MKM Engineers, Inc.

FINAL SAMPLING AND ANALYSIS PLAN ADDENDUM FOR THE CHARATERIZATION OF 14 RVAAP AOCs

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Ravenna Army Ammunition Plant
Ravenna, Ohio 44266

Prepared for:

US Army Corps of Engineers – Louisville District
600 Dr. Martin Luther King Jr. Place
Louisville, Kentucky 40202
GSA Contract No. GS-10F-0542N

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ABBREVIATIONS/ACRONYMS

ACM	Asbestos Containing Materials
AOC	Area of Concern
ASTM	American Society for Testing and Materials
BGS	Below Ground Surface
CELRL	Army Corps of Engineers, Louisville District
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CIH	Certified Industrial Hygienists
COPC	Chemical of Potential Concern
CRZ	Contamination Reduction Zone
DNT	Dinitrotoluene
DOT	Department of Transportation
DQO	Data Quality Objective
EZ	Exclusion Zone
FSP	Field Sampling Plan
ft	Feet
FWSAP	Facility-Wide Sampling and Analysis Plan
FWQAPP	Facility-Wide Quality Assurance Project Plan
GPS	Global Positioning System
HMX	High Melting Explosive
IDW	Investigation-Derived Waste
LDPE	Low Density Polyethylene
LL	Load Line
MCL	Maximum Contaminant Level
MEC	Munitions and Explosives of Concern
MI	Multi-Incremental
MKM	MKM Engineers, Inc.
MOA	Memorandum of Agreement
MPH	Masters in Public Health
NGB	National Guard Bureau
NGVD	National Geodetic Vertical Datum
NTU	Nephelometric Turbidity Unit
OD	Outside Diameter
OE	Ordnance and Explosives
Ohio EPA	Ohio Environmental Protection Agency
JMC	Joint Munitions Command
PCB	Polychlorinated Biphenol
PG	Professional Geologist
PID	Photo-ionization Detector
QA	Quality Assurance
OHARNG	Ohio Army National Guard
OSHA	Occupational Safety and Health Administration
PAH	Polyaromatic Hydrocarbons
PCP	Pentachlorophenol
PETN	Pentaerythrite Tetranitrate
PPE	Personal protective equipment
QAPP	Quality Assurance Project Plan
QC	Quality Control
RDX	Rapid Detonating Explosive
RI	Remedial Investigation
RRSE	Relative-Risk Site Evaluation
RVAAP	Ravenna Army Ammunition Plant
SAIC	Science Applications International Corporation

SAP	Sampling and Analysis Plan
SOP	Standard Operating Procedures
sq ft	Square Feet
SSHP	Site-Specific Safety and Health Plan
SUXOS	Senior Unexploded Ordnance Supervisor
SVOC	Semi-Volatile Organic Compound
SZ	Support Zone
TAL	Target Analyte List
TCLP	Toxicity Characteristic Leaching Procedure
TNT	Trinitrotoluene
USACE	U.S. Army Corps of Engineers – Louisville District
USACHPPM	U.S. Army Center for Health Promotion and Preventative Medicine
USATHAMA	U.S. Army Toxic and Hazardous Materials Agency
USEPA	U.S. Environmental Protection Agency
UST	Underground Storage Tank
UXO	Unexploded Ordnance
VOC	Volatile Organic Compound
WP	Work Plan

1.0 PROJECT SCOPE

1.1 INTRODUCTION

MKM Engineers, Inc. (MKM) has developed this addendum under GSA Contract No. GS-10F-0542N, Order No. W912QR-04-F-0161 for the U.S. Army Corps of Engineers, Louisville District (USACE). This addendum supplements the Revised 2001 Facility-Wide Sampling and Analysis Plan (FWSAP) for the Ravenna Army Ammunition Plant (RVAAP), Ravenna, Ohio (USACE 1996a). The FWSAP provides the base documentation (i.e., technical and investigative protocols) for conducting a remedial investigation under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) at RVAAP. This document includes all the AOC-specific sampling and analysis objectives, rationale, planned activities, and criteria that will be followed to conduct characterization activities at the RVAAP 14 Areas of Concern (AOCs). When appropriate, this addendum references the FWSAP for basic procedures and protocols.

