and Drainage Sediment		
Load Line 1	Melt/Pour Buildings	CB-4	3	LL1ss-001 - 003	Adjacent to washout facilities
			2	LL1ss-004 - 005	Along south side of building
			2	LL1ss-006 - 007	Along north side near vacuums
			1	LL1ss-008	Adjacent to vacuum pump house near exhaust vent
		CB 4-A	3	LL1ss-009 - 011	Adjacent to washout facilities
			2	LL1ss-012 - 013	Along north side of building
			2	LL1ss-014 - 015	Along south side of building near vacuums
			1	LL1ss-016	Adjacent to vacuum pump house near exhaust vent
	Concrete Settling Tanks	N/A	2	LL1ss-017 - 018	Along pipeline between CB-4 and tanks
			4	LL1ss-019 - 022	Side of tanks & at inlet/outfall
			1	LL1ss-023	At pipeline outfall from CA-6
			1	LL1sd-024	Sediment from within tanks
	Truck Service Bldg.	CB-19	2	LL1ss-025 -026	Drain outfall from building & storm drain to SE
	Paint & Oil Storage/Mixing	CB-2	1	LL1ss-027	SE corner of bldg. at drain outfall
	Truck Washout Building	CB-3A	1	LL1sd-028	Sediment from tank
			1	LL1ss-029	At concrete tank outfall
			1	LL1ss-030	Downstream of outfall at storm drain
	Drilling & Boostering Bldg.	CB-10	3	LL1ss-031 - 033	Adjacent to each vacuum house neat exhaust vent
			4	LL1ss-034 - 037	Adjacent to each vacuum pump @ east side of bldg
	Propellant Charge Bldg	CA-14	1	LL1ss-038	SE corner of Bldg @ hazardous waste drum
	H.E. Preparation Bldgs.	CA-6	1	LL1ss-039	Pipe outfall south of settling tanks
		CA-6A	1	LL1ss-040	Pipe outfall south of settling tanks
	Background	N/A	1	LL1ss-041(b)	West side of LL1 west fence & east side of LL1 Road
			1	LL1ss-042(b)	West side of LL1 west fence & east side of LL1 Road
			1	LL1ss-043(b)	West side of LL1 west fence & east side of LL1 Road
	To Be Determined	N/A	2	LL1ss-044 - 045	Locations TBD as needed based on field observations
	Drainage Channel	N/A	1	LL1sd-046(d)	North side LL1
			1	LL1sd-047(d)	East side LL1
			1	LL1sd-048(d)	East side LL1
			1	LL1sd-049(d)	South side LL1
			1	LL1sd-050(d)	South side LL1
			1	LL1sd-051(d)	South side LL1
			1	LL1sd-052(d)	South of LL1 where south end drainage crosses RR Track on upsteam side
		Total	52		
Load Line 2	Melt Pour Buildings	DB-4	4	LL2ss-001 - 004	Adjacent to washout facilities
			2	LL2ss-005 - 006	Along south side of building
			1	LL2ss-007	Along north side near vacuums
			1	LL2ss-008	Adjacent to vacuum pump house near exhaust vent
		DB-4A	4	LL2ss-009 - 012	Adjacent to washout facilities
			2	LL2ss-013 - 014	Along north side of building
			1	LL2ss-015	Along south side of building near vacuums
			1	LL2ss-016	Adjacent to vacuum pump house near exhaust vent
	Concrete Settling Tanks	East of DB-4A	1	LL2ss-017	Along pipeline from DB-4A
			2	LL2ss-018 - 019	Adjacent to Settling Tanks at inlet and outfall
		North of DB-4	2	LL2ss-020 - 21	Adjacent to Settling Tanks at inlet and outfall
			1	LL2ss-022	Along pipeline from DB-4
		Northernmost tanks	2	LL2ss-023 - 024	Adjacent to Settling Tanks at inlet and outfall
	Truck Service Building	DB-19	2	LL2ss-025 - 026	One location near drain exit & one fron adjacent storm sewer (if present)
	Paint & Oil Storage/Mixing	DB-2	1	LL2ss-027	At building drain outfall
	Truck Washout Building	DB-25	1	LL2sd-028	Sample from within settling tank (if possible)
			1	LL2ss-029	At tank outfall
			1	LL2ss-030	Downgradient of tank outfall
	Drilling and Boostering Bldg.	DB-10	2	LL2ss-031 - 032	Adjacent to vacuum pump near exhaust vent

Table B-1. Phase 1 RI Surface Soil and Sediment Sampling Locations and Rationale					
AOC	**Site/Location**	**Map Identification**	**Sample Stations**	**Sample Station Identification**	**Sample Station Rationale Rationale**
			4	LL2ss-033 - 036	Adjacent to vacuums along east side of building
			1	LL2ss-037	Along south side of building
	H.E. Preparation Bldgs.	DA-28	1	LL2ss-038	Adjacent to settling tank outfall
		DA-28A	1	LL2ss-039	Adjacent to settling tank outfall
	Background	N/A	1	LL2ss-040	Southwest of operations area outside load line fence
			1	LL2ss-041(b)	Northwest of operations area outside load line fence
			1	LL2ss-042(b)	Northeast part of operations area inside load line fence
	To Be Determined	N/A	3	LL2ss-043(b) - 045(b)	Locations TBD as needed based on field observations
	Drainage Channel	N/A	1	LL2sd046(d)	Drainage channel on north side of load line at fence boundary
			1	LL2sd047(d)	Drainage channel on east side of load line area
			1	LL2sd048(d)	Drainage channel on south side of load line area at load line fence boundary
			1	LL2sd049(d)	Drainage channel on south side outside load line area at railroad track
			1	LL2sd050(d)	Drainage channel on west side outside load line area
			1	LL2sd051(d)	Drainage channel on west side downgradient from load line area
		Total	51		
Load Line 3	Melt Pour Buildings	EB-4	3	LL3ss-001 - 003	Adjacent to washout facilities
			2	LL3ss-004 - 005	Along south side of building
			2	LL3ss-006 - 007	Along north side near vacuums
			1	LL3ss-008	Adjacent to vacuum pump house near exhaust vent
		EB-4A	4	LL3ss-009 - 012	Adjacent to washout facilities
			1	LL3ss-013	Along north side of building
			2	LL3ss-014 - 015	Along south side of building near vacuums
			1	LL3ss-016	Adjacent to vacuum pump house near exhaust vent
	Concrete Settling Tanks		6	LL3ss-017 - 022	Adjacent to settling tanks and at inlet(s) and outfall(s)
	Truck Service Building	EB-19	2	LL3ss-023 - 024	One location near drain exit & one fron adjacent storm sewer (if present)
	Paint & Oil Storage/Mixing	EB-2	1	LL3ss-025	At building drain outfall
	Truck Washout Building	EB-25	1	LL3sd-026	Sample from within settling tank (if possible)
			1	LL3ss-027	At tank outfall
			1	LL3ss-028	Downgradient of tank outfall
	Drilling and Boostering	EB-10	2	LL3ss-029 - 030	Adjacent to each vacuum pump house near exhaust vent
			5	LL3ss-031 - 035	Along east and south sides of building
	H.E Preparation Bldgs.	EA-6	1	LL3ss-036	At settling tank outfall
		EA-6A	1	LL3ss-037	At settling tank outfall
	Background	N/A	1	LL3ss-038(b)	Southwest of operations area outside load line fence
			1	LL3ss-039(b)	East side of operations area inside load line fence
			1	LL3ss-040(b)	Northwest of operations area outside load line fence
	To Be Determined	N/A	5	LL3ss-041 - 045	Locations TBD as needed based on field observations
	Drainage Channel	N/A	1	LL3sd-046(d)	West side drainage at load line fence
			1	LL3sd-047(d)	West side drainage at load line fence
			1	LL3sd-048(d)	West side drainage at load line fence
			1	LL3sd-049(d)	South drainage channel upgradient of confluence with southern tributary
			1	LL3sd-050(d)	South drainage channel upgradient of confluence with northern tributary
			1	LL3sd-051(d)	South drainage channel upgradient of confluence with creek west side of AOC
			1	LL3sd-052(d)	West drainage channel upgradient of confluence with creek west side of AOC
			1	LL3sd-053(d)	Creek on west side of AOC upgradient of confluence with Load Line 2 drainage
		Total	53		
Load Line 4	Melt Pour Building	G-8	3	LL4ss-001 - 003	Along north side of building and adjacent to wash out facilities
			1	LL4ss-005	Along east side of building
			1	LL4ss-006	Along west side of building
			3	LL4ss-007 - 009	Along south side of building and adjacent to wash out facilities & vacuum pump
	To Be Determined	N/A	1	LL4ss-010	Location TBD as needed based on field observations
			2	LL4ss-011 - 012	Along effluent pipe from G-8 to concrete settling tanks
			1	LL4ss-013	Drain outfall

Table B-1. Phase 1 RI Surface Soil and Sediment Sampling Locations and Rationale

AOC	Site/Location	Map Identification	Sample Stations	Sample Station Identification	Sample Station Rationale Rationale
	Concrete Settling Tanks	Main tanks	6	LL4ss-014 - 019	At settling tank inlet & outfall, & adjacent to sides of tanks
		Small tanks	2	LL4ss-020 - 021	Along effluent pipe from settling tanks to outfall & at outfall to drainage ditch
	Service Buildings	G-2	1	LL4ss-022	Building drain exit
		G-7	1	LL4ss-023	Building drain exit
		G-14	1	LL4ss-024	Building drain exit
		G-17	1	LL4ss-025	Building drain exit
	Ammunition Cooling Bldgs.	G-12	4	LL4ss-026 - 029	Along sides of building at washout facilities and vacuum vents
		G-12A	4	LL4ss-030 - 033	Along sides of building at washout facilities and vacuum vents
		N/A	1	LL4ss-034	At vacuum pump house exhaust vent
	Exposive Preparation Bldg.	G-10	1	LL4ss-035	Washout drain
		G-15	1	LL4ss-036	Washout drain
	Transfer & Weighing Bldg.	G-13	2	LL4ss-037 - 038	One location at vacuum and vacuum pump house north side of G-13
			2	LL4ss-039 - 040	One location at vacuum and vacuum pump house south side of G-13
	Background	N/A	1	LL4ss-041(b)	Soutwest side of load line outside boundary fence
			1	LL4ss-042(b)	Northwest side of load line area inside boundary fence
			1	LL4ss-043(b)	North side of load line area inside boundary fence
	To Be Determined	N/A	2	LL4ss-044 - 045	Locations TBD as needed based on field observations
	Settling Tanks S. of G-12 Berm	N/A	2	LL4ss-046 - 047	Adjacent to inlet and outlet of concrete tanks
	Drainage Channel	N/A	1	LL4sd-048(d)	Northwest side of load line where main drainage channel enters load line area
			1	LL4sd-049(d)	West side of load line from main drainage channel
			1	LL4sd-050(d)	Main settling tank drainage channel west branch
			1	LL4sd-051(d)	Main settling tank drainage channel south branch
		Total	50		
Load Line 12	Bomb Disassembly Bldg.	FA-900	1	L12ss-001	South side of building
			2	L12ss-002 - 003	East side of building
	Bomb Melt-Out & Packing	FJ-904	3	L12ss-004 - 006	Along east side of building (discolored soil) under edge of foundation
			1	L12ss-007	Southeast corner of building at pipe outfall
			1	L12ss-008	Adjacent to vacuum barricade south of building
			1	L12ss-009	Adjacent to vacuum pump house near exhaust vent
			2	L12ss-010 - 011	Adjacent to concrete settling tank between Bldgs. FJ-904 & IWT01
	Waste Water Treatment Plant	IWT01	2	L12ss-012 - 013	Adjacent to Bldg. IWT01
	TNT Reclaimation	FJ-905	2	L12ss-014 - 015	Adjacent to former FJ-905 location
			2	L12ss-016 - 017	Adjacent to inlet and outfall of settling basin north of FJ-905
			4	L12ss-018 - 021	Adjacent to sides of filter bed north of FJ-905
	Background	N/A	3	L12ss-022(b) - 024(b)	West and south sides of load line along perimeter fence
	Drainage Channels	N/A	1	L12sd-025(d)	West side drainage upgradient of Bldg. 904 on west side of railroad track
			1	L12sd-026(d)	Southwest drainage north of Bldg. FN-54
			1	L12sd-027(d)	Southwest drainage northeast of Bldg. FN-54
			1	L12sd-028(d)	Southeast drainage near FA-902
			1	L12sd-029(d)	East drainage upgradient of confluence with main east to west drainage
			1	L12sd-030(d)	East drainage downgradient of confluence with main east to west drainage
			1	L12sd-031(d)	Main drainage north of load line upgradient of confluence with Load Line 3 drainage
			1	L12sd-032(d)	Main drainage north of load line downgradient of confluence with Load Line 3 drainage
			2	L12sd-033(d) - 034(d)	Low area northwest of settling pond north of paved road
			2	L12sd-035(d) - 036(d)	Drainage channel from low area northwest of settling pond to settling pond
			1	L12sd-037(d)	Central drainage south from confluence with main drainage
			1	L12sd-038(d)	Main drainage north of LL12 upgradient from confluence with north drainage
			1	L12sd-039(d)	Drainage north of LL12 upgradient from confluence with main LL12 drainage
	Neutral Liquor	Bldg. FF-19	2	L12ss-040 - 041	From pad adjacent to railroad tracks
	To Be Determined	N/A	9	L12xx-042 - 050	Locations TBD as needed based on field observations
		Total	50		
Winklepeck Burning Ground	Burning Pads	Pad #1	1	WBGss-001	Center of burn area
		Pad #2	1	WBGss-002	Center of burn area

Table B-1. Phase 1 RI Surface Soil and Sediment Sampling Locations and Rationale

AOC	Site/Location	Map Identification	Sample Stations	Sample Station Identification	Sample Station Rationale Rationale
		Pad #3	1	WBGss-003	Center of burn area
		Pad #4	1	WBGss-004	Center of burn area
		Pad #5	1	WBGss-005	Center of burn area
		Pad #6	1	WBGss-006	Center of burn area
		Pad #7	1	WBGss-007	Center of burn area
		Pad #8	1	WBGss-008	Center of burn area
		Pad #14	1	WBGss-009	Center of burn area
		Pad #15	1	WBGss-010	Center of burn area
		Pad #16	1	WBGss-011	Center of burn area
		Pad #17	1	WBGss-012	Center of burn area
		Pad #18	1	WBGss-013	Center of burn area
		Pad #19	1	WBGss-014	Center of burn area
		Pad #20	1	WBGss-015	Center of burn area
		Pad #23	1	WBGss-016	Center of burn area
		Pad #24	1	WBGss-017	Center of burn area
		Pad #25	1	WBGss-018	Center of burn area
		Pad #26	1	WBGss-019	Center of burn area
		Pad #27	1	WBGss-020	Center of burn area
		Pad #28	1	WBGss-021	Center of burn area
		Pad #29	1	WBGss-022	Center of burn area
		Pad #30	1	WBGss-023	Center of burn area
		Pad #31	1	WBGss-024	Center of burn area
		Pad #32	1	WBGss-025	Center of burn area
		Pad #33	1	WBGss-026	Center of burn area
		Pad #34	1	WBGss-027	Center of burn area
		Pad #35	1	WBGss-028	Center of burn area
		Pad #36	1	WBGss-029	Center of burn area
		Pad #37	2	WBGss-030-031	Center of burn area
		Pad #38	4	WBGss-032-035	Adjacent to burning pad outside of RCRA area
		Pad #39	1	WBGss-036	Center of burn area
		Pad #40	1	WBGss-037	Center of burn area
		Pad #41	1	WBGss-038	Center of burn area
		Pad #43	1	WBGss-039	Center of burn area
		Pad #44	1	WBGss-040	Center of burn area
		Pad #45	1	WBGss-041	Center of burn area
		Pad #46	1	WBGss-042	Center of burn area
		Pad #47	1	WBGss-043	Center of burn area
		Pad #48	1	WBGss-044	Center of burn area
		Pad #49	1	WBGss-045	Center of burn area
		Pad #50	1	WBGss-046	Center of burn area
		Pad #51	1	WBGss-047	Center of burn area
		Pad #52	1	WBGss-048	Center of burn area
		Pad #53	1	WBGss-049	Center of burn area
		Pad #54	1	WBGss-050	Center of burn area
		Pad #55	1	WBGss-051	Center of burn area
		Pad #56	1	WBGss-052	Center of burn area
		Pad #57	1	WBGss-053	Center of burn area
		Pad #58	1	WBGss-054	Center of burn area
		Pad #59	2	WBGss-055-056	Center of burn area
		Pad #60	2	WBGss-057-058	Center of burn area
		Pad #61	2	WBGss-059-060	Center of burn area
		Pad #62	2	WBGss-061-062	Center of burn area
		Pad #63	2	WBGss-063-064	Center of burn area
		Pad #64	2	WBGss-065-066	Center of burn area
		Pad #65	1	WBGss-067	Center of burn area