Based upon information from previous investigations, assessments and/or evaluations, the soil, sediment, and surface water sample locations were selected by the USACE and reviewed/approved by the Ohio EPA. These approved sampling locations were included in the USACE 11 May 2004 Scope of Work (SOW), which stipulates the soil, sediment, surface water sample location sites. On July 21, 2004, a site walk was conducted to identify the locations for the 62 monitoring wells that will be installed during this characterization project. The meeting was attended by representatives from the Ohio Environmental Protection Agency (Ohio EPA), RVAAP, USACE, ARCADIS and MKM. After the site walk, a meeting was held to discuss the RVAAP 14 AOC characterization activities. Information from that meeting, comments from the USACE and Ohio EPA on the Draft Addenda that were submitted, and information from a September 21, 2004 meeting with the USACE and Ohio EPA also have been incorporated into this addendum.

1.2 SUMMARY OF EXISTING DATA

RVAAP is located in Northeastern Ohio in Portage and Trumbull Counties (see Figure 1). RVAAP was established in 1940 to load conventional and medium and large caliber artillery, ammunition, bombs; mines; fuzes and boosters; primers and percussion elements; and to store finished ammunition components and bulk explosive compounds. A detailed history of the facility is summarized in the FWSAP March 2001 (Section 1.1). On 13 May 2002, an additional 3,774 acres of land was transferred from Joint Munitions Command (JMC) ownership to the National Guard Bureau (NGB) via an amendment to the Memorandum of Agreement (MOA). As AOCs are remediated, the remaining acreage will transfer to the NGB.

A short description of each AOC, a brief summary of past investigation results (if any), and the AOC-specific characterization activities are found in the following appendices:

- Appendix A RVAAP-06: C-Block Quarry
- Appendix B RVAAP-12: Load Line 12
- Appendix C RVAAP-13 Building 1200
- Appendix D RVAAP-19: Landfill North of Winkelpeck Burning Grounds
- Appendix E RVAAP-36: Pistol Range
- Appendix F RVAAP-38: NACA Test Area
- Appendix G RVAAP-39: Load Line 5
- Appendix H RVAAP-40: Load Line 7
- Appendix I RVAAP-41: Load Line 8
- Appendix J RVAAP-43: Load Line 10
- Appendix K RVAAP-45: Wet Storage Area
- Appendix L RVAAP-46: Buildings F-15/F-16
- Appendix M RVAAP-48: Anchor Test Area
- Appendix N RVAAP-50: Atlas Scrap Yard

Figure 2 shows the RVAAP facility and the location of each AOC.

2.0 PROJECT ORGANIZATION AND RESPONSIBILITIES

The organization chart in Figure 3 shows the management structure that will be used to implement the RVAAP 14 AOC characterization. The responsibilities of key personnel are described in Section 2.0 of the FWSAP. In addition to the personnel listed in the FWSAP, a description of the duties of an unexploded ordnance (UXO) technician is provided.

2.1 PROJECT MANAGER/LEAD GEOLOGIST

Mr. Stan Levenger, Professional Geologist, will serve as MKM's Project Manager for the characterization of the 14 AOCs. Mr. Levenger will be directly responsible for implementing the investigations in accordance with the approved work plan. He will be the technical lead for activities, as well as being the Lead Geologist. Mr. Levenger will be the primary liaison with the USACE Project Manager, the RVAAP Facility Manager and the Ohio EPA Project Manager. He will ensure that the appropriate staff members are assigned and that they have the resources required to complete their assignments. He will monitor expenditures and will adjust project activities to ensure schedules are met.