Table B-1. Phase 1 RI Surface Soil and Sediment Sampling Locations and Rationale

AOC	Site/Location	Map Identification	Sample Stations	Sample Station Identification	Sample Station Rationale Rationale
		Pad #66	2	WBGss-068-069	Center of burn area
		Pad #67	2	WBGss-070-071	Center of burn area
		Pad #68	2	WBGss-072-073	Center of burn area
		Pad #69	2	WBGss-074-075	Center of burn area
		Pad #70	2	WBGss-076-077	Center of burn area
	Drainage Ditches	Road D, East	4	WBGsd-078-081	2 samples from north ditch and 2 samples from south ditch in vicinity of Pads 50-52
		Road E, East	5	WBGsd-082-086	3 samples from north ditch and 2 samples from south ditch in vicinity of Pads 66-69
		North Drainage	1	WBGsd-087	North drainage in center of burning ground
		North Drainage	1	WBGsd-088	North drainage in east of burning ground
		South Drainage	1	WBGsd-089	South drainage in center of burning ground
		South Drainage	1	WBGsd-090	South drainage in east of burning ground
		To Be Determined	9	WBGss-091-099	TBD based on field observations
		Total	99		
Building 1200	Building 1200	Bldg. 1200	1	B12ss-001	Adjacent to building drain/vent on west side
			1	B12ss-002	Adjacent to building at effluent pipe inlet
	Drainage Channel	N/A	1	B12sd-003(d)	At effluent pipe outfall
			4	B12sd-004(d) - 007(d)	From drainage channel at ~100 ft intervals between pipe outfall & pond
		Total	7		
		Pond and Stream Sediment Sampling			
Load Line 1	Settling Ponds	Griggy's Pond	3	LL1sd-053(p) - 055(p)	From pond along drainage axis
			2	LL1sd-056(p) - 057(p)	At pond outfall prior ot exiting RVAAP facility boundary
		Charlie's Pond	2	LL1sd-058(p) - 059(p)	From pond along drainage axis
			2	LL1sd-060(p) - 061(p)	At pond outfall and downstream prior to crossing Butts-Kistler Road
			1	LL1sd-062(p)	From small pond located between Charlie's and Griggy's Pond
		Total	10		
Load Line 2	Settling Ponds	Kelly's Pond	2	LL2sd-052(p) - 053(p)	From pond along drainage axis and at outfall in-take
			1	LL2sd-054(p)	At pond outfall
			1	LL2sd-055(p)	From pond drainage channel prior to exiting RVAAP facility boundary
		Total	4		
Load Line 3		Upper & Lower Cobbs Ponds	N/A		Drainage outfalls to Upper and Lower Cobbs Ponds
		Total	N/A		
Load Line 4	Settling Ponds	LL4 Settling Pond	4	LL4sd-052(p) - 055(p)	From pond along drainage axis
			1	LL4sd-056(d)	At pond outfall
			1	LL4sd-057(d)	From pond drainage channel south of load line
			1	LL4sd-058(d)	From pond drainage channel prior to exiting RVAAP facility boundary
		Total	7		
Load Line 12	Settling Pond	LL12 Settling Pond	3	L12sd-051(p) - 053(p)	From pond along drainage axis
			1	L12sd-054(p)	At pond outfall
			1	L12sd-055(d)	Downgradient of pond outfall at railroad tracks
		Total	5		
Building 1200	Settling Pond	N/A	2	B12sd-008(p) - 009(p)	Along drainage axis of former pond
		Total	2		
Landfill North of WBG	North Drainage	N/A	1	WBGsd-011(d)	From creek adjacent to northeast of landfill area upgradient from the landfill
			1	WBGsd-012(d)	From creek adjacent to northeast of landfill area adjacent to the landfill
			1	WBGsd-013(d)	From creek adjacent to northeast of landfill area downgradient from the landfill
	South Drainage	N/A	1	WBGsd-014(d)	From creek south of landfill area upgradient from the landfill area
			1	WBGsd-015(d)	From creek south of landfill area adjacent (downgradient) to the landfill area
			1	WBGsd-016(p)	From beaver pond on creek south (downgradient) of landfill

Table B-1. Phase 1 RI Surface Soil and Sediment Sampling Locations and Rationale

AOC	Site/Location	Map Identification	Sample Stations	Sample Station Identification	Sample Station Rationale Rationale
		Total	6		
Demolition Area No. 2	Sand Creek	N/A	1	DA2sd-031(d)	From creek upgragient of demolition area
			1	DA2sd-032(d)	From creek adjacent to demolition area
			1	DA2sd-033(d)	From creek downgradient of demolition area
		Total	3		
Upper & Lower Cobbs Ponds	Upper Cobbs Pond	N/A	5	CPCsd-001(p) - 003(p)	Along drainage axis of pond
	Lower Cobbs Pond	N/A	3	CPCsd-004(p) - 008(p)	Along drainage axis of pond
	Pond Complex Outfall	N/A	2	CPCsd-009(d) - 010(d)	At pond outfall and downstream of Lower Cobbs Pond
		Total	10		

APPENDIX C

OHIO ADMINISTRATIVE CODE 3745-27-13

REQUEST FOR AUTHORIZATION FOR THE RAVENNA ARMY AMMUNITION PLANT RAVENNA, OHIO

1. INTRODUCTION

This is a generic request for authorization from the Ohio Environmental Protection Agency (OEPA) to conduct investigative activities at high priority Areas of Concern (AOCs) at the Ravenna Army Ammunition Plant (RVAAP) that are regulated under the Ohio Administrative Code (OAC) 3745-27-13 (Authorization to engage in filling, grading, excavating, building, drilling, or mining on land where a hazardous waste facility or solid waste facility was operated), hereinafter referred to OAC Rule 13. An agreement between the RVAAP and the OEPA, Northeast District, (documented in a letter from the RVAAP to the OEPA, Northeast District, dated January 4, 1996) stipulates that a generic OAC Rule 13 authorization request be developed according to the requirements of the rule and presented in the Sampling and Analysis Plan (SAP) covering the AOCs at RVAAP where a hazardous waste facility or solid waste facility was operated. The request for authorization under OAC Rule 13 addresses measures necessary to ensure that investigative activities (drilling and soil sampling, monitoring well installation and groundwater sampling, trenching to collect waste materials and soil samples, surface water and sediment sampling, etc.) necessary to characterize these AOCs under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) are protective of human health and the environment.

This generic request for OAC Rule 13 authorization includes the high priority AOCs being addressed under CERCLA at RVAAP where a hazardous waste facility or solid waste facility is known to have operated based on currently available information. AOCs where there is no current evidence that a solid or hazardous waste have been deposited are not proposed under this authorization request. However, as more information becomes available about environmental conditions at AOCs at RVAAP, additional AOCs, not designated under this authorization request, may become applicable areas under OAC Rule 13 if evidence indicates that additional safeguards are needed to protect human health and the environment. Should it be determined by the OEPA and RVAAP that additional AOCs are applicable under OAC Rule 13, then a formal request will be submitted to the OEPA requesting authorization for additional AOCs. Any additional safeguards for additional AOCs, if necessary, will be addressed in the supplemental request for each AOC. Conversely, if AOCs are determined to be non-contaminated (i.e., chemical concentrations below regulatory limits), based on the results of characterization investigations, then a request will be made to the OEPA to remove these AOCs from the OAC Rule 13 status.

The AOCs currently proposed under this generic request for authorization are listed in Table 1-1. The AOCs proposed under this OAC Rule 13 request are those that have been identified as high priority AOCs in the *Action Plan for the Ravenna Army Ammunition Plant, Ravenna, Ohio* (USACE 1996).

Table 1-1 Proposed OAC Rule 13 Applicable AOCs

AOC Number	AOC Name
RVAAP-04	Demolition Area #2
RVAAP-05	Winklepeck Burning Grounds
RVAAP-08	Load Line 1 and Dilution Settling Ponds
RVAAP-09	Load Line 2 and Dilution Settling Ponds
RVAAP-10	Load Line 3 and Dilution Settling Ponds
RVAAP-11	Load Line 4 and Dilution Settling Ponds
RVAAP-12	Load Line 12 and Dilution Settling Ponds
RVAAP-13	Building 1200 and Dilution Settling Pond
RVAAP-18	Load Line 12 Pink Wastewater Treatment Plant
RVAAP-19	Landfill North of Winklepeck Burning Ground
RVAAP-29	Upper and Lower Cobbs Ponds

Following is a brief summary of the rationale for the AOCs included in the OAC Rule 13 authorization request:

<u>RVAAP-04 Demolition Area #2</u> - Used to detonate munitions and explosives. Thermal destruction of explosives and explosive wastes at 0.25 acre Resource Conservation and Recovery Act (RCRA) burning area. Reported burials of scrap bombs and explosives along with visual evidence of burial areas. Stressed vegetation observed. 1983 U.S. Army Environmental Hygiene Agency (USAEHA) investigation of RCRA area detected high concentrations of explosives and metals in surface soils. 1995 RCRA groundwater monitoring has detected no contamination in groundwater. 1992 USAEHA investigation detected low concentrations of explosives and metals in surface soils.

<u>RVAAP-05 Winklepeck Burning Grounds</u> - Widely used for the thermal destruction of explosives on earthen "open burning pads". Thermal destruction process used waste oils poured on starter materials on the ground surface as an ignition source. 1983 USAEHA investigation of 11 active burning pads found significant concentrations of explosives and metals in surface soils and in one drainage ditch.

<u>RVAAP-08 Load Line 1 and Dilution Settling Ponds</u> - Potential for surface soil contamination adjacent to process buildings from washout of explosive and metal residues. Potential for surface soil and sediment contamination from the release of large volumes of process effluent (pink water) containing explosive and metal constituents into unlined earthen ditches. Potential for sediment and shallow groundwater contamination from earthen settling ponds receiving process effluent. Sediment samples detected explosives. Settling ponds located in close

proximity to the facility boundary.

RVAAP-09 Load Line 2 and Dilution/Settling Ponds - Potential for surface soil contamination adjacent to process buildings from washout of explosive and metal residues. Potential for surface soil and sediment contamination from the release of large volumes of process effluent (pink water) containing explosive and metal constituents into unlined earthen ditches. Potential for sediment and shallow groundwater contamination from earthen settling pond receiving process effluent. Sediment samples detected explosives. Settling pond located in close proximity to the facility boundary.

RVAAP-10 Load Line 3 and Dilution/Settling Pond - Potential for surface soil contamination adjacent to process buildings from washout of explosive and metal residues. Potential for surface soil and sediment contamination from the release of large volumes of process effluent (pink water) containing explosive and metal constituents into unlined earthen ditches. Potential for sediment and shallow groundwater contamination from earthen settling pond receiving process effluent. Sediment samples detected explosives in settling ponds (Cobbs Ponds).

RVAAP-11 Load Line 4 and Dilution/Settling Ponds - Potential for surface soil contamination adjacent to process buildings from washout of explosive and metal residues. Potential for surface soil and sediment contamination from the release of large volumes of process effluent (pink water) containing explosive and metal constituents into unlined earthen ditches. Potential for sediment and shallow groundwater contamination from earthen settling pond receiving process effluent. Sediment samples detected explosives. Settling pond located in close proximity to the facility boundary.

RVAAP-12 Load Line 12 and Dilution/Settling Ponds - Potential for surface soil contamination adjacent to process buildings from washout of explosive and metal residues. Potential for surface soil and sediment contamination from the release of large volumes of process effluent (pink water) containing explosive and metal constituents into unlined earthen ditches. Potential for sediment and shallow groundwater contamination from earthen settling pond receiving process effluent. Red surface soil stains indicating explosives adjacent to Building FJ-905. Sediment samples detected explosives in settling ponds (Cobbs Ponds).

RVAAP-13 Building 1200 and Dilution Settling Pond - Potential for surface soil and sediment contamination from process effluent (pink water) containing explosive and metal constituents from ammunition sectionalizing operations released to earthen ditch and settling pond.

RVAAP-18 Load Line 12 Pink Wastewater Treatment Plant - Potential for surface soil and sediment contamination from the processing of effluent (pink water) containing explosive and metal constituents. Adjacent to Load Line 12 Building FJ-905 where red surface soil stains have been observed.

RVAAP-19 Landfill North of Winklepeck Burning Grounds - Potential for soil and groundwater contamination from leaching of wastes buried in unlined trenches. Explosive waste residue from Winklepeck Burning Ground reported to be buried. Potential impact to adjacent stream. Location of burial trenches and waste inventory are un-documented.

RVAAP-29 Upper and Lower Cobbs Ponds - Potential for sediment contamination from process effluent containing explosive and metal constituents from Load Line #3 and #12. Explosives detected in sediment and fish kill reported in 1966.

The status, plans, and schedule for current characterization activities of AOCs at RVAAP is presented in the *Action Plan for the Ravenna Army Ammunition Plant, Ravenna, Ohio* (USACE 1996). The facility Action Plan is revised annually to reflect current and planned environmental activities at RVAAP.

The following sections include the information required under OAC Rule 13 authorization request, in the order in which it is specified. Because much of the information required under the provisions of OAC Rule 13 is contained in existing facility documents and CERCLA work plans developed for conducting investigations of AOCs at RVAAP, references to existing documentation are used where appropriate to meet the requirements of the rule.

2. LOCATION AND DESCRIPTION - OAC 3745-27-13(C)(1)

RVAAP is located in northeastern Ohio within Portage and Trumbull Counties, approximately 4.8 kilometers (3 miles) east/northeast of the Town of Ravenna and approximately 1.61 kilometers (1 mile) northwest of the Town of Newton Falls. The installation consists of 21,419 acres (8668 hectares) contained in a 17.7-kilometers-long (11-mile-long), 5.63-kilometers-wide (3.5-mile-wide) tract bounded by State Route 5 and the CSX System Railroad on the south; State Route 534 on the east; the Garrettsville and Berry Roads on the west; and the CONRAIL Railroad on the north. The land use surrounding the installation is primarily farmland with sparse private residences. The Michael J. Kirwan Reservoir is located immediately south of the facility.

RVAAP is a government-owned, contractor-operated U.S. Army Industrial Operations Command (IOC) facility. Currently, RVAAP is an inactive facility maintained by a contracted caretaker, Mason and Hanger-Silas Mason Co., Inc. Table 2-1 presents the RVAAP Command Organization, IRP executing agencies, and lead regulatory agencies.

Over the years, RVAAP handled and stored strategic and critical materials for various government agencies and received, stored, maintained, transported, and demilitarized military ammunition and explosive items. RVAAP maintained the capabilities to load, assemble, and pack military ammunition; however, these operations are inactive. As part of the RVAAP mission, the inactive facilities were maintained in a standby status by keeping equipment in a condition to permit resumption of production within the prescribed time limitations.

The location of the RVAAP facility on a 7.5 minute USGS topographic map is provided in the *Preliminary Assessment for The Ravenna Army Ammunition Plant, Ravenna, Ohio* (USACE 1996). The location, description, and operating history for the AOCs at RVAAP, including those currently covered under this OAC Rule 13 request for authorization, are also included in the Preliminary Assessment. Figures 2-1 through 2-10 are large scale (1 inch equals 200 feet) maps of the AOCs currently proposed under this generic request for authorization, as required.

Table 2-1. RVAAP Organizational Responsibilities

Command Organization
Major Command: U.S. Army Materiel Command Major Subordinate Command: U.S. Army Industrial Operations Command Installation: RVAAP, Commander's Representative Installation Contractor: Mason & Hanger-Silas Mason Co., Inc.
Installation Restoration Program Executing Agency
U.S. Army Corps of Engineers, Nashville District
Regulatory Agencies
Ohio Environmental Protection Agency, Northeast District U.S. Environmental Protection Agency, Region V

3. INVESTIGATION ACTIVITIES - OAC 3745-27-13(C)(2)

The activities for which authorization is requested (drilling and soil sampling, monitoring well installation and groundwater sampling, trenching to collect waste material and soil samples, piezometer and well point installation, surface water and sediment sampling) are necessary to characterize the AOCs under CERCLA leading to the environmental restoration of these under the U.S. Department of Defense (DoD) Installation Restoration Program (IRP). The approach to implementing CERCLA under the IRP is described in Section 1 of the *Facility-wide Sampling and Analysis Plan for the Ravenna Army Ammunition Plant, Ravenna, Ohio* (USACE 1996) and in the facility Action Plan. The characterization of the AOCs under this generic authorization request are expected to include investigative activities to evaluate potential sources of contamination and their impact on adjacent soils, groundwater, surface water, and sediment. The specific investigation activities for each AOC will be defined in a investigation-specific SAP addendum to the Facility-wide SAP and submitted in draft for OEPA review and comment, and as a final document for OEPA approval prior to conducting any investigative activities at an AOC.

Planned investigative activities at the AOCs addressed under this generic request for authorization are: (1) drilling and soil sampling, (2) monitoring well installation and groundwater sampling, (3) piezometer and well point installation, (4) trenching to collect waste material and soil samples, (5) surface water and sediment sampling, and (6) surface soil sampling. Following is a brief description of each investigative activity:

<u>Drilling and soil sampling</u> - Soil borings may be drilled in and adjacent to the former disposal areas in order to collect subsurface soil samples for laboratory analysis to characterize potential contaminants in the soils associated with these AOCs.

<u>Monitoring well installation and groundwater sampling</u> - Boreholes may also be drilled to install monitoring wells in and adjacent to these AOCs to collect groundwater samples for laboratory

analysis to characterize groundwater associated with these AOCs.

Piezometer and well point installation - Piezometers and well points may be installed at these AOCs to determine the depth to shallow groundwater and the potentiometric surface at these AOCs, and to collect groundwater samples to screen for potential contamination. This information will be used to determine the depth of trenches so as not to intersect the water table during trenching operations to mitigate the potential for cross-contamination of media and the creation of a preferential flow path. This information will additionally be used to locate monitoring wells to monitor groundwater downgradient of these areas.

Trenching and waste material and soil sampling - Trenches may be excavated in these disposal areas to evaluate the nature of buried waste in former landfill areas because burial records are limited or unavailable. Samples of waste materials and subsurface soils adjacent to the burials will be collected for laboratory analysis to characterize potential source materials and contamination resulting from the leaching of buried materials. Trenches will be small excavations (~2 feet wide x ~10 feet long) and will not intersect groundwater zones (perched or water table). Currently, trenching is planned only at the Landfill North of Winklepeck Burning Grounds (RVAAP-19).

Surface water and sediment sampling - Surface water and sediment samples may be collected from surface streams and drainage adjacent to the former disposal areas and submitted for laboratory analysis to characterize the impact of the disposal areas on these media.

Surface soil sampling - Surface soil samples may be collected from surface soils adjacent to former disposal areas and submitted for laboratory analysis to characterize the potential impact of disposal practices on these areas.

4. PREVIOUS AND EXISTING PERMITS, APPROVALS, AND ORDERS - OAC 3745-27-13(C)(3)

There are no previous or existing permits, approvals, or orders pertaining to the AOCs for which authorization under OAC Rule 13 is being requested. The regulatory history of AOCs at RVAAP are presented in the Preliminary Assessment, and the facility Action Plan that contains additional information on the regulatory history of the installation.

5. LETTERS OF ACKNOWLEDGMENTS - OAC 3745-27-13(C)(4)

All parcels of land to which this request for authorization pertains are owned by the U.S. Army. Because of the interior location of the AOCs within the boundaries of the 21,149 acre (8668 hectares) RVAAP facility, all adjacent parcels are similarly owned by the U.S. Army. Consequently, no letters of acknowledgement are included in this request for authorization under OAC Rule 13.

6. LETTERS OF NOTICE - OAC 3745-27-13(C)(5)

Letters of notice of this request for authorization are required, under the provisions of the OAC Rule 13, to be sent to the board of health for the health district and the local zoning authority for the area within which the facility is located. The Department of Health for both Trumbull and Portage Counties, Ohio, have been notified and the copies of the letters of notice are attached to this request for authorization as Attachments I and II. Because the Federal Government owns the RVAAP, local zoning authorities do not have jurisdiction over the facility; therefore, notices of this request for authorization were not sent to these agencies. The local zoning authorities were contacted to confirm their jurisdiction at RVAAP.

7. HISTORY OF HAZARDOUS WASTE OR SOLID WASTE TREATMENT, STORAGE OR DISPOSAL OPERATIONS - OAC 3745-27-13(C)(6)

A summary of all currently known hazardous waste and solid waste treatment, storage and disposal facilities at RVAAP are presented in the Preliminary Assessment. The histories of the AOCs proposed under this authorization request are included in this document.

8. CLOSURE ACTIVITIES - OAC 3745-27-13(C)(7)

No formal closure activities have previously been initiated at the AOCs covered under this request for authorization. However, hazardous waste and solid waste treatment, storage and disposal operations have ceased at all AOCs at RVAAP. Under the CERCLA process, as presented in Section 1 (Introduction) of the Facility-wide SAP, the investigation of potentially contaminated AOCs is the first step in the remediation and closure process. A summary of all known previous closure activities for AOCs at RVAAP is presented in the Preliminary Assessment, and additional closure information is also presented in the facility Action Plan.

9. INVESTIGATION METHODS AND PROCEDURES - OAC 3745-27-13(C)(8)

The investigation of AOCs at RVAAP will be conducted in accordance with facility-wide work plans and investigation-specific work plan addenda developed to meet the requirements established by the OEPA and the United States Environmental Protection Agency (EPA), Region V, under CERCLA. These plans contain detailed methods and procedures for performing the described investigation activities. Facility-wide work plans consist of a Facility-wide SAP and a *Facility Safety and Health Plan for the Ravenna Army Ammunition Plant, Ravenna, Ohio* (USACE 1996). The intent of the facility-wide documents are to guide the investigation activities, to the extent practical, expected to be common to the investigation of all AOCs at RVAAP. For each AOC-specific investigation, addenda to the facility-wide work plans will be developed that contain additional project-specific information regarding the investigation activities and implementing methods and procedures. The investigation of an AOCs cannot be implemented without the Facility-wide SAP, FSHP, and a investigation-specific addendum for each plan. The contents and relationship of the facility-wide work plans and investigation-specific addenda are addressed in greater detail in Section 1 (Introduction) of the Facility-wide SAP. The facility-wide work plans and their addenda will be approved by the OEPA prior to initiating investigation activities.

Detailed procedures describing the investigative methods are contained in the Field Sampling Plan (FSP) part of either the Facility-wide SAP or the AOC-specific SAP addenda as follows:

Drilling and soil sampling - Facility-wide SAP, FSP Section 4.4 Subsurface Soil.

Monitoring well installation and groundwater sampling - Facility-wide SAP, FSP Section 4.3 Groundwater.

Piezometer and well point installation - Investigation-specific SAP Addenda, FSP Section 4.3 Groundwater.

Trenching and waste material and soil sampling - Facility-wide SAP, FSP Section 4.4 Subsurface Soil.

Surface water and sediment sampling - Facility-wide SAP, FSP Sections 4.6 and 4.5.

Surface soil sampling - Facility-wide SAP, FSP Section 4.5.

10. ENVIRONMENTAL PROTECTION - OAC 3745-27-13(C)(9)

As previously described in Section 9 of this request for authorization, the investigation of AOCs at RVAAP will be conducted in accordance with facility-wide work plans and investigation-specific work plan addenda developed to meet the requirements established by the OEPA and the EPA, Region V, under CERCLA. These plans contain detailed methods and procedures for performing the described investigation activities. The primary focus of these documents are to produce legally defensible investigation results and ensure protection of human health and the environment. Consequently, the investigation methods and procedures cited in Section 9 are prepared to be compliant with applicable state and federal laws and regulations for conducting CERCLA investigations. These procedures contain provisions for protection of the environment resulting from investigative activities. In addition, the Facility-wide SAP and it's addenda contain provisions (Section 7, FSP) for the management of Investigation-Derived Waste (IDW) in accordance with applicable state and federal laws and regulations. Provisions are included for the treatment, storage, and disposal (TSD) of IDW in accordance with applicable state and federal laws and regulations.

11. REMOVAL OF SOLID OR HAZARDOUS WASTE, OR POTENTIALLY CONTAMINATED SOILS - OAC 3745-27-13(C)(10)

During the investigation of AOCs at RVAAP, it is expected that only contaminated or hazardous IDW generated as a result of characterization activities (excess soil and drill cuttings from soil borings and monitoring well boreholes; purged groundwater from monitoring well development; hazardous waste, if any, from characterization trenches; and sampling equipment decontamination water) will potentially be removed from an AOC. Section 7 of the FSP in the Facility-wide SAP and the investigation-specific SAP addenda contain provisions for representative sampling and analysis and TSD of IDW in accordance with applicable state and federal laws and regulations. Section 7 of the FSP in the Facility-wide SAP requires submittal of a copy of a letter of acceptance from a disposal facility be submitted to the OEPA prior to removal of IDW for disposal from an AOC.

12. CLOSURE PROCEDURES - OAC 3745-27-13(C)(11)

The formal process for completing regulatory closure of AOCs at RVAAP, regulated under CERCLA, is described in Section 1 (Introduction) of the Facility-wide SAP, and additional information regarding closure/remediation of AOCs under CERCLA is presented in the Action Plan (USACE 1996). Because the CERCLA process is iterative, and, therefore, requires a considerable amount of time in which to implement a remediation, the FSP part of the Facility-wide SAP and investigation-specific SAP addenda contain provisions for reestablishing AOC conditions following completion of characterization activities to mitigate the impact on human health and the environment from these activities until such time that the AOC can be remediated, if necessary, under the CERCLA process. These reestablishment measures are described for each investigative activity presented in the FSP part of the Facility-wide SAP and investigation-specific addenda.

13. OAC RULE 13 AUTHORIZATION REQUEST SIGNATURES - OAC 3745-27-13(C)(12)(D)(1)(d)

The statements and assertions of fact made in this application are true and complete to my knowledge and comply fully with applicable state requirements as stated in OAC Rule 3745-27-13.

____

John A. Cicero, Jr.
Commander's Representative
Ravenna Army Ammunition Plant

____

Notary Public

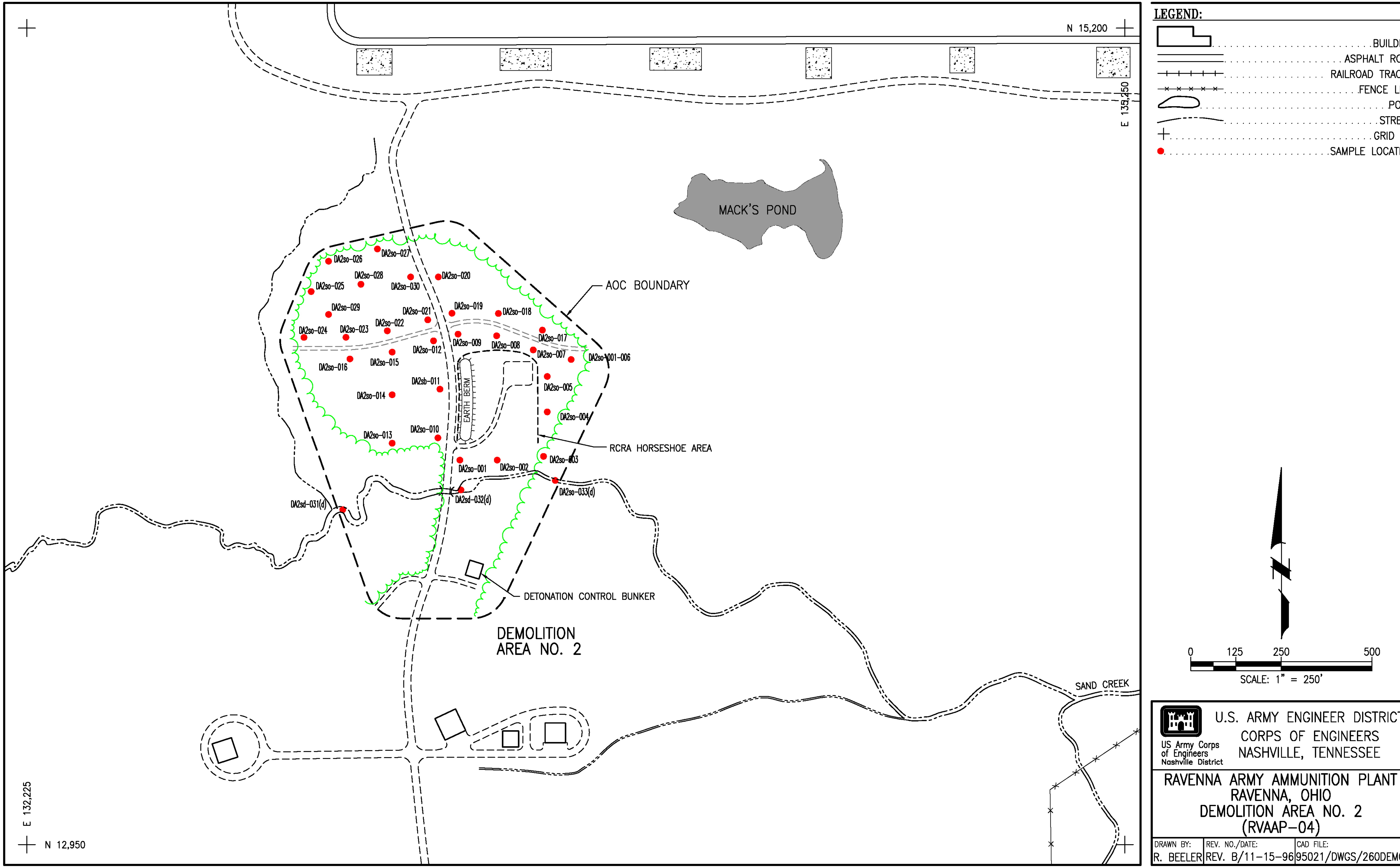


Fig. C-1. Demolition Area No. 2 (RVAAP-04)

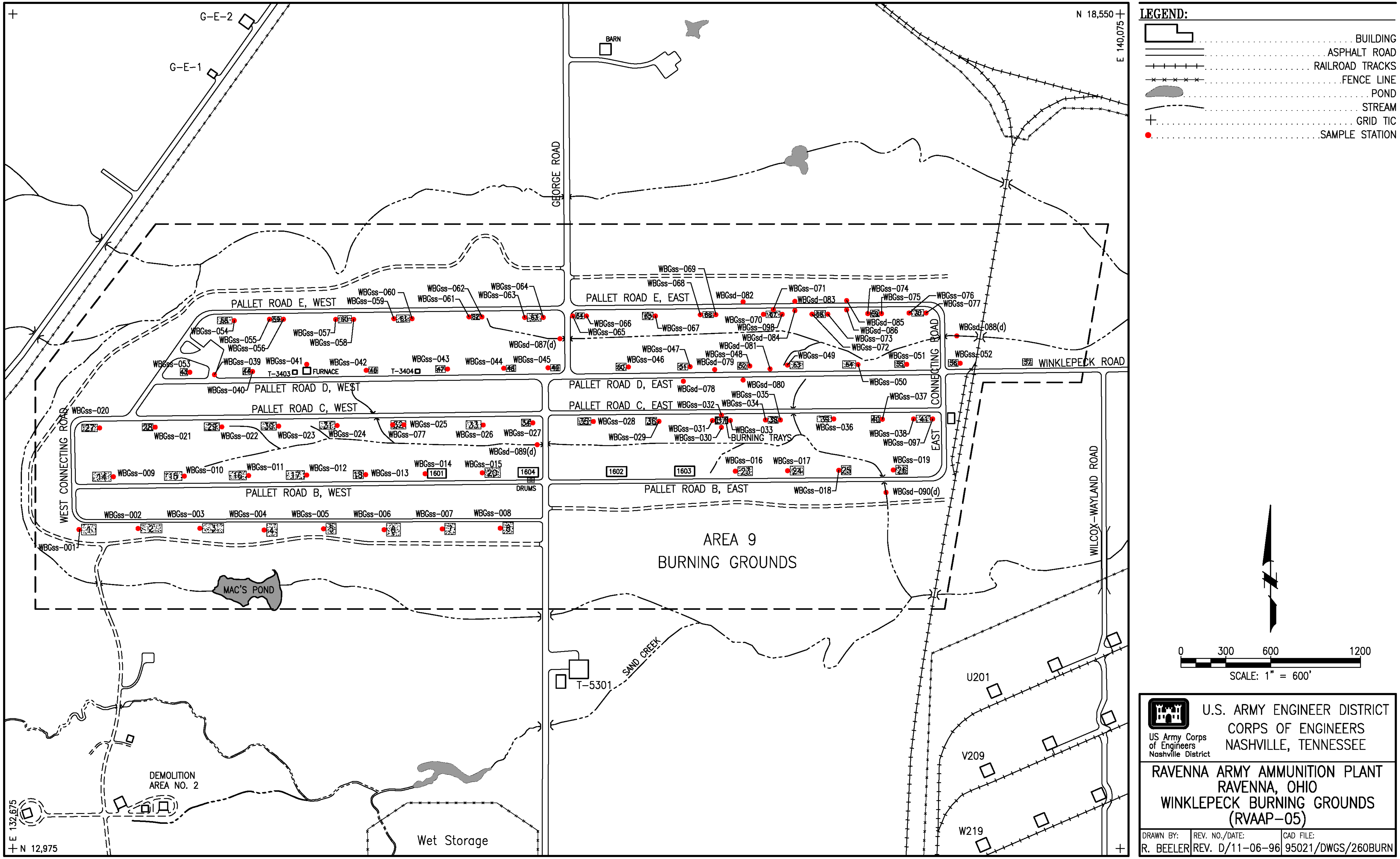


Fig. C-2. Winklepeck Burning Grounds (RVAAP-05)

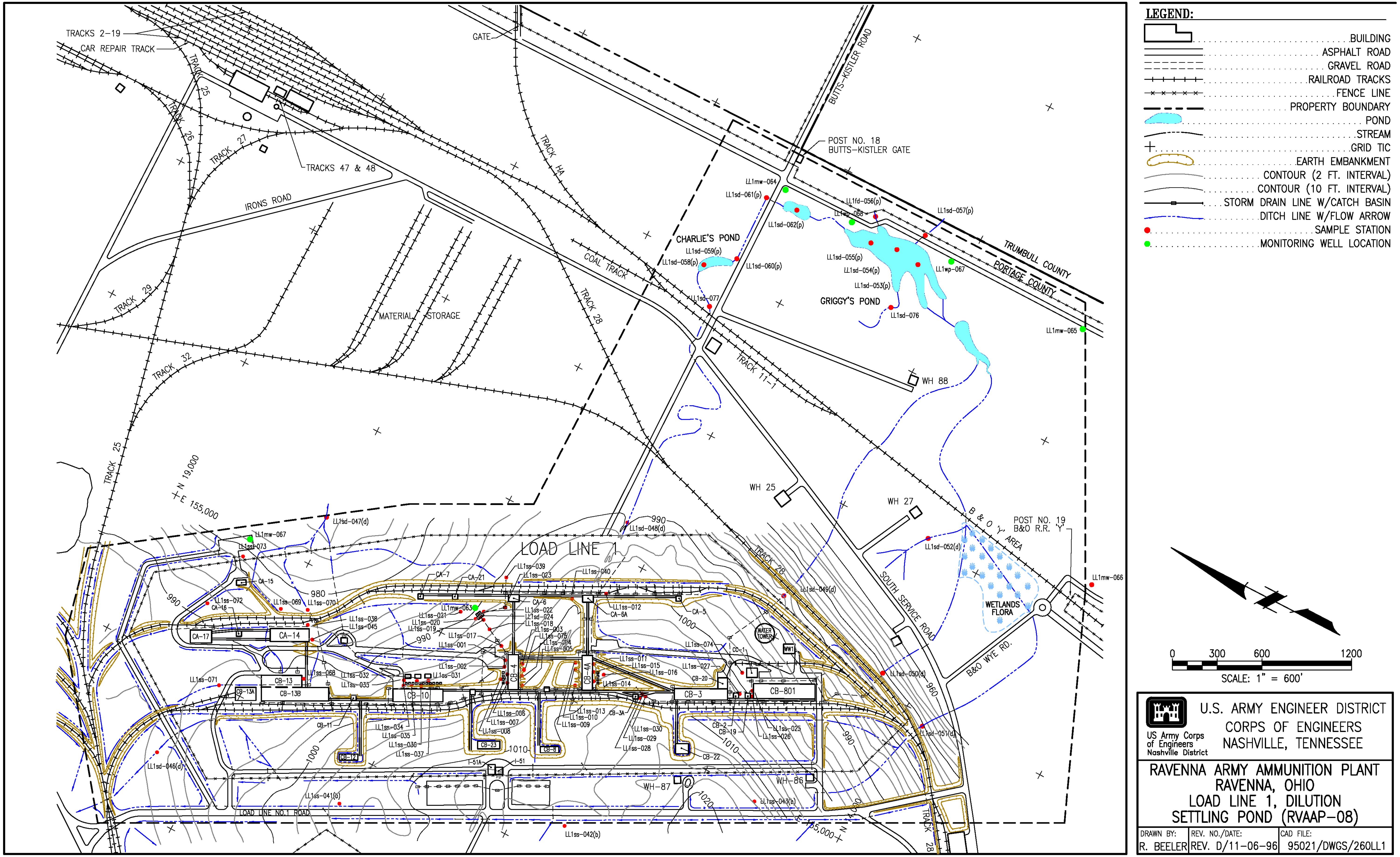


Fig. C-3. Load Line 1, Dilution Settling Pond (RVAAP-08)