2.2 QA/QC MANAGER

The QA/QC Manager is responsible for the project QA/QC in accordance with the requirements of the Facility-Wide Quality Assurance Project Plan (FWQAPP), the project-specific QAPP addendum, and appropriate management guidance. Mr. Mark Lamb, who will serve as the QA/QC Manager for this project, will coordinate with the Field Investigation Task Manager to monitor the technical aspects of all field operations and field sampling activities; will ensure that project staff adhere to the required sample custody and other related QA/QC field procedures; and will review procedures used to manage investigation-derived wastes (IDW) associated with the project. The QA/QC Manager will coordinate the sampling activities with the Field Investigation Task Manager and the Task QA/QC Manager.

2.3 FIELD INVESTIGATION TASK MANAGER

Mr. James Panozzo, the Field Investigation Task Manager, will ensure that field activities are implemented in accordance with the FWSAP and QAPP. He will direct the technical performance of field activities; supervise four field crews (two sampling crews and two drilling crews); develop daily schedules and assign field tasks; coordinate activities of subcontractors; and ensure field crews have appropriate and adequate equipment and supplies. In addition, the Field Investigation Task Manager will monitor the field crews to ensure that they adhere to the Health and Safety and Work Plan procedures. Mr. Panozzo will also be the primary liaison between the field crews and the Project Manager.

2.4 TASK QA/QC MANAGER/REPORT AND DATA MANAGEMENT TASK MANAGER

The Task QA/QC Manager, Mr. Eric Ellis, will prepare sample collection packages; direct the preparation of bottle sets and labels; assign the QC samples; develop a detailed sample collection schedule for each sampling team; interface with the laboratory's Project Manager and track samples; monitor the decontamination process; and monitor the sample processing, handling and shipping activities to ensure sample integrity is maintained. When appropriate, Mr. Ellis will delegate responsibilities for tasks, but will monitor the activities as they are conducted. The Task QA/QC Manager also will direct the data management and reporting tasks.

2.5 UXO TEAM LEADER

Mr. Steven King, the UXO Team Leader, will coordinate the activities of the UXO staff; sweep work zones and intrusive sampling locations to ensure no munitions and explosives of concern (MEC) are present; and report any MEC-related issues immediately to the Project Manager. See the Munitions and Explosives of Concern Avoidance Plan in Attachment 1 of this addendum.

2.6 SITE HEALTH AND SAFETY OFFICER

Mr. Kaizad Wadia will serve as the Site Safety and Health Officer. He will oversee the implementation of the SSHP; ensure that field personnel are equipped with the required personal protective equipment (PPE); monitor field crews to ensure compliance with the SSHP; and report any health and safety issues immediately to the Project Manager and/or MKM's Corporate Health and Safety Officer.

2.7 LEAD RISK ASSESSOR

The Lead Risk Assessor, Dr. Tim Barber, will direct the ecological and human health risk screening activities and will review the results for accuracy. He will identify future risk assessment tasks that are required.

3.0 DATA QUALITY OBJECTIVES

The RVAAP 14 AOC Characterization data quality objectives (DQOs) are to collect and provide sufficient, high-quality data for all applicable media such that future actions (i.e. human health and ecological risk assessments) can be efficiently planned and accomplished at each AOC.

3.1 CONCEPTUAL SITE MODEL

Based on current data, the conceptual site model presented in Section 3.2.1 of the FWSAP is applicable to these AOC characterizations. The samples collected during this characterization effort will be used to update the AOC-specific preliminary conceptual models that have been developed for each of the 14 AOCs. Appendices A to N contain:

- A description of each AOC (past uses and current conditions);
- A summary of known hydrogeologic information;
- A list of characterization activities; and
- Rationale for the soil, sediment and surface water sampling, trenching, coring and groundwater well locations.

3.2 DEFINE THE STUDY BOUNDARIES

The investigation area boundaries for each AOC are illustrated on figures found in Appendices A through N. The boundaries of each AOC were established to encompass all known or reported historical activities and potential surface water/sediment exit pathways.

3.3 IDENTIFY DECISIONS

Data generated by the characterization activities will be used to determine:

- Do residual contaminants remain in any of the 14 AOCs?
- Do contaminants in any of the AOCs impact soils, sediments, groundwater or surface water?
- Given the future land use, does either the preliminary human health and/or ecological screen indicate the need for a more extensive risk assessment?
- What remedial action, if any, is appropriate for each of the 14 AOCs?