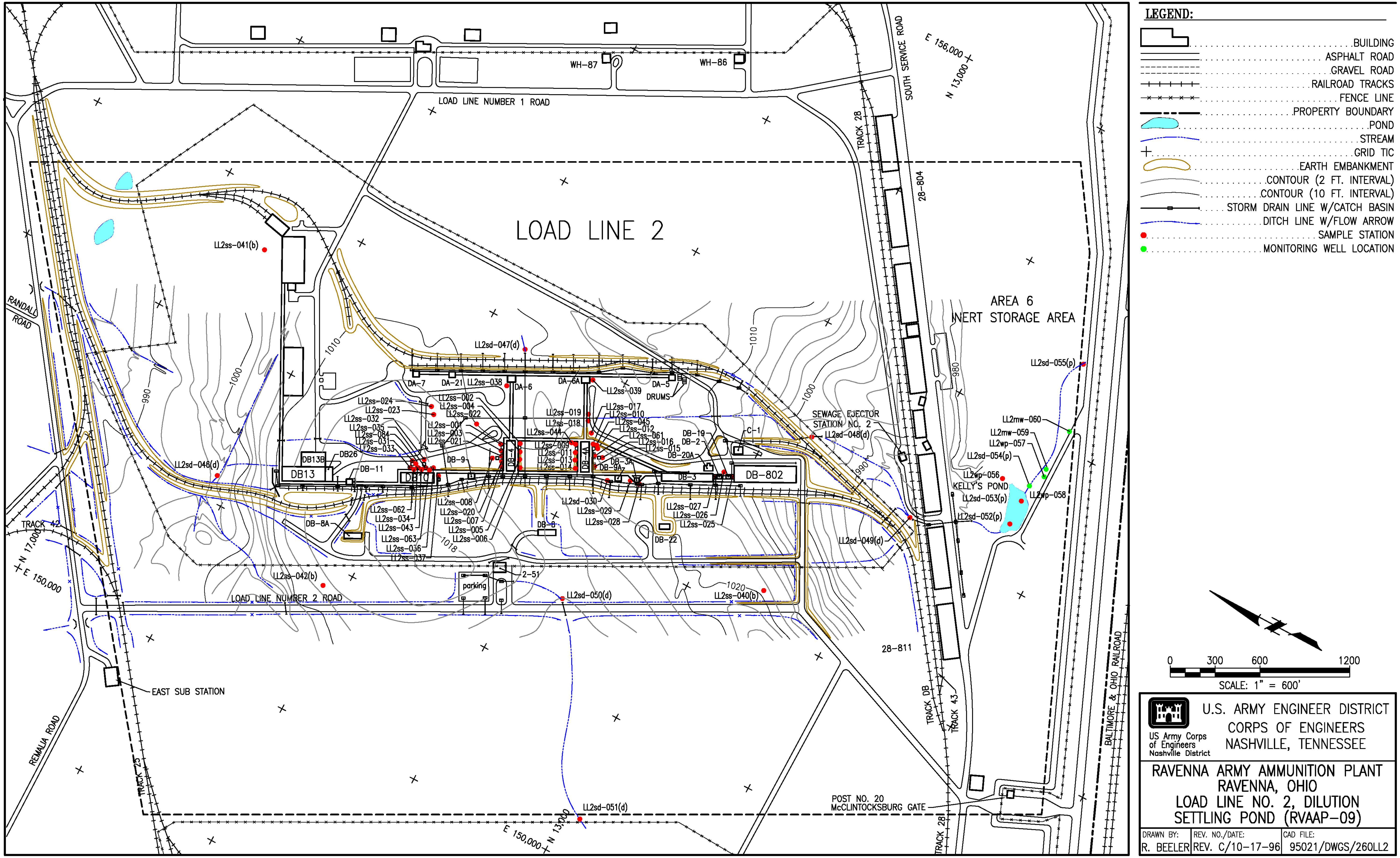


Fig. C-4. Load Line 2, Dilution Settling Pond (RVAAP-09)

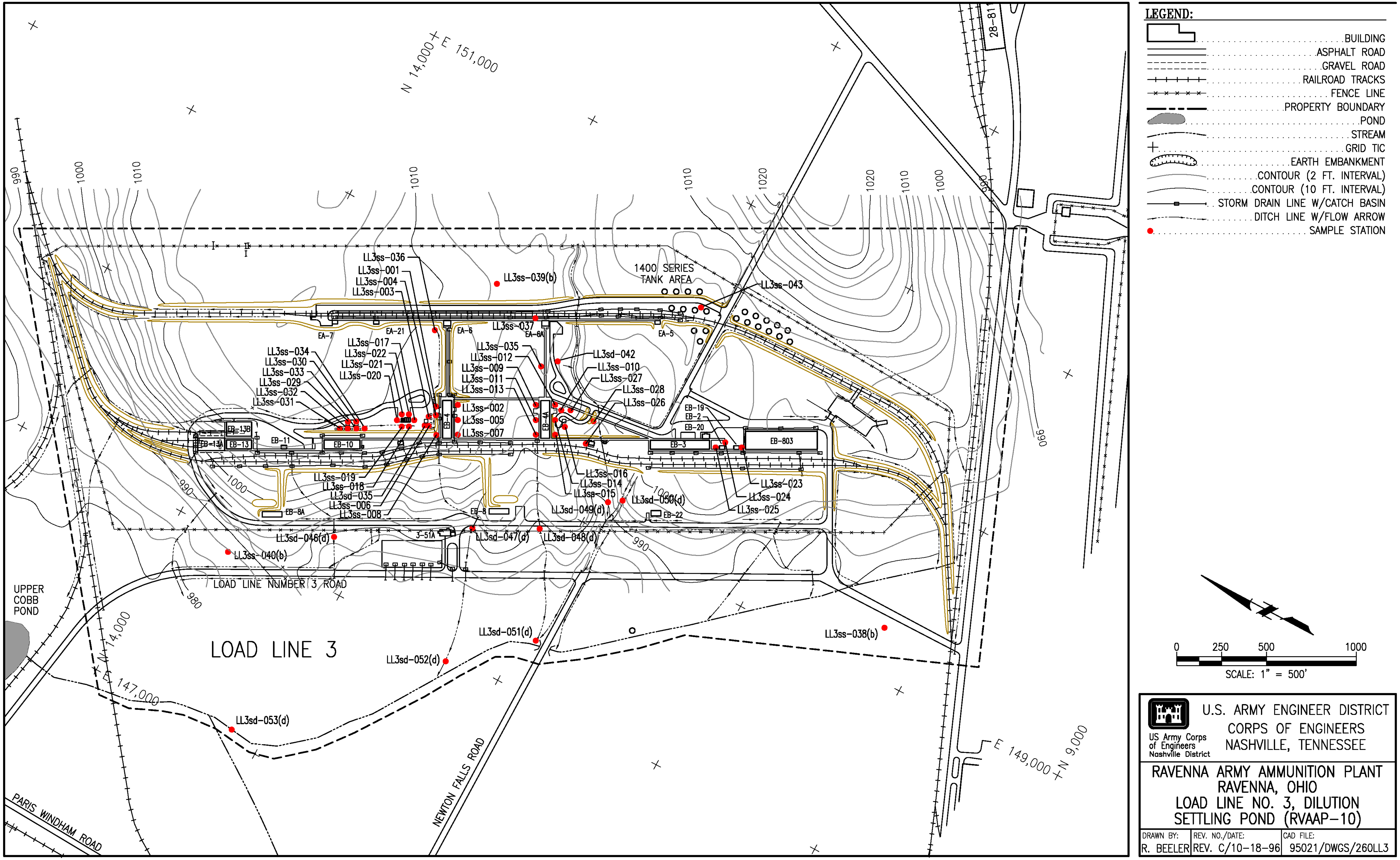


Fig. C-5. Load Line 3, Dilution Settling Pond (RVAAP-10)

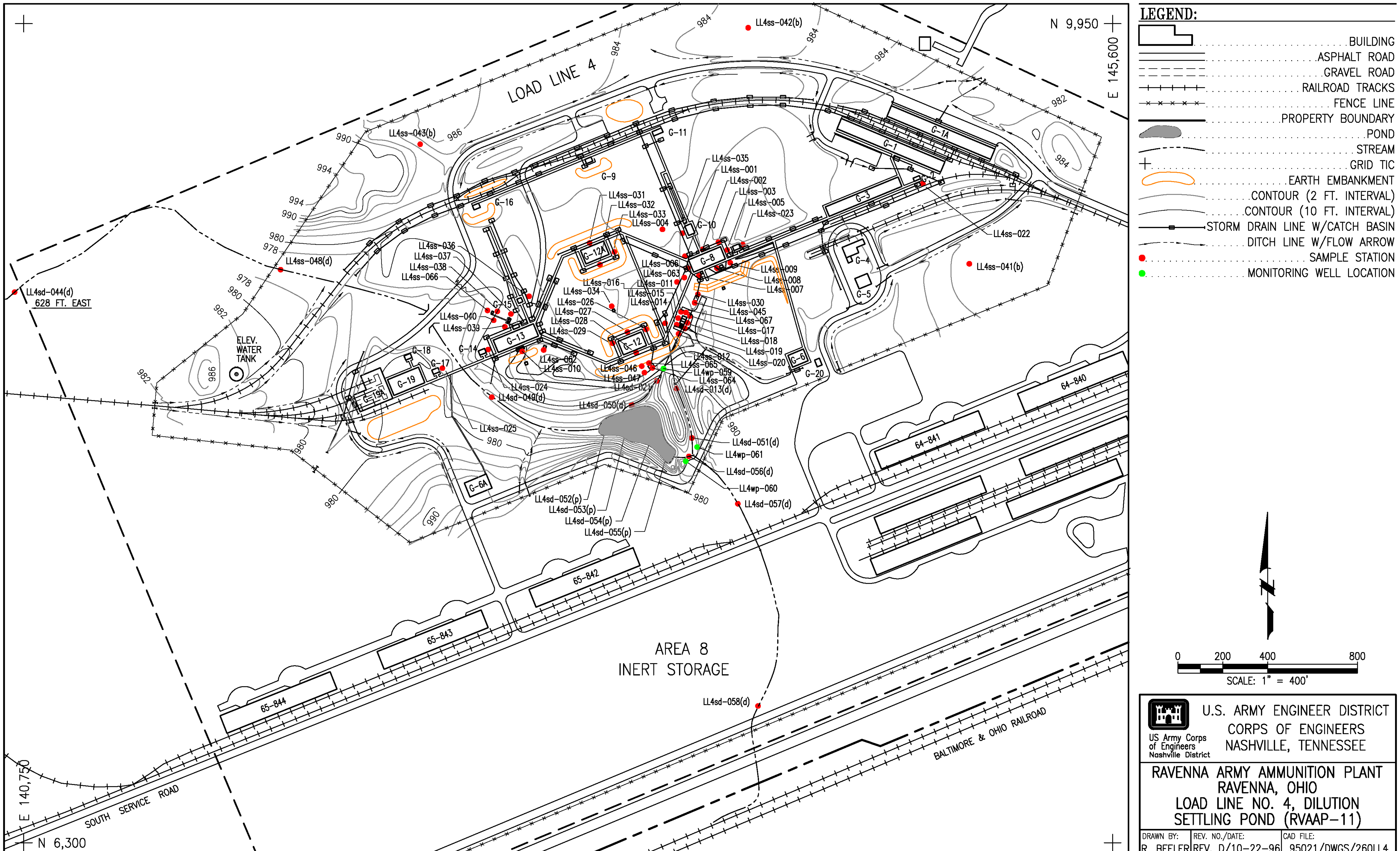


Fig. C-6. Load Line 4, Dilution Settling Pond (RVAAP-13)

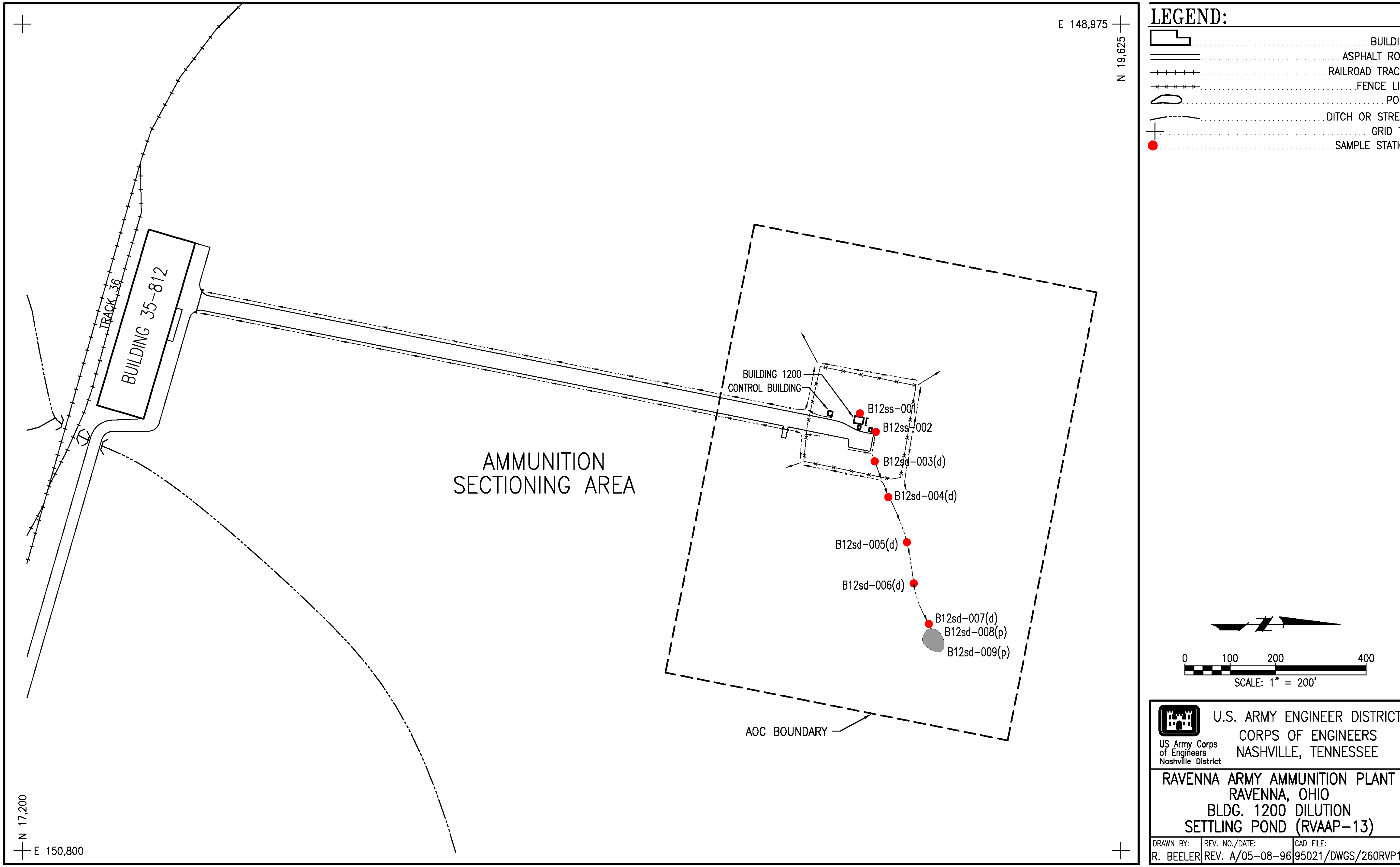


Fig. C-7. Bldg. 1200 Dilution Settling Pond (RVAAP-13)

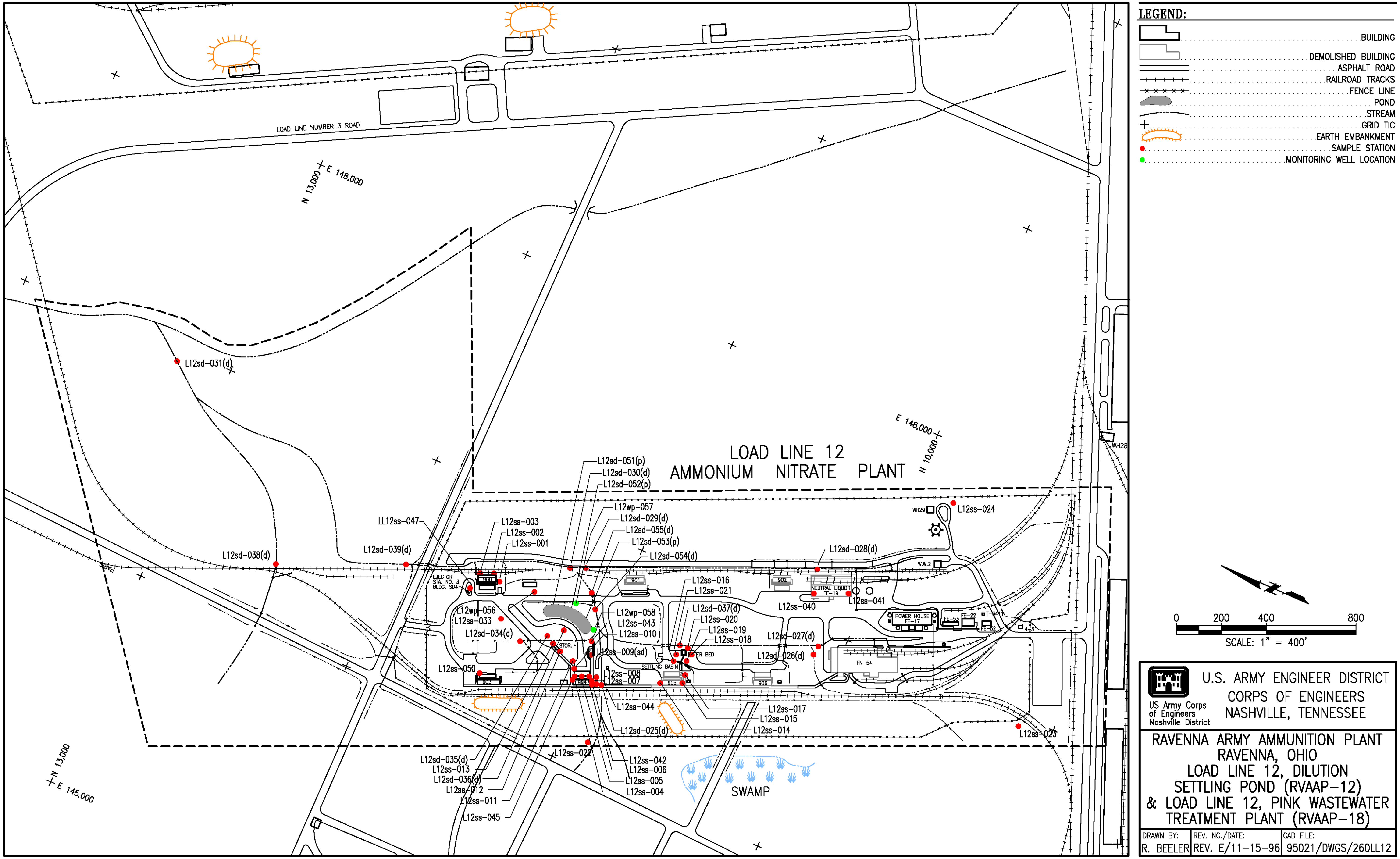


Fig. C-8. Load Line 12, Dilution Settling Pond (RVAAP-12)