3.4 IDENTIFY DECISION RULES

Decision rules used to guide remediation decisions are provided in Section 3.2.6 of the FWSAP. Data generated during this characterization project will be compared to the human health and ecological risk screens specified in the 11 May 2004 SOW. The need for further risk evaluations will be determined by the outcome of those screening activities.

3.5 INPUTS TO THE DECISION

The inputs to the decision include the results of the field investigation and data analysis. The data will be obtained through the collection of discrete and MI shallow soil, MI sub-surface soil, discrete and MI sediment, surface water and groundwater samples.

3.6 SPECIFY LIMITS ON DECISION ERRORS

Limits on decision errors are discussed in Section 3.2.8 of the FWSAP.

3.7 SAMPLE DESIGN

Sample design rationale is provided in Section 3.2.9 of the FWSAP. A more detailed description of the AOC-specific sample design can be found in Appendices A to N. The sample design for each AOC is based on historical information including past usage, past investigations, ecological settings, climatic conditions, and geological and hydrologic characteristics. The purpose of the sampling is to provide sufficient data for all applicable media such that future actions can be efficiently planned and accomplished.

Additionally, at the July 21, 2004 meeting, the placement of groundwater monitoring well locations was agreed upon by USACE, Ohio EPA and MKM. MI and discrete soil, MI and discrete sediment and surface water sampling locations were specified in the 11 May 2004 SOW received from USACE-Louisville. Within the multi-incremental (MI) sampling areas, the locations of the 30 individual aliquots that will comprise the incremental sample will be determined either by randomly throwing stakes into the sampling location boundaries or by following a random zigzag path across the sampling location area and randomly collecting soils/sediments. Section 4.2 describes the sampling procedures in more detail.

4.0 PROJECT ACTIVITIES

Before any field activities are initiated, MKM's Project Manager, the Field Investigation Task Manager, the Task QA/QC Manager, the Site Safety and Health Officer and the UXO Lead will brief project personnel about the project objectives and planned activities; facility operations (past and present); individual's roles and responsibilities; regulatory requirements; MEC issues; and other safety issues. This kick-off meeting will familiarize the field team with the project's activities and safety requirements and will give the participants the opportunity to ask questions about the project. The RVAAP Facility Industrial Specialist will also participate in the meetings.

4.1 PRE-SAMPLING ACTIVITIES

Before the sampling crews are mobilized, activities that will ensure a quick, efficient mobilization and orderly execution of the characterization project will be completed. Pre-mobilization activities include conducting an ordnance and explosives survey, mowing/clearing AOCs, staking sampling locations, conducting a geophysical survey at Atlas Scrap Yard, trenching in AOCs where monitoring wells will be installed, establishing work zones and a decontamination area, procuring field equipment and supplies, and training personnel.

4.1.1 Ordnance and Explosives Survey

Using a magnetometer, a UXO Technician will screen discrete and MI sampling locations and work zones for potential MEC items prior to entry by sampling team members. Soil boreholes will be screened using a down-hole magnetometer (Schonstedt, GeoMag) until the geologist has determined that the boring has reached undisturbed soil. Refer to the Ordnance and Explosives Avoidance Plan in Attachment 1 for details.

4.1.2 Limited Clearing of AOCs

Ground level vegetation will be mowed so personnel and equipment can safely access the designated sampling locations.

4.1.3 Identify Utilities

Underground and overhead utilities will be identified before initiating any intrusive sampling activities. MKM personnel will review existing drawings to identify potential utilities and then will conduct visual surveys to verify their presence. If necessary, sampling locations will be adjusted to avoid both overhead and underground structures and utilities. Field reconnaissance will be conducted to identify any access problems or unusual sampling conditions.

4.1.4 Staking Sample Locations

Stakes will be placed at the approximate discrete shallow soil sampling locations and at the groundwater monitoring well locations. MI sampling locations will be delineated by staking the four corners of the targeted sample collection area. A UXO technician will randomly pre-screen, using the zig-zag or drunken sailor method, MI sample locations within each MI sampling grid. Surface water and sediment sampling locations may be adjusted in the field due to presence or absence of water at the sampling location. At surface water sampling locations where standing water is not present, the location of the sample may be adjusted up or downstream. If no water is present in an SOW-specified ditch, no surface water sample will be collected unless an alternative ditch that may have similar contaminants is nearby. In the latter case, the new surface water sampling location will be noted in the field logbook and a technical field change memo will be issued to the USACE and the Ohio EPA for approval. At sediment sampling locations where standing water is not present, a shallow soil sample may be collected rather than sediment. This will ensure that the targeted sampling point is evaluated. Approval and documentation for a change in sample media will be acquired prior to collection of the sample(s).

4.1.5 Geophysical Survey

Geophysical screening (electromagnetic conductivity survey) will be performed at the former locations of Service Stations 1 and 2 at the Atlas Scrap Yard to locate any remaining underground storage tanks. This screening activity will be performed using both an EM-31 and EM-61 unit. The locations of electromagnetic anomalies will be flagged. Section 1.4 of Appendix N presents a more detailed description of the processes used to conduct the geophysical survey.

4.1.6 Trenching

Trenches will be excavated at most AOCs where drilling will be conducted and no pre-existing groundwater monitoring wells have been installed. Test trenches will not be excavated at Load Line 12, where there are existing monitor wells and previous trenching has been completed, or at C-Block Quarry, where bedrock is found at the ground surface. The trenching activities will provide information about the soil stratification profile, depth to groundwater and depth to bedrock. Trenching will be conducted in accordance with Section 4.4.2.4.2 of the FWSAP as outlined below, although no samples will be collected during the trenching operations. Additionally, standard operating procedures (SOP-34) for trenching can be found in Appendix C of the SSHP.

- Using a wheeled backhoe (John Deer 310 Extendahoe), soil will be removed to a maximum depth of 12 ft.
- Soil will be removed in 2 to 3 ft lifts and placed adjacent to the excavation.
- A geologist will note the stratigraphic profile of the soils in the trench. Once the trench reaches a depth that inhibits profiling from the surface, the backhoe will bring soil to the top of the trench where the geologist will assess the stratigraphic characteristics.

- Once the required information (depth to bedrock or groundwater, if either is encountered, and stratigraphic profile information) has been obtained, all soil will be immediately returned to the excavated trench.
- After soil is replaced in the trench, the soil will be graded, compacted and re-seeded.
- Perimeter air monitoring will be conducted using an MIE pdr-1000 Particulate Air Monitor and a Photovac PID 2020.

Trenching will be halted immediately upon encountering bedrock, groundwater (water that flows at a rate greater than one gallon per minute), any suspect soils (discolored soils or soils that exhibit an unusual odor) or any suspected MEC items. If suspect soil is removed from the trench, it will be containerized, sampled and handled as hazardous waste until analytical results are received. Based on analytical results, the suspect soils will be disposed at an appropriately permitted facility.

The appendix for each AOC where trenching will be conducted includes a figure showing the trench locations.

4.1.7 Establish Work Zones

MKM will not install any facilities within the AOCs except work zones in drilling, trenching and sampling locations. The work zone (exclusion zone) will be delineated by yellow DO NOT ENTER caution tape. In areas where potential contaminant concentrations warrant the use of Level D personal protective equipment, an exclusion zone, a contamination reduction zone and support zone will be established to control access to the drilling, trenching or sampling location. The work zones are further described in the Health and Safety Plan Addendum for this characterization activity. The SSHO will maintain the access logs for the work zones.

Due to the relatively short duration of this project and the proximity of the AOCs to the MKM RVAAP field office at Building 1038, services such as water, telephone, sanitary, and gas will not be installed at the AOCs. Potable water for the decontamination of personnel and equipment will be stored in portable poly containers in Building 1036. Cellular telephones and RVAAP base security radios will be used for communications and emergency notifications.