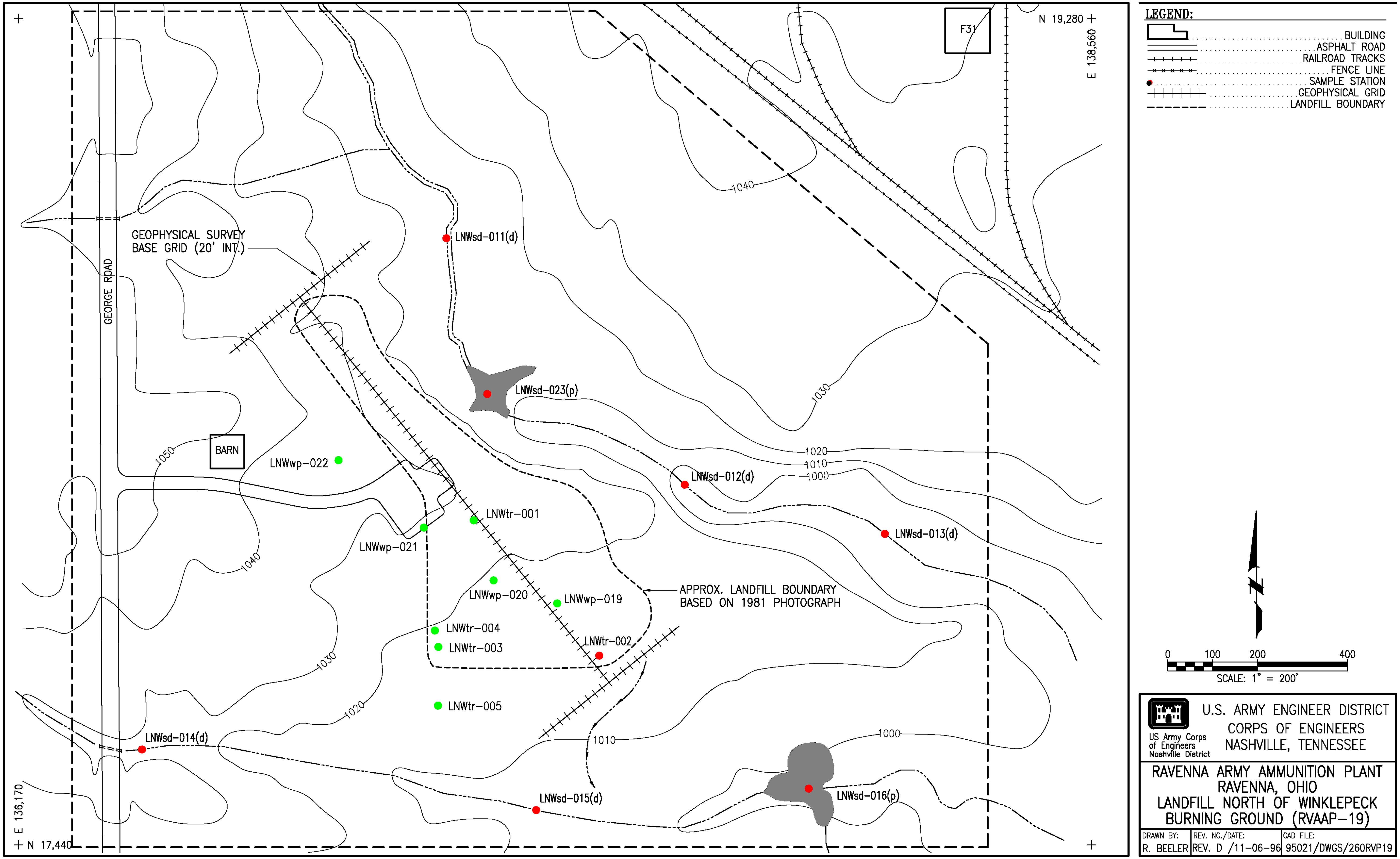


Fig. C-9. Landfill North of Winklepeck Burning Ground (RVAAP-19)

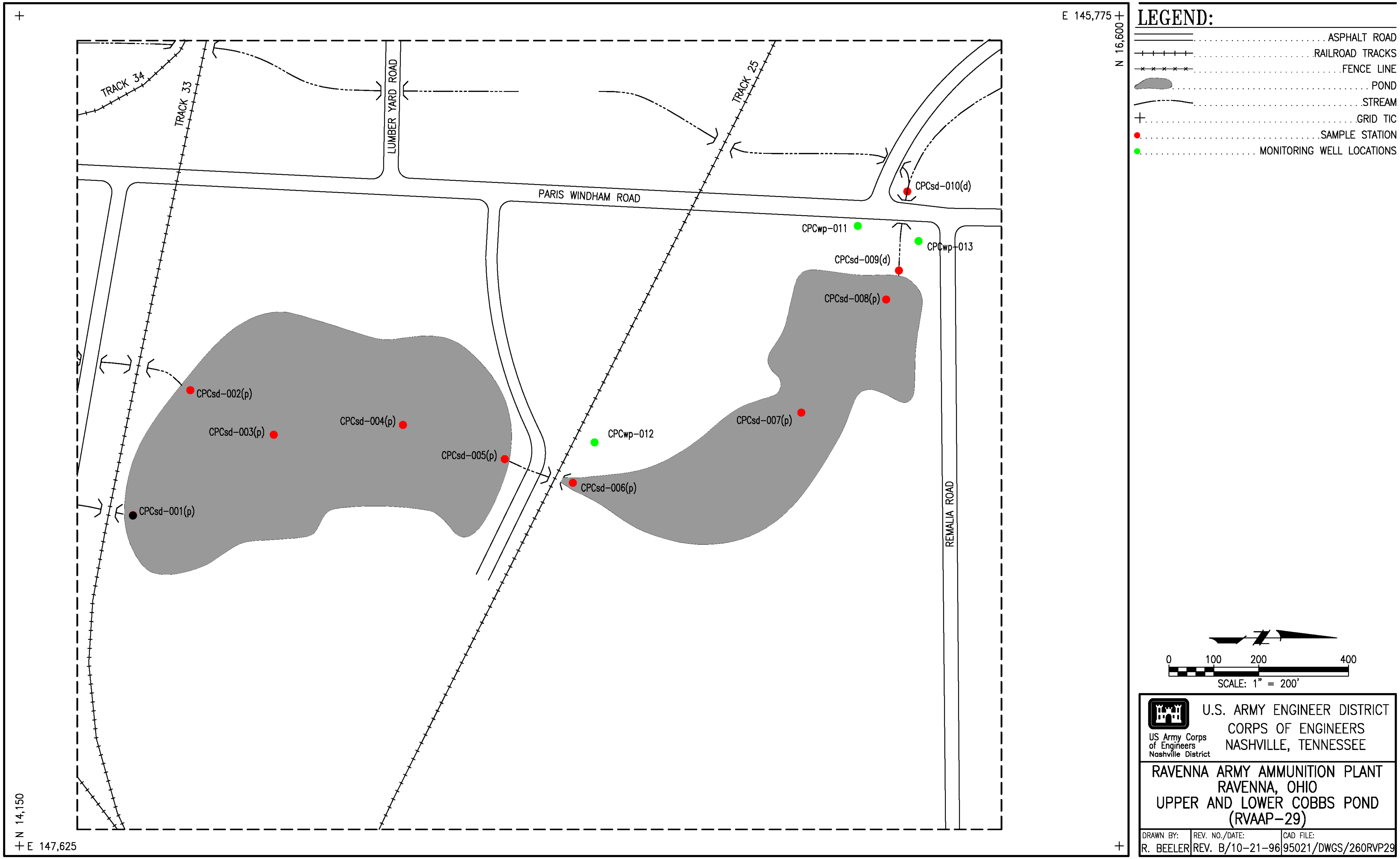


Fig. C-10. Upper & Lower Cobbs Pond (RVAAP-29)

QUALITY ASSURANCE PROJECT PLAN, ADDENDA
FOR THE
PHASE I REMEDIAL INVESTIGATION
OF
HIGH PRIORITY AREAS OF CONCERN
AT THE
RAVENNA ARMY AMMUNITION PLANT
RAVENNA, OHIO

July 1996

QUALITY ASSURANCE PROJECT PLAN
CONTENTS

LIST OF TABLES

ACRONYMS

AOCs	Areas of Concern
COC	chain of custody
DQO	data quality objective
EPA	United States Environmental Protection Agency
FSP	Field Sampling Plan
GC/MS	gas chromatograph/mass spectrometer
HTRW	Hazardous, Toxic, and Radioactive Waste
ICP	inductively coupled plasma
LCS	Laboratory Control Sample
MCX	Mandatory Center of Expertise
MRD	Missouri River District
MS	matrix spike
MSD	matrix spike duplicate
OEPA	Ohio Environmental Protection Agency
PCB	Polychlorinated biphenyls
QA	quality assurance
QAPP	Quality Assurance Project Plan
QC	quality control
RVAAP	Ravenna Army Ammunition Plant
SAIC	Science Applications International Corporation
SOP	standard operating procedure
USACE	United States Army Corps of Engineers

INTRODUCTION

This Quality Assurance Project Plan (QAPP) addenda addresses supplemental project specific information in relation to the Site-Wide QAPP for the Ravenna Army Ammunition Plant (RVAAP), Ravenna, Ohio. Each QAPP section is presented documenting adherence to the Site-Wide QAPP or stipulating project specific addenda and requirements.

1. PROJECT DESCRIPTION

1.1 SITE HISTORY/BACKGROUND INFORMATION

This information is contained in Sect. 1.1 of the Phase I High Priority Areas of Concern (AOCs), Field Sampling Plan (FSP) Addendum.

1.2 PAST DATA COLLECTION ACTIVITY/CURRENT STATUS

This information is contained in Sect. 1.2 of the Phase I High Priority AOCs, FSP Addendum.

1.3 PROJECT OBJECTIVES AND SCOPE

This information is contained in Sect. 3 of the Phase I High Priority AOCs, FSP Addendum.

1.4 SAMPLE NETWORK DESIGN AND RATIONALE

This information is contained in Sect. 4 of the Phase I High Priority AOCs, FSP Addendum.

1.5 PARAMETERS TO BE TESTED AND FREQUENCY

Sample matrix types, analytical parameters, and analytical methods are discussed in Sect. 4 of the Phase I High Priority AOCs, FSP Addendum. These are summarized in Table 1-1 of this QAPP in conjunction with anticipated sample numbers, quality assurance (QA) sample frequencies, and field quality control (QC) sample frequencies.

1.6 PROJECT SCHEDULE

The Phase I High Priority AOCs project schedule is discussed in Sect. 11 of the Phase I High Priority AOCs, FSP Addendum.

Table 1.1. Phase I RI Analytical Summary

Parameter	Methods	No. of Field Samples	No. of Fld. Dup. Samples	No. of Sampler Rinsates	No. of Trip Blanks	Total A-E Samples	QA Splits	QA Trip Blanks	Total QA Samples
SOIL/SEDIMENT (DRY)									
Volatile Organics	SW-846, 8260A	94	9	0	-	103	3	-	3
Semivolatile Organics	SW-846, 8270B	94	9	0	-	103	3	-	3
Pesticides/PCBs	SW-846, 8081	94	9	0	-	103	3	-	3
Explosives	SW-846, 8330	438	45	0	-	483	22	-	22
Metals (short list)[c]	SW-846, 6010A/7471	359	36	0	-	395	17	-	17
Metals (TAL)	SW-846, 6010A/7471	94	9	0	-	103	5	-	5
Cyanide	SW-846, 9013	94	9	0	-	103	3	-	3
Total Organic Carbon (TOC)	SW-846, 9060	58	0	0	-	58	10	-	0
Grain Size (sieve)	ASTM, D422	58	0	0	-	58	-	-	-
SEDIMENT (WET)									
Volatile Organics	SW-846, 8260A	8	2	0	-	10	2	-	2
Semivolatile Organics	SW-846, 8270B	8	2	0	-	10	2	-	2
Pesticide/PCBs	SW-846, 8081	8	2	0	-	10	2	-	2
Explosives	SW-846, 8330	47	8	0	-	55	8	-	8
Metals (short list)	SW-846, 6010A/7471	39	8	0	-	47	8	-	8
Metals (TAL)	SW-846, 6010A/7471	8	2	0	-	10	2	-	2
Cyanide	SW-846, 9013	8	2	0	-	10	2	-	2

Table 1.1. (continued)

Parameter	Methods	No. of Field Samples	No. of Fld. Dup. Samples	No. of Sampler Rinsates	No. of Trip Blanks	Total A-E Samples	QA Splits	QA Trip Blanks	Total QA Samples
Total Organic Carbon (TOC)	SW-846, 9060	47	0	0	-	47	0	-	0
Grain Size (sieve)	ASTM, D422	47	0	-	-	47	-	-	-
GROUNDWATER/IDW									
Volatile Organics	SW-846, 8260A	27	3	6	4	40	2	2	4
Semivolatile Organics	SW-846, 8270B	27	3	6	-	33	2	-	2
Pesticides/PCBs	SW-846, 8081	27	3	6	-	33	2	-	2
Explosives	SW-846, 8330	27	3	6	-	33	2	-	2
Metals (TAL)	SW-846, 6010A/7471	27	3	6	-	33	2	-	2
Cyanide	SW-846, 9013	27	3	6	-	33	2	-	2

2. PROJECT ORGANIZATION AND RESPONSIBILITY

The functional project organization and responsibilities are described in Sect. 2 of the Facility-wide FSP and the Phase I High Priority AOCs, FSP Addendum.

Analytical support for Phase I High Priority AOCs has been assigned to Southwest Laboratories of Oklahoma. This laboratory has been validated by the U.S. Army Corp of Engineers Missouri River District (MRD) Hazardous, Toxic, and Radioactive Waste (HTRW) Mandatory Center of Expertise (MCX), Omaha, Nebraska. Southwest Laboratory of Oklahoma's Quality Assurance Manual, Rev. May 31, 1995, Doc. No. 95/07-079 is available for review upon request, and a copy has been included with the original of this QAPP Addendum. The laboratory's organizational structure, roles and responsibilities are identified in Figure 1.1 and Chapter 1 of their QA Manual.

<u>Analytical Laboratory</u>

Southwest Laboratory of Oklahoma, Inc.
1700 West Albany
Broken Arrow, OK 74012-1421
Tel: (918) 251-2858
Fax: (918) 251-2599

3. QUALITY ASSURANCE OBJECTIVES FOR MEASUREMENT DATA

3.1 DATA QUALITY OBJECTIVES

Data quality objective (DQO) summaries for this investigation will follow Tables 3-1 and 3-2, as presented in the Facility-wide QAPP. All QC parameters stated in the specific SW-846 methods will be adhered to for each chemical listed. Laboratories are required to comply with all methods as written: recommendations are considered requirements.

3.2 LEVEL OF QUALITY CONTROL EFFORT

Quality control efforts will follow Sect. 3.2 of the Facility-wide QAPP. Field QC measurements will include field source water blanks, trip blanks, field duplicates, and equipment rinsate blanks. Laboratory QC measurements will include method blanks, laboratory control samples, laboratory duplicates, and matrix spike/matrix spike duplicate (MS/MSD) samples.

3.3 ACCURACY, PRECISION, AND SENSITIVITY OF ANALYSIS

Accuracy, precision, and sensitivity goals identified in the Facility-wide QAPP Sect. 3.3 and Tables 3-1 through 3-3 will be imposed for these investigations.

3.4 COMPLETENESS, REPRESENTATIVENESS, AND COMPARABILITY

Completeness, representativeness, and comparability goals identified in the Facility-wide QAPP Sect. 3.4 and Tables 3-1 and 3-2 will be imposed for these investigations.

4. SAMPLING PROCEDURES

Sampling procedures are discussed in the Facility-wide FSP and the FSP Addendum for Phase I High Priority AOCs.

Tables 4-1 and 4-2 summarize sample container, preservation, and holding time requirements for soil, sediment, and water matrices for these investigations. The number of containers required are estimated in these tables.

Table 4.1. Container Requirements for Soil and Sediment Samples at Ravenna Army Ammunition Plant Ravenna, Ohio

Analyte Group	Approx. No. of Bottles	Container	Minimum Sample Size	Preservative	Holding Time
Volatile Organic Compounds	118	1 - 4 oz glass jar with Teflon®-lined cap (no headspace)	20 g	Cool, 4°C	14 d
Semivolatile Organic Compounds	118	1 - 8 oz glass jar with Teflon®-lined cap	100 g	Cool, 4°C	14 d (extraction) 40 d (analysis)
Pesticide/PCB Compounds	118	use same container as SVOC	100 g	Cool, 4°C	14 d (extraction) 40 d (analysis)
Explosive Compounds	568	use type same container as SVOC	20 g	Cool, 4°C	14 d (extraction) 40 d (analysis)
Metals (other than Hg)	587	1 - 8 oz wide mouth polybottle	50 g	Cool, 4°C	180 d
Mercury	587	use same container as other metals	10 g	Cool, 4°C	28 d
Total Organic Carbon (TOC)	105	1 - 8 oz glass jar with Teflon®-lined cap	10 g	Cool, 4°C	28 d
Grain Size	105	use same container as TOC	200 g	None	None
Cyanide	118	use same container as metals	25 g	Cool, 4°C	14 d

Table 4.2. Container Requirements for Water Samples at Ravenna Army Ammunition Plant Ravenna, Ohio[1]

Analyte Group	Samples incl. Field QC	Container	Minimum Sample Size	Preservative	Holding Time
Volatile Organic Compounds	88	2 - 40 mL glass vials with Teflon®-lined septum (no headspace)	80 mL	HCl to pH <2 Cool, 4°C	14 d
Semivolatile Organic Compounds	40	1 - L amber glass bottle with Teflon®-lined lid	1000 mL	Cool, 4°C	7 d (extraction) 40 d (analysis)
Pesticide/PCB Compounds	38	1 - L amber glass bottle with Teflon®-lined lid	1000 mL	Cool, 4°C	7 d (extraction) 40 d (analysis)
Explosive Compounds	38	1 - 40 mL amber glass vial with Teflon®-lined lid	40 mL	Cool, 4°C	7 d (extraction) 40 d (analysis)
Metals (other than Hg)	38	1 - L polybottle	500 mL	HNO_3 to pH <2 Cool, 4°C	180 d
Mercury	38	use same container as other metals	200 mL	HNO_3 to pH <2 Cool, 4°C	28 d
Cyanide	38	500 mL polybottle	500 mL	NaOH to pH >12 Cool, 4°C	14 d

[1] One sample will be tripled in volume for the laboratory to perform appropriate laboratory QC analysis.