4.1.8 Temporary Decontamination Area

A temporary decontamination area will be constructed to facilitate decontamination of the drill rigs, augers, rods and other associated equipment and personnel. The Field Investigation Task Manager, SSHO and Project Manager will determine the location and layout. Additionally, a decontamination area will be located in Building 1036 and will be used to decontaminate soil sampling equipment.

All sampling and drilling equipment will be decontaminated in accordance with the procedures outlined in Sections 4.4.2.8 and 4.3.8 of the FWSAP.

4.1.9 Personnel Training

Before initiating field activities, MKM will train the project team members who will be collecting and/or processing samples or decontaminating equipment. The training will summarize the purpose of and approach for MI sampling. This training will review the concepts of random sampling, emphasize the importance of complete sample processing and explain the importance of handling samples and equipment in a manner that avoids cross-contaminating samples. Each crew will receive a checklist, developed by the Field Investigation Team Manager and the QA/QC Task Manager, which details each step to be completed for a particular activity. A mock sampling drill will be held to allow staff members to become familiar with the equipment they will use.

All contractor/subcontractor personnel engaged in field activities will participate in a project kick-off meeting. During this time, the Project Manager, SSHO, Task QA/QC Manager and Field Investigation Team Manager will review the goals and objectives of the characterization project; details about the SAP, QAPP and SSHP; work assignments; and health and safety requirements of the investigation. Special emphasis will be placed on the individuals' roles so that each project team member has a clear understanding about the lines of communication for the characterization activity. This understanding will facilitate effective decision-making when field decisions are required.

Unique procedural or AOC-specific aspects of the investigation will be highlighted. Prior to a specific field task, a briefing covering pertinent sections of the SAP Addendum will be conducted on-site for all MKM and subcontractor employees assigned to that task. The briefing will also include a complete discussion of the health and safety requirements for the task.

Daily task-order safety briefings will be conducted during the course of the field effort. The project SSHO will compile all pertinent OSHA training and medical monitoring records for the MKM and subcontractor staff involved with field activities. A copy of these records will be maintained at the MKM field office.

4.2 SAMPLING ACTIVITIES

Once the crews are mobilized, they will collect soil, sediment, and surface water samples; install monitoring wells; collect geotechnical samples; process MI samples; and package, ship and track samples. The characterization field activities must be performed in a well-defined and consistent manner to ensure that the resulting data are comparable between sampling locations and can be validated against all applicable QA/QC requirements. This section defines field methods and procedures, or references sections of the FWSAP that describe the methods and procedures, that are applicable to the following field activities:

- Surface soil sampling;
- Subsurface (soil borings) soil sampling;
- Surface water sampling;
- Ditch sediment sampling;

- MI sampling;
- Geotechnical sampling;
- Trenching;
- Monitoring well installation and development;
- Groundwater sampling; and
- Decontamination procedures.

All sampling procedures will be consistent with Section 4.0 of the FWSAP. In addition, Tables 1-1 thru 1-16 in the QAPP Addendum summarize the RVAAP 14 AOC Characterization sampling and analyses requirements. The following sections discuss the field protocols and procedures to be used for the sampling activities to be conducted for this AOC characterization.

4.2.1 Numbering Samples

Samples will be numbered in accordance with Section 5.3 of the FWSAP. Each sample will be assigned a unique number following the format shown below:

XXXYY-ZZZ-VV, where

XXX	=	AOC designator (Example: CBL = C-Block Quarry);
YY	=	Type of sample (Example: SS = Shallow Soil);
ZZZ	=	Sample number; and
VV	=	Media type (Example: SO = Soil).

If the sample is a MI sample, an `m' will follow the `ZZZ' (sample number). At four of the AOCs (Load Line 12, Building 1200, NACA Test Area and the landfill north of Winkelpeck), samples have already been collected. In those areas, the sample number that is assigned will be the next sequential number after the highest sample number that has already been assigned. The sample numbers in those four areas will be assigned sequentially across all media. In the remaining ten AOC's, no samples have been collected previously. In those ten areas, sample numbers will be assigned sequentially ***by media***.

In the Anchor Test Area, two MI at-depth soil samples will be collected: one from the one to three ft interval and one from the three to five ft interval. The five aliquots collected from the one to three ft interval will be combined to make one MI sample, and thus will receive a unique sample number. Likewise, the five aliquots collected from the three to five ft interval will comprise the second at-depth MI sample and will be assigned a unique number.

As each sample is collected, it will be labeled in accordance with Section 5.4 of the FWSAP.

4.2.2 Soil/Sediment Sample Collection

Discrete and MI soil and sediment samples will be collected.

4.2.2.1 Discrete (surface soil, sub-surface soil and sediment)

Surface soil and subsurface soil samples will be collected in accordance with Sections 4.5.2.1.1 (bucket hand auger method) and 4.5.2.1.2 (trowel/spoon method) of the FWSAP. Sediment samples will be collected in accordance with Section 4.5.2.1.2 (trowel/spoon method) of the FWSAP.

4.2.2.2 MI Sample Collection (surface soil, at-depth soil and sediment)

MI surface soil samples will be collected in accordance with Appendix O that was part of USACE's 11 May 2004 Scope of Work (see Attachment 2). The following procedures will be used:

- The four corners of the MI sampling locations will be staked and surveyed.
- Within the sampling boundaries, 30 sampling points will be randomly selected using the "drunken sailor walk" or random zigzag pattern described in Attachment 2.
- Surface vegetation and roots will be scraped aside or removed.
- Using a stainless steel soil step probe or paint-free mattock, an aliquot of soil will be collected at each of the 30 sampling points.
- The thirty aliquots will be placed into a plastic-lined bucket. The 30 aliquots will be combined to make one MI sample.
- The plastic liner will be closed, labeled and delivered to Building 1036 for drying and processing. Section 6.1 describes the procedures that will be used to process the MI samples.

At the Anchor Test Site, two at-depth soil samples will be collected: one from the one to three ft depth and a second at the three to five ft depth. Five aliquots collected from the one to three ft depth will be collected and combined to make one sample. Likewise, five aliquots will be collected from the three to five ft depth and combined to make the second sample.

The incremental sediment samples will be collected in accordance with Appendix O of the USACE SOW; each of the 30 aliquots will be collected in accordance with Section 4.5.2.2.1 and/or 4.5.2.2.2 of the FWSAP (using a hand core sampler). The following procedures will be used:

- If the pond is shallow enough, the boundaries of the incremental sampling location will be marked using stakes driven into the pond sediment.
- Within the staked boundaries, 30 sampling points will be randomly selected using the `drunken sailor walk' or random zigzag pattern described in Attachment 2. Because walking through the sediment will cause the sediment to suspend and shift, care will be taken to start at one end of the staked area and zigzag toward the opposite side.
- If the water level in the pond is too deep to allow sample collection by wading in the water, the sampling team will collect the samples from a boat. The boundaries of the MI sampling area will be staked and 30 aliquots will be collected from randomly-spaced locations within those boundaries.
- The 30 aliquots will be collected using either a stainless steel spoon or a hand core sampler. As they are collected, the 30 aliquots will be placed into a lined bucket and combined to make one sample.
- The bucket liner will be closed, labeled and delivered to Building 1036 for drying and processing. Section 6.1 describes the procedures that will be used to process the MI samples.

It may be necessary to remove rubble, ballast or debris from the sides of the ditches where MI samples are collected. As much as possible, removal of rubble/debris will be limited to the small patches where individual aliquots will be collected. Any material that is removed will be replaced and the ditch returned to its original state after analytical results are received. If a large area must be cleared to facilitate sampling, the situation will be discussed with Ohio EPA's representative to determine whether it is acceptable to leave the soil exposed until analytical results are received. If surface water samples will also be collected from the ditch, the water samples will be collected before the ballast, rubble or debris is disturbed. This sequencing will ensure that a representative water sample is collected.