5. SAMPLE CUSTODY

5.1 FIELD CHAIN-OF-CUSTODY PROCEDURES

Sample handling, packaging, and shipment procedures will follow those identified in Sect. 5.1 of the Facility-wide QAPP.

5.2 LABORATORY CHAIN-OF-CUSTODY PROCEDURES

Laboratory chain of custody will follow handling and custody procedures identified in Chapter 3.3, Chapter 3.4 , and Figure 3.3 of the Southwest Laboratory of Oklahoma QA Manual.

5.3 FINAL EVIDENCE FILES CUSTODY PROCEDURES

Custody of evidence files will follow those criteria defined in Sect. 5.3 of the Facility-wide QAPP.

6. CALIBRATION PROCEDURES AND FREQUENCY

6.1 FIELD INSTRUMENTS/EQUIPMENT

Field instruments and equipment calibrations will follow those identified in Sect. 6.1 of the Facility-wide QAPP.

6.2 LABORATORY INSTRUMENTS

Calibration of laboratory equipment will follow procedures identified in Chapter 8 of the Southwest Laboratory of Oklahoma QA Manual.

7. ANALYTICAL PROCEDURES

7.1 LABORATORY ANALYSIS

Analytical methods, parameters and quantitation or detection limits are those listed in Table 3-3 of the Facility-wide QAPP.

Southwest Laboratory of Oklahoma's QA Manual Chapter 7 will be followed during the analysis of these samples and the following laboratory Standard Operating Procedures (SOPs) will implement the defined United States Environmental Protection Agency (EPA) Methods.

SWL SOP for the Analysis of Volatile Organics by gas chromatograph/mass spectrometer (GC/MS), MS326 Rev 1.1 (1/19/95)

SWL SPO for the Extraction of Semivolatile Organics, MS500/MS510 Rev 2.0 (4/1/94)

SWL SOP for the Analysis of Semivolatile Organics, MS500 Rev 2.5 (5/19/95)

SWL SOP for the Digestion of Soil Matrices for inductively coupled plasma (ICP) Analysis, MT600S Rev. 3.0 (8/3/95)

SWL SOP for the Digestion of Aqueous Samples and Extracts for ICP Analysis, MT600W Rev.2.0 (8/3/95)

SWL SOP for the Analysis of Metals, MT900 Rev 1.0 (12/4/92)

SWL SOP for the Determination of Pesticides/polychlorinated biphenyls (PCBs) by GC Capillary Column, GC800 Rev 4.2 (8/5/95)

SWL SOP for the Analysis of Nitroaromatics & Nitramines by HPLC, GC200 Rev 2.2 (2/3/95)

7.2 FIELD SCREENING ANALYTICAL PROTOCOLS

Procedures for field analysis are identified in the Facility-wide FSP Sect. 6 and in the Phase I High Priority AOCs, FSP Addendum, Sect. 6.

8. INTERNAL QUALITY CONTROL CHECKS

8.1 FIELD SAMPLE COLLECTION

Field QC sample types, numbers, and frequencies are identified in Sect. 4 of the Phase I High Priority AOCs, FSP Addendum. In general, field duplicates will be collected at a frequency of 10%, field equipment rinsates and blanks will be collected at a frequency of 5%, and volatile organic trip blanks will accompany all shipments containing volatile organic samples.

8.2 FIELD MEASUREMENT

Refer to Section of the Phase I High Priority AOCs, Facility-wide FSP for details regarding these measurements.

8.3 LABORATORY ANALYSIS

Analytical QC procedures will follow those identified in the referenced EPA methodologies. These will include method blanks, Laboratory Control Sample (LCS), MS, MSD, laboratory duplicate analysis, calibration standards, internal standards, surrogate standards, and calibration check standards.

Southwest Laboratory of Oklahoma will conform to its Quality Assurance Manual and implement its established SOPs to perform the various analytical methods required by the project. QC frequencies will follow those identified in Sect. 8.3 of the Facility-wide QAPP.

9. DATA REDUCTION, VALIDATION, AND REPORTING

9.1 DATA REDUCTION

Sample collection and field measurements will follow the established protocols defined in the Facility-wide QAPP, Facility-wide FSP, and Phase I High Priority AOCs, FSP Addendum. Laboratory data reduction will follow SWL QA Manual Chapter 12 guidance and conform to general direction provided by the Facility-wide QAPP.

9.2 DATA VALIDATION

Data will be validated at a frequency of 10% following the direction provided in the Facility-wide QAPP.

9.3 DATA REPORTING

Analytical data reports will follow the direction provided in the Facility-wide QAPP.

10. PERFORMANCE AND SYSTEM AUDITS

10.1 FIELD AUDITS

A minimum of one field surveillance for each media being sampled during the investigation will be performed by the Science Applications International Corporation (SAIC) QA Officer and/or the SAIC Field Team Leader. These audits will encompass the sampling of surface soils, subsurface soils, well installation, and well sampling. Surveillances will follow SAIC QAPP No. 18.3.

United States Army Corps of Engineers (USACE), EPA Region V, or Ohio Environmental Protection Agency (OEPA) audits may be conducted at the discretion of the respective agency.

10.2 LABORATORY AUDITS

Routine MRD HTRW MCX on-site laboratory audits will be conducted by the USACE. EPA Region V or OEPA audits may be conducted at the discretion of the respective agency.

Internal performance and systems audits will be conducted by Southwest Laboratory's QA Officer as defined in the laboratory QA Manual, Chapter 14.

11. PREVENTIVE MAINTENANCE PROCEDURES

11.1 FIELD INSTRUMENTS AND EQUIPMENT

Maintenance of all field analytical and sampling equipment will follow direction provided in Sect. 11.1 of the Facility-wide QAPP.

11.2 LABORATORY INSTRUMENTS

Routine and preventive maintenance for all laboratory instruments and equipment will follow the direction of Chapters 5 and 6 of Southwest Laboratory's Quality Assurance Manual.

12. SPECIFIC ROUTINE PROCEDURES TO ASSESS DATA PRECISION, ACCURACY, AND COMPLETENESS

12.1 FIELD MEASUREMENTS DATA

Field data will be assessed as outlined in Sect. 12.1 of the Facility-wide QAPP.

12.2 LABORATORY DATA

Laboratory data will be assessed as outlined in Sect. 12.2 of the Facility-wide QAPP.

12.3 PROJECT COMPLETENESS

Project data completeness is addressed in Sect. 12.3 of the Facility-wide QAPP.

12.4 REPRESENTATIVENESS/COMPARABILITY

Representativeness and comparability of data is addressed in Sect. 12.4 of the Facility-wide QAPP.

13. CORRECTIVE ACTIONS

13.1 SAMPLE COLLECTION/FIELD MEASUREMENTS

Field activity corrective action protocol will follow the direction provided in Sect. 13.1 of the Facility-wide QAPP.

13.2 LABORATORY ANALYSES

Laboratory activity corrective action protocol will follow directions provided in Sect. 13.2 of the Facility-wide QAPP and Chapter 11 of the Southwest Laboratory QA Manual.

14. QA REPORTS TO MANAGEMENT

Procedures and reports will follow the protocol identified in Sect. 14 of the Facility-wide QAPP and those directed by Chapter 16 of Southwest Laboratory's QA Manual.

15. REFERENCES

Additional references to the Facility-wide QAPP are:

Southwest Laboratory of Oklahoma, Inc. 1995. Quality Assurance Manual, Revised May 31, 1995, Document Log No. 95/07-079

SWL SOP for the Analysis of Volatile Organics by GC/MS, MS326 Rev 1.1 (1/19/95)

SWL SPO for the Extraction of Semivolatile Organics, MS500/MS510 Rev 2.0 (4/1/94)

SWL SOP for the Analysis of Semivolatile Organics, MS500 Rev 2.5 (5/19/95)

SWL SOP for the Digestion of Soil Matrices for ICP Analysis, MT600S Rev. 3.0 (8/3/95)

SWL SOP for the Digestion of Aqueous Samples and Extracts for ICP Analysis, MT600W Rev.2.0 (8/3/95)

SWL SOP for the Analysis of Metals, MT900 Rev 1.0 (12/4/92)

SWL SOP for the Determination of Pesticides/PCBs by GC Capillary Column, GC800 Rev 4.2 (8/5/95)

SWL SOP for the Analysis of Nitroaromatics & Nitramines by HPLC, GC200 Rev 2.2 (2/3/95)

FINAL

PHASE 1 REMEDIAL INVESTIGATION SITE SAFETY AND HEALTH PLAN ADDENDUM FOR HIGH PRIORITY AREAS OF CONCERN

FOR

THE RAVENNA ARMY AMMUNITION PLANT, RAVENNA, OHIO

PREPARED FOR

U.S. ARMY CORPS OF ENGINEERS NASHVILLE DISTRICT

CONTRACT No. DACA62-94-D-0029
Delivery Order 0010

July 1996

SAIC

95-033MS/0071196

SCIENCE APPLICATIONS INTERNATIONAL CORPORATION

contributed to the preparation of this document and should not be considered an eligible contractor for its review.

APPROVALS

SITE SAFETY AND HEALTH PLAN ADDENDUM
FOR THE
PHASE 1 REMEDIAL INVESTIGATION OF HIGH PRIORITY AREAS OF CONCERN
AT
RAVENNA ARMY AMMUNITION PLANT, RAVENNA, OHIO

7/10/96
Stephen B. Selecman, SAIC Project Manager — Date

7/10/96
Stephen L. Davis CIH CSP, SAIC Health and Safety Manager — Date

FINAL

SITE SAFETY AND HEALTH PLAN ADDENDUM FOR THE PHASE 1 REMEDIAL INVESTIGATION OF HIGH PRIORITY AREAS OF CONCERN AT RAVENNA ARMY AMMUNITION PLANT, RAVENNA, OHIO

Prepared for

United States Army Corps of Engineers
Nashville District
Nashville, Tennessee 37202

Prepared by

SCIENCE APPLICATIONS INTERNATIONAL CORPORATION
800 Oak Ridge Turnpike
Oak Ridge, Tennessee 37830

July 1996

96-054P/070996

CONTENTS

TABLES

ACRONYMS

AOC	Areas of Concern
CNS	central nervous system
COC	chemicals of concern
EC&HS	Environmental Compliance and Health and Safety (manual)
FP	flash point
FSHP	Facility-wide Safety and Health Plan
GFCI	ground fault circuit interrupter
HAZWOPER	Hazardous Waste Site Operations
IDLH	immediately dangerous to life and health
IP	ionization potential
LEL	lower explosive level
NIOSH	National Institute of Occupational Safety and Health
PCBs	polychlorinated biphenyls
PEL	permissible exposure limit
PPE	personal protective equipment
PVC	polyvinyl chloride
RAC	Risk assessment code
RI	Remedial Investigation
RVAAP	Ravenna Army Ammunition Plant
SAIC	Science Applications International Corporation
SSHO	Site Safety and Health Officer
SSHP	Site Safety and Health Plan
STEL	short-term exposure limit
TLV	threshold limit value
TWA	time-weighted average
UXO	unexploded ordnance
VP	vapor pressure

EXECUTIVE SUMMARY

Science Applications International Corporation's (SAIC) formal policy, stated in the Environmental Compliance and Health and Safety (EC&HS) 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 (FSHP) and the Phase 1 Remedial Investigation (RI) of High Priority Areas of Contamination (AOCs) Site Safety and Health Plan (SSHP) Addendum collectively set forth the specific procedures required to protect SAIC and SAIC subcontractor personnel involved in the Phase 1 RI field activities. All field personnel are required to comply with the requirements of these plans. In addition, subcontractors are responsible for providing their employees with a safe workplace and nothing in these plans relieves such subcontractors of this responsibility. If the requirements of these plans are not sufficient to protect the employees of a subcontractor, that subcontractor is required to supplement this information with work practices and procedures that will ensure the safety of its personnel.

The FSHP addresses program issues and hazards and hazard controls common to the entire installation. This Phase 1 RI SSHP Addendum to the FSHP serves as the lower tier document addressing the hazards and controls specific to this project. Copies of the FSHP and this SSHP addendum will be present at the work site.

The 11 AOCs addressed in this plan have been used for the processing and/or disposal of a variety of materials, including munitions and wastes from munitions loading and demilitarization. These areas include the following:

- Demolition Area #2 (RVAAP-04),
- Winklepeck Burning Grounds (RVAAP-05),
- Load Line 1 and Dilution/Settling Pond (RVAAP-08),
- Load Line 2 and Dilution/Settling Pond (RVAAP-09),
- Load Line 3 and Dilution/Settling Pond (RVAAP-10),
- Load Line 4 and Dilution/Settling Pond (RVAAP-11),
- Load Line 12 and Dilution/Settling Pond (RVAAP-12),
- Building 1200 and Dilution/Settling Pond (RVAAP-13),
- Load Line 12 Pink Waste Water Treatment Plant (RVAAP-18),
- Landfill North of Winklepeck Burning Grounds (RVAAP-19), and
- Upper and Lower Cobbs Pond (RVAAP-29).

Contaminants of concern include explosives residues (RDX, TNT), metals, petroleum hydrocarbons, chlorinated biphenyls,volatile and semivolatile organic compounds, pesticides, and the products of incomplete combustion of laboratory chemicals.

The following are tasks to be performed by SAIC as part of the Phase 1 RI:

- geophysical survey,
- soil boring and sampling with power augers,
- installation of well points and groundwater sampling,
- installation of groundwater monitoring wells with combination auger/air rotary drill rig,

- soil sampling with hand augers or scoops,
- soil excavation and sampling with trenching equipment,
- sediment sampling in drainage areas and ponds, and
- sampling equipment decontamination.

Potential hazards posed by the tasks planned at these locations include unexploded ordnance (Open Detonation Area #2 only), moving equipment (power auger, drill rig and backhoe), potential excavation cave-ins, fuel or decontamination solvent fires, chemical exposure, temperature extremes, noise, stinging/biting insects, poisonous plants, and snakes.

The potential for chemical overexposure appears to be very low given the nature of planned tasks. All of the expected contaminants have low vapor pressures, making overexposure through vapor inhalation very unlikely. All of the planned tasks, with the exception of excavation, pose minimal potential for creating airborne particulates. Precautions will be taken to prevent the inhalation of dust generated by excavation. None of the planned tasks appears to pose a significant potential for dermal contact with potentially contaminated materials. The crew will use protective gloves to handle potentially contaminated materials, and if necessary, will upgrade the required personal protective equipment (PPE) to prevent dermal contact with potentially contaminated materials. A detailed analysis of these hazards and specific appropriate controls is presented in Section 2, Table 2.2.

This investigation will be performed in Level D PPE, plus chemical-resistant gloves when handling potentially contaminated materials, unless 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 Site Safety and Health Officer (SSHO) based on established action levels or judgment.

1. SITE DESCRIPTION AND CONTAMINATION CHARACTERIZATION

1.1 SITE DESCRIPTION

RVAAP is located in northeastern Ohio within Portage and Trumbull Counties, approximately 4.8 km (3 miles) northeast of the Town of Ravenna. The installation consists of 8668 ha (21,419 acres) in a 17.7 km (11 mile) long, 5.6 km (3.5 mile) wide tract bordered by sparsely inhabited private residences. The site is an inactive government owned armament, munitions, and chemical command facility maintained by a contracted caretaker, Mason and Hanger-Silas Co., Inc.

The installation was active from 1941 to 1992. Activities included loading, assembling, storing, and packing military ammunition; demilitarization of munitions; production of ammonium nitrate fertilizer; and disposal of "off-spec" munitions. Munitions handled on the installation included artillery rounds of 90 mm or more and 2000 lb bombs. Thirty eight Areas of Concern (AOCs) have been identified to date. A description of each AOC is included in the installation Action Plan. Descriptions of each of the 11 AOCs that will be accessed during this project follow.

RVAAP-04 Demolition Area #2. This AOC was used for the open detonation of large caliber munitions and "off-spec" bulk explosives. Pits were dug to 1.2 m (3.9 ft) or more and the munitions were detonated within the pits. After detonation, metal parts were recovered and removed from the site. Evidence exists indicating that areas of buried unexploded ordnance (UXO) are presented. Potential contaminants include explosives residues, white phosphorous, and heavy metals.

RVAAP-05 Winklepeck Burning Grounds. This is a 81 ha (200 acre) area that was used for open burning of RDX, antimony sulfide, composition B, lead azide, TNT, propellant, black powder, waste oils, sludge from the load lines, domestic wastes, and small amounts of laboratory chemicals. Chemicals of concern (COCs) include explosives residues, organic compounds including polychlorinated biphenyls (PCBs), and metals.

RVAAP-08 Load Line 1 and Dilution/Settling Pond. From 1941 to 1971, this AOC produced large volumes of process effluent (pink water) resulting form the loading, packing, and assembly of munitions. The wastewater passed through concrete sumps and sawdust filtration units prior to entering a settling pond via unlined ditches. The unlined settling pond received washdown water and wastewater from the load line operations. Building washdown water was also swept through doorways onto the ground surrounding load line buildings. COCs include explosives residues and metals (arsenic, lead, chromium, and mercury).

RVAAP-09 Load Line 2 and Dilution/Settling Pond. From 1941 to 1971, this AOC produced large volumes of process effluent (pink water) resulting form the loading, packing, and assembly of munitions. The wastewater passed through concrete sumps and sawdust filtration units prior to entering a settling pond via unlined ditches. The ~.8 ha (2 acre), 1.8 to 2.4 m (6 to 8 ft) deep unlined pond received washdown water and wastewater from the load line operations. Building washdown water was also swept through doorways onto the ground surrounding load line buildings. COCs include explosives residues and metals (arsenic, lead, chromium, and mercury).

RVAAP-10 Load Line 3 and Dilution/Settling Pond. From 1941 to 1971, this AOC produced large volumes of process effluent (pink water) resulting from the loading, packing, and assembly of munitions. The wastewater passed through concrete sumps and sawdust filtration units prior to flowing via unlined ditches and surface water drainage to Cobbs Ponds. Building washdown water was also swept through doorways onto the ground surrounding load line buildings. COCs include explosives residues and metals (arsenic, lead, chromium, and mercury).

RVAAP-11 Load Line 4 and Dilution/Settling Pond. From 1941 to 1971, this AOC produced large volumes of process effluent (pink water) resulting from the loading, packing, and assembly of munitions. The wastewater passed through concrete sumps and sawdust filtration units prior to entering a settling pond. This .8 ha (2 acre) unlined pond received washdown water and wastewater from the load line operations. Building washdown water was also swept through doorways onto the ground surrounding load line buildings. COCs include explosives residues and metals (arsenic, lead, chromium, and mercury).

RVAAP-12 Load Line 12 and Dilution/Settling Pond. From 1951-57, 1981-83, and 1989-93 building washdown water and wastewater from the bomb melt out facility operations were collected in a house gutter system and passed through two stainless steel tanks. The first tank acted as a settling basin, the second as a filter system. After 1981 water was treated in the Load Line 12 wastewater treatment system (RVAAP 18). An unlined dilution/settling pond received washdown water and wastewater from the load line, bomb melt out, and ammonium nitrate fertilizer operations. Building washdown water was swept through doorways onto the ground surrounding load line buildings. COCs include explosives residues, Ammatol, and heavy metals (arsenic, lead, chromium, mercury).

RVAAP-13 Building 1200 and Dilution/Settling Pond. From 1941 to 1971, ammunition was demilitarized at this building by steaming munitions rounds. Steam decontamination generated pink water which drained through a manmade ditch to a 0.2 ha (0.5 acre) settling pond. COCs are explosives residues and heavy metals (lead, chromium, mercury).

RVAAP-18 Load Line 12 Pink Waste Water Treatment Plant. From 1982 to 1983 and 1984 to 1985, dual mode activated carbon filters were used to treat explosive-contaminated wastewater from the bomb melt out operations. Treated wastewater was discharged to surface waters under an NPDES permit. COCs include explosives residues.

RVAAP-19 Landfill North of Winklepeck Burning Grounds. This was a 4 ha (10 acre) unlined landfill that received plant refuse, sanitary wastes, ash residue, and possibly explosive wastes from 1969 to 1976. COCs are explosives residues and metals.

RVAAP-29 Upper and Lower Cobbs Pond. This AOC consists of two unlined ponds that received discharges from Load Line 3 and Load Line 12 wastewater treatment systems from 1941 through 1971. The Upper Cobb pond is approximately 2 ha (5 acres) in size. The Lower Cobb pond is approximately 1.4 ha (3.5 acres) in size. COCs include explosives residues, metals, and aluminum chloride.

1.2 CONTAMINANTS

Table 1-1 lists contaminants known or suspected to occur at one or more of the AOCs. Inclusion in this table indicates the potential presence of a contaminant but does not necessarily indicate that the contaminant is present at any specific AOC in sufficient quantity to pose a health risk to workers.

Prior sampling data is insufficient to characterize the greatest concentrations of contaminants at each AOC or even to determine with certainty if a particular contaminant is present at all AOCs. In addition, numerous existing reports refer to materials that may have been disposed or positive sampling results for some contaminants but do not provide quantitative results. Because of this uncertainty, if a contaminant is reported as being present in one of the load line settling ponds, it has been assumed that all of the load line settling ponds contain that contaminant even if no sampling data can be found to verify this assumption. Some of the potential contaminants listed below are included because they would normally be expected to result from known disposal practices. For instance, chlorodiphenyls (PCBs) and petroleum hydrocarbons have been listed as potential contaminants in the open burning area (RVAAP-05) because prior reports indicate that waste oils were burned there. Because of the apparent data gaps in prior reports and because some of the contaminants have been assumed based on prior experience, maximum concentrations are not known for some of the contaminants.

Table 1-1. Contaminants

Contaminant	Maximum reported concentration	Media	Probable Locations	Quantities to be encountered
Aluminum chloride	Unknown	Assumed potentially present in soil, sediment, surface water, groundwater	RVAAP-29	Small quantities contained in samples and adjacent surfaces.
Ammatol	Unknown	"	RVAAP-12	
Arsenic	Unknown	"	RVAAP-08, 09 10, 11, 12	
Chlorodiphenyls (PCBs)			RVAAP-05	
Incomplete combustion products of laboratory chemicals	Unknown	"	RVAAP-05	
Pesticides	Unknown	"	RVAAP-04, 05, 19	
Volatile and semivolatile organic compounds	Unknown	"	RVAAP-04, 05, 19	
White phosphorus	Unknown	"	RVAAP-04	
Unexploded ordnance	N/A	Soil	RVAAP-04	
Chromium	46 $\mu g/g$	Greatest concentration measured in soil, may be present in other media	RVAAP-04, 05, 08, 09, 10, 11, 12, 13, 19, 29	
DNT (Dinitrotoluene)	2.1 $\mu g/g$	"	RVAAP-04, 05, 08, 09, 10, 11, 12, 13, 18, 19, 29	
HMX (Octogen)	686.1 $\mu g/g$ in Demolition Area 2 soil	"	RVAAP-04, 05, 08, 09, 10, 11, 12, 13, 18, 19, 29	

Table 1-1. (continued)

Contaminant	Maximum reported concentration	Media	Probable Locations	Quantities to be encountered
Lead	69 mg/g	Greatest concentration measured in soil, may be present in other media	RVAAP-04, 05, 08, 09, 10, 11, 12, 13, 19, 29	Small quantities contained in samples and adjacent surfaces.
Mercury	0.28 mg/g	"	RVAAP-04, 05, 08, 09, 10, 11, 12, 13, 19, 29	
Petroleum hydrocarbons	Unknown	"	RVAAP-05	
RDX (Cyclonite)	1.75 μg/mL in Load Line 2 settling pond sediment 72.6 mg/g in Demolition Area 2 soil	"	RVAAP-04, 05, 08, 09, 10, 11, 12, 13, 18, 19, 29	
TNT (Trinitrotoluene)	10.7 mg/g Demolition Area 2 soil 0.30 μg/mL in Load Line 1 settling pond sediment	"	RVAAP-04, 05, 08, 09, 10, 11, 12, 13, 18, 19, 29	

2. 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 2-1, 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.

Specific tasks are as follows:

- Soil sampling with hand augers or scoops to .6 m (2 ft) depths at RVAAPs 05, 08, 09, 10, 11, 12, 13 and 18.
- Soil boring and sampling to 1.2 m (4 ft) depths with power augers at RVAAP 04.
- Installation of well point probes (hydraulic truck mounted system) and groundwater sampling at RVAAPs 09, 10, 11, 12, 18, and 19.
- Sediment sampling in drainage areas, ponds and streams to .6 m (2 ft) using hand augers, scoops, or subaqueous samplers at RVAAPs 04, 08, 09, 10, 11, 12, 18, 19, and 29.
- Soil excavation and sampling with excavation equipment [3 m (9.8 ft) deep by 4.6 m (15.0 ft) long] at RVAAP 19.
- Geophysical survey at RVAAP 19.
- Monitoring well installation using combination hollow stem auger/air rotary drill rig at RVAAP 08.
- Equipment decontamination at the central equipment decontamination facility.

2.1 TASK-SPECIFIC HAZARD ANALYSIS

Table 2.2 presents task-specific hazards, task-specific hazard analyses [Risk Assessment Code (RAC)], relevant hazard controls, and required monitoring, if appropriate, for all of the planned site tasks. The RACs in Table 2.2 are derived through a qualitative risk assessment process using probability codes and severity codes. The severity codes are

- I = injuries/illnesses involving permanent total disability or death,
- II = injuries/illnesses with permanent partial disability or temporary total disability,
- III = injuries/illnesses resulting in temporary, reversible conditions with period of disability of less than 3 months, and
- IV = injuries/illnesses with reversible adverse effects requiring only minor treatment.

Table 2-1. Hazards Inventory

Yes	No	Hazard
	X	Confined space entry
	X	Excavation entry (deeper than 1.2 m)
X		Heavy equipment
X		Fire and explosion
X		Electrical shock
X		Exposure to chemicals
X		Temperature extremes
X		Biological hazards
	X	Radiation or radioactive contamination
X		Noise
X		Drowning

Table 2-2. Hazards Analysis

Safety and health hazards	RAC	Controls	Monitoring
Soil sampling using excavation equipment at RVAAP 19			
Safety hazards associated with excavation equipment	D, II	Level D PPE including hardhat (see Section 5). Hazardous Waste Site Operations (HAZWOPER) training. Buddy system. Medical clearance. Personnel will stay well clear of operating equipment.	Daily safety inspections of SAIC operations.
Potential excavation cave-in	C, II	SAIC personnel will keep at least .9 m (3 ft) distant from sides of excavations deeper than 1.5 m (5 ft). Employees may approach closer to the ends of these excavations if the ends are clearly cohesive and show no signs of collapse. Samples will be collected from outside the excavation by sampling soil in the backhoe bucket or soil from the bottom of the excavation using an auger extension. No personnel will be allowed inside trenches deeper than 1.5 m (5 ft).	Daily safety inspections of SAIC operations. Examine excavation edge for signs of spalling or collapse.
Contact with unexploded ordnance (UXO)	D, II	On-site training in ordnance recognition for all field personnel. Visual surveillance for the presence of UXO. Withdrawal of all SAIC and subcontractor personnel and field marking of the area if ordnance or suspected ordnance is discovered. Notification of USACE and facility EOD personnel is ordnance is discovered.	Visual surveys for ordnance (large artillery rounds or bombs).
Exposure to chemicals (see Table 2.3)	C, III	Natural rubber or similar gloves for contact with potentially contaminated material. Washing face and hands prior to taking anything by mouth. Minimal contact.	Photoionization detector, visual surveillance for dust generation, visual surveillance for significant contamination.
Gunfire (deer hunting with shotguns loaded with slugs is allowed in some areas on Friday and Saturday during season)	D, I	No field work at dawn or dusk in areas open to hunting. High visibility vests in these areas. When possible, schedule work in these areas for Sunday through Thursday.	None.
Noise	B, II	Hearing protection within 7.6 m (25 ft) of equipment.	Daily safety inspections.

Table 2-2 (continued)

Safety and health hazards	RAC	Controls	Monitoring
Fire (vehicle fuels)	D, III	Control of ignition sources. Control of flammable material. Fire extinguisher (see Section 9).	Daily safety inspection.
Animal hazards (bees, ticks, wasps, snakes)	C, III	PPE (boots, work clothes). Pants tucked into boots or wrapped with duct tape. Insect repellant, as necessary.	Visual survey.
Electric shock	D, II	Identification and clearance of overhead and underground utilities	Visual inspection of all work areas.
Temperature extremes	C, II	Administrative controls (see Section 8)	Ambient temperature, heart rates as appropriate.
Soil boring and soil sampling using a hand operated power auger at RVAAP 04			
General safety hazards (rotating machinery, moving equipment, slips, falls)	C, II	Level D PPE (see Section 5) plus hardhat. Operate auger per manufacturers directions. Positive action control (Deadman switch) or easily accessible kill switch on power auger. HAZWOPER training. Buddy system. Medical clearance.	Daily site safety inspections. Weekly drill rig inspections.
Contact with unexploded ordnance	D, II	On-site training in ordnance recognition for all field personnel. Clearance of work areas by visual and magnetometer surveys performed by UXO specialist. Field marking of surveyed areas and continuous surveillance by UXO specialist to verify that field personnel do not enter uncleared areas. Visual and magnetometer clearance of each location for intrusive work. Down-hole magnetometer clearance every .6 m down-hole. If initial or down-hole magnetometry for intrusive work indicates the presence of ferrous material, the location will be abandoned and a new location will be selected. Withdrawal of all SAIC and subcontractor personnel and field marking of suspect area if ordnance or suspected ordnance is discovered. Notification of USACE Project Manager and facility EOD personnel if ordnance is discovered.	Visual surveys for ordnance (large artillery rounds or bombs). Visual and instrument surveys by UXO technicians.

Table 2-2 (continued)

Safety and health hazards	RAC	Controls	Monitoring
Exposure to chemicals (see Table 2.3)	D, II	Natural rubber or similar gloves for contact with potentially contaminated material. Washing face and hands prior to taking anything by mouth. Minimal contact	Photoionization detector, visual surveillance for dust generation, visual surveillance for significant contamination.
Gunfire (deer hunting with shotguns loaded with slugs is allowed in some areas on Friday and Saturday during season)	D, II	No field work at dawn or dusk in areas open to hunting. High visibility vests in these areas. When possible, schedule work in these areas for Sunday through Thursday.	None.
Noise	B, II	Hearing protection within 7.6 m (25 ft) of equipment.	Daily safety inspections.
Fire (fuels)	D, III	Control of ignition sources. Control of flammable material. Fire extinguisher (see Section 9).	Daily safety inspection.
Animal hazards (bees, ticks, wasps, snakes)	C, III	PPE (boots, work clothes). Pants tucked into boots or wrapped with duct tape. Insect repellant, as necessary.	Visual survey.
Electric shock	D, II	Identification and clearance of underground utilities	Visual of all work areas.
Temperature extremes	C, II	Administrative controls (see Section 8)	Ambient temperature, heart rates as appropriate.
Installation of well point probes (hydraulic truck mounted system) and groundwater sampling at RVAAPs 09, 10, 11, 12, and 19			
General safety hazards (power machinery, moving equipment, slips, falls)	D, III	Level D PPE (see Section 5) plus hardhat. Personnel not involved with equipment will stand clear during operation. HAZWOPER training. Buddy system. Medical clearance.	Daily site safety inspections.
Contact with unexploded ordnance	D, II	On-site training in ordnance recognition for all field personnel. Visual surveillance for the presence of UXO. Withdrawal of all SAIC and subcontractor personnel and field marking of the area if ordnance or suspected ordnance is discovered. Notification of USACE Project Manager and facility EOD personnel if ordnance is discovered.	Visual surveys for ordnance (large artillery rounds or bombs).

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Table 2-2 (continued)

Safety and health hazards	RAC	Controls	Monitoring
Exposure to chemicals (see Table 2.3)	D, III	Natural rubber or similar gloves for contact with potentially contaminated material. Washing face and hands prior to taking anything by mouth. Minimal contact	Photoionization detector, visual surveillance for dust generation, visual surveillance for significant contamination.
Gunfire (deer hunting with shotguns loaded with slugs allowed in some areas on Friday and Saturday during season)	D, I	No field work at dawn or dusk in areas open to hunting. High visibility vests in these areas. When possible, schedule work in these areas for Sunday through Thursday.	None.
Noise	B, III	Hearing protection within 7.6 m (25 ft) of equipment during point driving.	Daily safety inspections.
Fire (fuels)	D, III	Control of ignition sources. Control of flammable material. Fire extinguisher (see Section 9).	Daily safety inspection.
Animal hazards (bees, ticks, wasps, snakes)	C, III	PPE (boots, work clothes). Pants tucked into boots or wrapped with duct tape. Insect repellant, as necessary.	Visual survey.
Electric shock	D, II	Identification and clearance of utilities	Visual inspection of all work areas.
Temperature extremes	C, II	Administrative controls (see Section 8)	Ambient temperature, heart rates as appropriate.

Table 2-2 (continued)

Safety and health hazards	RAC	Controls	Monitoring
Soil sampling with hand augers or scoops at RVAAPs 05, 08, 09, 10, 11, 12, and 13			
General safety hazards (manual lifting, slips, falls)	D, IV	Level D PPE (see Section 5). HAZWOPER training. Buddy system. Medical clearance.	Daily site safety inspections.
Contact with unexploded ordnance	D, II	On-site training in ordnance recognition for all field personnel. Visual surveillance for UXO. Withdrawal of all SAIC and subcontractor personnel and field marking of the area if ordnance or suspected ordnance is discovered. Notification of USACE Project Manager and facility EOD personnel if ordnance is discovered.	Visual surveys for ordnance (large artillery rounds or bombs).
Exposure to chemicals (see Table 2.3)	D, III	Natural rubber or similar gloves for contact with potentially contaminated material. Washing face and hands prior to taking anything by mouth. Minimal contact	Photoionization detector, visual surveillance for significant contamination.
Gunfire (deer hunting with shotguns loaded with slugs allowed in some areas on Friday and Saturday during season)	D, I	No field work at dawn or dusk in areas open to hunting. High visibility vests in these areas. When possible, schedule work in these areas for Sunday through Thursday.	None.
Animal hazards (bees, ticks, wasps, snakes)	C, III	PPE (boots, work clothes). Pants tucked into boots or wrapped with duct tape. Insect repellant, as necessary.	Visual survey.
Temperature extremes	C, II	Administrative controls (see Section 8)	Ambient temperature, heart rates as appropriate.
Geophysical surveying at RVAAP 19			
General safety hazards (manual lifting, slips, falls)	D, IV	Level D PPE (see Section 5). HAZWOPER training. Buddy system. Medical clearance.	Daily site safety inspections.

Table 2-2 (continued)

Safety and health hazards	RAC	Controls	Monitoring
Contact with unexploded ordnance	D, II	On-site training in ordnance recognition for all field personnel. Visual surveillance for UXO. Withdrawal of all SAIC and subcontractor personnel and field marking of the area if ordnance or suspected ordnance is discovered. Notification of USACE Project Manager and facility EOD personnel if ordnance is discovered.	Visual surveys for ordnance (large artillery rounds or bombs).
Exposure to chemicals (see Table 2.3)	D, III	Natural rubber or similar gloves for contact with potentially contaminated material. Washing face and hands prior to taking anything by mouth. Minimal contact	Photoionization detector, visual surveillance for significant contamination.
Gunfire (deer hunting with shotguns loaded with slugs allowed in some areas on Friday and Saturday during season)	D, I	No field work at dawn or dusk in areas open to hunting. High visibility vests in these areas. When possible, schedule work in these areas for Sunday through Thursday.	None.
Animal hazards (bees, ticks, wasps, snakes)	C, III	PPE (boots, work clothes). Pants tucked into boots or wrapped with duct tape. Insect repellant, as necessary.	Visual survey.
Temperature extremes	C, II	Administrative controls (see Section 8)	Ambient temperature, heart rates as appropriate.
Sediment sampling using hand cores, scoops, or subaqueous samplers at RVAAPs 04, 08, 09, 10, 11, 12, 19, and 29			
General safety hazards (moving equipment, slips, falls)	D, IV	Level D PPE (see Section 5). Good housekeeping. HAZWOPER training. Buddy system. Medical clearance.	Daily site safety inspections
Drowning	C, II	Personal floatation devices if within 1.5 m (5 ft) of water deeper than 1.2 m (4 ft).	Daily site safety inspections
Exposure to chemicals (see Table 2.3)	D, III	Natural rubber or similar gloves for contact with potentially contaminated material. Washing face and hands prior to taking anything by mouth. Minimal contact	Daily site safety inspections.

Table 2-2 (continued)

Safety and health hazards	RAC	Controls	Monitoring
Gunfire (deer hunting with shotguns loaded with slugs is allowed in some areas on Friday and Saturday during season)	D, I	No field work at dawn or dusk in areas open to hunting. High visibility vests in these areas. When possible, schedule work in these areas for Sunday through Thursday.	None.
Contact with unexploded ordnance	D, II	On-site training in ordnance recognition for all field personnel. Visual surveillance for UXO. Clearance of sites where UXO may be present (open detonation area) by UXO specialist personnel for intrusive work. Withdrawal of all SAIC and subcontractor personnel and field marking of the area if ordnance or suspected ordnance is discovered. Notification of USACE Project Manager and facility EOD personnel if ordnance is discovered.	Visual surveys for ordnance (large artillery rounds or bombs). Visual and instrument surveys by EOD technicians in munitions disposal areas.
Animal hazards (bees, ticks, wasps, snakes)	C, III	PPE (boots, work clothes). Pants tucked into boots or wrapped with duct tape. Insect repellant, as necessary. Snake chaps if moving through underbrush.	Visual survey.
Temperature extremes	C, III	Administrative controls (see Section 8)	Ambient temperature, heart rates as appropriate.
Installation of monitoring wells using combination hollow stem auger air rotary drill at RVAAP 08			
General safety hazards (power machinery, moving equipment, slips, falls)	D, III	Level D PPE (see Section 5) plus hardhat. Personnel not involved with equipment will stand clear during operation. HAZWOPER training. Buddy system. Medical clearance.	Daily site safety inspections.
Contact with unexploded ordnance	D, II	On-site training in ordnance recognition for all field personnel. Visual surveillance for UXO. Withdrawal of all SAIC and subcontractor personnel and field marking of the area if ordnance or suspected ordnance is discovered. Notification of USACE Project Manager and facility EOD personnel if ordnance is discovered.	Visual surveys for ordnance (large artillery rounds or bombs).

Table 2-2 (continued)

Safety and health hazards	RAC	Controls	Monitoring
Exposure to chemicals (see Table 2.3)	D, III	Natural rubber or similar gloves for contact with potentially contaminated material. Washing face and hands prior to taking anything by mouth. Minimal contact	Photoionization detector, visual surveillance for dust generation, visual surveillance for significant contamination.
Gunfire (deer hunting with shotguns loaded with slugs is allowed in some areas on Friday and Saturday during season)	D, I	No field work at dawn or dusk in areas open to hunting. High visibility vests in these areas. When possible, schedule work in these areas for Sunday through Thursday.	None.
Noise	B, III	Hearing protection within 7.6 m (25 ft) of equipment during operation.	Daily safety inspections.
Fire (fuels)	D, III	Control of ignition sources. Control of flammable material. Fire extinguisher (see Section 9).	Daily safety inspection.
Animal hazards (bees, ticks, wasps, snakes)	C, III	PPE (boots, work clothes). Pants tucked into boots or wrapped with duct tape. Insect repellant, as necessary.	Visual survey.
Electric shock	D, II	Identification and clearance of aboveground and underground utilities.	Visual of all work areas.
Temperature extremes	C, II	Administrative controls (see Section 8).	Ambient temperature, heart rates as appropriate.

Table 2-2 (continued)

Safety and health hazards	RAC	Controls	Monitoring
Disposal of Investigation Derived Wastes (Soil Cuttings and Decontamination Rinsates)			
General safety hazards (power machinery, moving equipment, slips, falls)	D, III	Level D PPE (see Section 5) plus heavy duty work gloves. Hardhat if overhead hazards are present. Personnel not involved with equipment (trailer mounted liquid tank, manual drum truck, drum grappler, Tommy lift, etc.) will stand clear during operation. HAZWOPER training. Buddy system. Medical clearance. No personnel under lifted loads. Only adequately trained, experienced personnel will be allowed to operate equipment. Equipment used to lift or move drums will be used within its rated weight capacity.	Daily site safety inspections.
Contact with unexploded ordnance	D, II	On-site training in ordnance recognition for all field personnel. Visual surveillance for UXO. Withdrawal of all SAIC and subcontractor personnel and field marking of the area if ordnance or suspected ordnance is discovered. Notification of USACE Project Manager and facility EOD personnel if ordnance is discovered.	Visual surveys for ordnance (large artillery rounds or bombs).
Exposure to chemicals (see Table 2.3)	D, III	Natural rubber or similar gloves for contact with potentially contaminated material. Washing face and hands prior to taking anything by mouth. Minimal contact	Daily site safety inspections.
Gunfire (deer hunting with shotguns loaded with slugs allowed in some areas on Friday and Saturday during season)	D, I	No field work at dawn or dusk in areas open to hunting. High visibility vests in these areas. When possible, schedule work in these areas for Sunday through Thursday.	None.
Fire (fuels)	D, III	Control of ignition sources. Control of flammable material. Fire extinguisher (see Section 9).	Daily safety inspection.
Animal hazards (bees, ticks, wasps, snakes)	C, III	PPE (boots, work clothes). Pants tucked into boots or wrapped with duct tape. Insect repellant, as necessary.	Visual survey.
Temperature extremes	C, II	Administrative controls (see Section 8)	Ambient temperature, heart rates as appropriate.

Table 2-2 (continued)

Safety and health hazards	RAC	Controls	Monitoring
Equipment decontamination (hot water washing, soap and water washing, solvent rinse)			
General equipment decontamination hazards (hot water, slips, falls, equipment handling)	C, III	Level D PPE (see Section 5) plus: Nitrile or PVC gloves, face shield and Saranax or rain suit (when operating steam washer). HAZWOPER training. Medical clearance.	Daily safety inspections.
Noise (spray washer)	B, II	Hearing protection when within 7.6 m (25 ft) of operating washer.	Daily safety inspections.
Fire (flammable decontamination solvents and gasoline)	D, III	Exclusion of ignition sources during solvent use. Control of flammable materials (quantities in decontamination area limited to single day use, proper storage). Fire extinguisher (see Section 9).	Daily safety inspections.
Exposure to chemicals (see Table 2.3)	D, III	Natural rubber or similar gloves for handling potentially contaminated materials. Adequate ventilation during solvent use. Washing face and hands prior to taking anything by mouth. Minimal contact.	None.
Temperature extremes	C, II	Administrative controls (see Section 8).	Temperature measurements as appropriate; heart rate monitoring as appropriate.

PPE - personal protective equipment GFCI - ground fault circuit interrupter PVC - polyvinyl chloride

The probability codes are

- A = likely to occur immediately,
- B = probably will occur in time,
- C = possible to occur in time, and
- D = Unlikely to occur.

2.2 POTENTIAL EXPOSURES

Information on the significant suspected contaminants and chemical tools that will be used for the project is contained in Table 2.3. This table includes potential contaminants that pose a potential to cause adverse effects in site workers during or after the execution of this project. It excludes potential contaminants that are unlikely to pose a threat to site workers.

Table 2-3. Potential Exposures

Chemical[a]	TLV/PEL/STEL/IDLH[b]	Health effects/ potential hazards[c]	Chemical and physical properties[c]	Exposure route(s)[c]	Location
Arsenic	TLV: 0.01 mg/m^3 PEL: 0.01 mg/m^3	Carcinogen, GI disturbance, respiratory irritation	Gray solid; VP: 0 mm; FP: NA	Inhalation Absorption Contact Ingestion	RVAAP-8, 09, 10, 11, 12
Chlorinated biphenyls (PCBs)	TLV/TWA: 0.5 mg/m^3 PEL/TWA: 0.5 mg/m^3 IDLH: Ca (5 mg/m^3)	Carcinogen per NIOSH, chloracne, liver damage	Viscous liquid; VP: <0.001 mm; FP: NA;	Inhalation Ingestion Absorption Contact	RVAAP- 05
Chromium	TLV/TWA: 0.5, A4 mg/m^3 IDLH: 25 mg/m^3	Eye irritation, sensitization	Solid; properties vary depending upon specific compound	Inhalation Ingestion Contact	RVAAP- 04, 05, 08, 09, 10, 11, 12, 13, 19, 29
DNT (dinitrotoluene)	TLV/TWA: 0.15, A2 mg/m^3 IDLH: Ca [50 mg/m^3]	Suspected human carcinogen, anorexia, cyanosis, reproductive effects	Orange-yellow solid, VP: 1 mm; FP: 404°F	Inhalation Absorption Ingestion Contact	RVAAP- 04, 05, 08, 09, 10, 11, 12, 13, 18, 19, 29
Gasoline (used for fuel)	TLV/TWA: 300 ppm 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	All
Hexane (potentially used for equipment decontamination)	TLV/TWA: 50 ppm IDLH: 1100 ppm	Irritation of eyes, skin, respiratory system; dizziness; headache; nerve damage	Liquid; VP: 124 mm; FP: -54 to 19°F; IP: 10.18 eV	Inhalation Ingestion Contact	Equipment decontamination area
Hydrochloric acid (used for equipment decontamination)	TLV: 5 ppm ceiling IDLH: 50 ppm	Irritation of eyes, skin, respiratory system	Liquid; VP: fuming; IP: 12.74 eV; FP: none	Inhalation Ingestion Contact	Equipment decontamination area

Table 2-3 (continued)

Chemical[a]	TLV/PEL/STEL/IDLH[b]	Health effects/ potential hazards[c]	Chemical and physical properties[c]	Exposure route(s)[c]	Location
Isopropyl alcohol (potentially used for equipment decontamination)	TLV/TWA: 400 ppm STEL: 500 ppm IDLH: 2000 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	Equipment decontamination area
Lead	TLV/TWA: 0.05, A3 mg/m^3 PEL/TWA: 0.05 mg/m^3 IDLH: 100 mg/m^3	Weakness, anorexia, abdominal pain, anemia	Solid metal; VP: 0 mm; FP: NA; IP: NA	Inhalation Ingestion Contact	RVAAP- 04, 05, 08, 09, 10, 11, 12, 13, 19, 29
Liquinox (used for decontamination)	TLV/TWA: None	Inhalation may cause local irritation to mucus membranes	Yellow odorless liquid (biodegradable cleaner); FP: NA;	Inhalation Ingestion	Equipment decontamination area
Mercury	TLV/TWA: 0.025,A4 mg/m^3 Skin notation IDLH: 10 mg/m^3	Irritation of eyes and skin; coughing, GI disturbance, anorexia	Silver liquid; FP: NA; VP: 0.0012 mm;	Inhalation Absorption Ingestion Contact	RVAAP- 04, 05, 08, 09, 10, 11, 12, 13, 19, 29
Methanol (used for equipment decontamination)	TLV/TWA: 200 ppm Skin notation IDLH: 6000 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	Equipment decontamination area
HMX (octogen)	TLV/TWA: None established, toxicity assumed to be similar to RDX as compounds are very similar	Explosive; assumed irritation of eyes and skin, dizziness, weakness	Assumed similar to RDX - FP: explodes; VP: 0.0004 mm at 230°F	Assumed: Inhalation Absorption Ingestion Contact	RVAAP- 04, 05, 08, 09, 10, 11, 12, 13, 19, 29
RDX (cyclonite)	TLV/TWA: 1.5 mg/m^3 Skin notation IDLH: none established	Explosive; irritation of eyes and skin, dizziness, weakness	White powder; FP: explodes; VP: 0.0004 mm at 230°F	Inhalation Absorption Ingestion Contact	RVAAP- 04, 05, 08, 09, 10, 11, 12, 13, 19, 29

Table 2-3 (continued)

Chemical[a]	TLV/PEL/STEL/IDLH[b]	Health effects/ potential hazards[c]	Chemical and physical properties[c]	Exposure route(s)[c]	Location
TNT	TLV/TWA: 0.5 mg/m^3 Skin notation IDLH: 500 mg/m^3	Irritation of skin and mucus membranes, liver damage, kidney damage	Pale solid; FP: explodes; VP: 0.0002 mm	Inhalation Absorption Ingestion Contact	RVAAP- 04, 05, 08, 09, 10, 11, 12, 13, 19, 29
White Phosphorus	TLV: 0.02 ppm PEL: 0.1 mg/m^3	Eye and skin irritation, skin burns, abdominal pain, anemia	White to yellow waxy solid; flammable solid; VP: 0.03 mm; ignites spontaneously in moist air	Inhalation Ingestion Contact	RVAAP-04

[a]The potential chemicals were obtained from the *Draft Action Plan for the Ravenna Army Ammunition Plant*, May 5, 1995.
[b]From 1995-1996 Threshold Limit Values, *NIOSH Pocket Guide to Chemical Hazards*, 1994.
[c]From 1994 *NIOSH Pocket Guide to Chemical Hazards, the Condensed Chemical Dictionary*, Tenth Edition.

A1	- confirmed human carcinogen	A2	- suspected human carcinogen	CNS	- central nervous system
IP	- ionization potential	TWA	- time-weighted average	A4	- Not Classifiable as a human carcinogen
PEL	- permissible exposure limit	VP	- vapor pressure	FP	- flash point
STEL	- short-term exposure limit	NA	- not available	IDLH	- immediately dangerous to life and health
TLV	- threshold limit value	NIOSH	- National Institute for Occupational Safety and Health		

3. STAFF ORGANIZATION, QUALIFICATIONS, AND RESPONSIBILITIES

This section presents the personnel (and their associated telephone numbers) responsible for site safety and health and emergency response. Table 3-1 identifies the SAIC and subcontractor individuals who will fill key roles. See the FSHP for information on the roles and responsibilities of key positions.

Table 3-1. Staff Organization

Position	Name	Phone
Program Manager	Gregg Grim	615-481-8786
Health and Safety Manager	Steve Davis CIH, CSP	615-481-4755
Project Manager	Steve Selecman	615-481-8761
Field Operations Manager	Kathy Dominick	513-429-2699
Site Safety and Health Officer	Martha Cramer	513-429-2699

4. TRAINING

See the FSHP.

5. PERSONAL PROTECTIVE EQUIPMENT

See the FSHP and hazard/risk analysis section.

6. MEDICAL SURVEILLANCE

See the FSHP.

7. 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 actions, 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, personnel exposure sampling for specific chemicals, etc. 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 *CFR* 1910.20. The minimum monitoring requirements and action levels for RVAAP Phase 1 field work are presented in Table 7.1.

Table 7-1. Monitoring Requirements and Action Limits

Hazard or measured parameter	Area	Interval	Limit	Action	Tasks
Airborne organics with PID or equivalent	Breathing zone [.9 m (3 feet) from source or .36 m (14 inches)] in front of employee's shoulder	At least once every 30 minutes during intrusive activities; continuously if readings exceed background	<5 ppm ≥5 ppm (over background)	Level D Withdraw and evaluate -identify contaminants -notify Project Manager and Health and Safety Manager	All intrusive tasks.
Detector tubes	Breathing zone	If organic vapor > 5 ppm	PEL/TLV	Withdraw and evaluate, controls may include engineering, administrative, or personal protective measures	Any indicated by organic vapor instrument readings
Flammability and oxygen content with combustible gas indicator	Near borehole and any area where flammable gases are suspected	Only if PID readings exceed 100 ppm or other indicators of flammability observed	<10% LEL >10% LEL	Continue and evaluate source. Withdraw and allow area to ventilate; notify Project Manager and H&S Manager	Intrusive tasks
Noise	None, SAIC has performed monitoring of drill rigs and generators on previous projects.	Only if there is some doubt about noise levels	85 dBA and any area perceived as noisy	Require the use of hearing protection	None. Hearing protection will be worn within the exclusion zone around drill rigs, excavation equipment, power augers, and generators

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Table 7-1. (continued)

Hazard or measured parameter	Area	Interval	Limit	Action	Tasks
Visible contamination	All	Continuously	Visible contamination of skin or personal clothing	Upgrade PPE to preclude contact. May include disposable coveralls, boot covers, etc.	All
Dust	All	Continuously	Visible dust generation	Stop work. Use dust suppression techniques such as wetting surface.	All

LEL - lower explosive limit
PEL - permissible exposure limit
TLV - threshold limit value

8. HEAT/COLD STRESS MONITORING

See the FSHP.

9. STANDARD OPERATING SAFETY PROCEDURES

See the FSHP.

10. SITE CONTROL MEASURES

See the FSHP.

11. PERSONNEL HYGIENE AND DECONTAMINATION

See the FSHP.

12. EQUIPMENT DECONTAMINATION

See the FSHP.

13. EMERGENCY PROCEDURES AND EQUIPMENT

Emergency contacts, telephone numbers, directions to the nearest medical facility, and general procedures can be found in the FSHP. 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 sampling locations. The SSHO will verify that the emergency information in the FSHP is correct during mobilization for the Phase 1.

14. LOGS, REPORTS, AND RECORD KEEPING

See the FSHP.