In some ditches, the presence or absence of water depends on weather conditions. During a rainy period, a ditch that is normally dry may have water running through, or standing in, it. If ditch conditions vary (presence or absence of water), the condition that is found most of the year will be considered when deciding whether to treat the sample as a `soil' or `sediment' sample. A portion of the sediment samples will be tested for grain size and total organic content.

4.2.3 Surface Water Sample Collection

Surface water will be collected from wet ditches, sumps and/or ponds.

4.2.3.1 Wet Ditches

Wet ditch and pond surface water samples will be collected in accordance with Section 4.6.2.1.1 (hand-held bottle or dipper method) of the FWSAP.

4.2.3.2 Sumps/Ponds

Sump surface water samples will be collected in accordance with Section 4.6.2.1.2 (dipper and pond sampler method) of the FWSAP or using a disposable Teflon bailer. The following procedures will be employed if the bailer method is used:

- The bailer will be lowered into the standing water.
- The bailer will be allowed to slowly fill with water, and then raised to the surface.
- The collected sample will be slowly poured directly into a sample container.

4.2.4 Installation and Development of Monitoring Wells

Groundwater monitoring wells will be installed and developed in accordance with Section 4.3.2 of the FWSAP. One of two drilling methods may be utilized for installation of groundwater monitoring wells: hollow stem auger (HSA) for alluvial wells and air rotary method for bedrock wells. Sections 4.4.2.4 and 4.4.2.5 of the FWSAP describe the HSA drilling method; and Section 4.3.2.3.2 describes the air rotary drilling method. Per USACE's 11 May 2004 SOW, a subset of the bedrock wells will be cored. For each AOC where monitoring wells will be installed, the appendix associated with that AOC lists each monitoring well, the rationale for the monitoring well's location, and, if the well is to be cored, the rationale for coring that particular borehole.

The FWSAP stipulates that a turbidity of five NTUs must be achieved during development. If five NTU's cannot be achieved after numerous well volumes have been removed, Ohio EPA will be notified about the inability to achieve the five NTU condition. Pertinent information, such as the number of well volumes removed thus far, will be provided to the Ohio EPA representative. Ohio EPA will help decide when sufficient groundwater has been removed from the well before collecting the samples.

According to a facility-wide inspection of groundwater monitoring wells, Background Well BKG-010 has 2.4 ft of sediment in the well screen. If field observations verify that silt has filled more than ten per cent of the well screen, the well will be re-developed.

4.2.5 Groundwater Sample Collection

Water level measurements will be collected in accordance with Section 4.3.3.2 of the FWSAP. Field measurements will be collected using a Horiba U-10 or U-22 water meter. Purging of monitoring wells will be conducted in accordance with Section 4.3.4.1 (conventional well purging) and/or 4.3.4.2 (micro-purging) of the FWSAP. Either a 2-inch bailer or low-flow technology (less than 500 ml per minute of purge/sample rate) will be used to collect groundwater samples. If low flow technology is appropriate, a QED Sample Pro bladder pump with an associated pump controller and flow cell will be used. Low flow samples will be collected using bonded LDPE and Teflon™-lined tubing (1/8” x ¼” OD). Groundwater samples will be collected in accordance with Section 4.3.5 of the FWSAP. The groundwater samples will be collected from the:

- Sixty-two monitoring wells installed during this characterization study;
- Fourteen existing monitoring wells at Load Line 12; and
- Background well at Building 1200.

Forms used to record groundwater sampling data can be found in Section 5.0.

4.2.6 Geotechnical Sample Collection

Geotechnical samples will be collected from a representative number of borehole locations at AOCs where groundwater wells will be installed. Geotechnical samples will be collected in accordance with Section 4.4.2.4 of the FWSAP. The basic approach is summarized below:

- Samples will be collected using hollow stem auger equipped with a Shelby (thin-walled) sampling device or other push equipment based upon site conditions.
- Three-inch diameter by three-foot length Shelby tubes will be used to collect the geotechnical samples.
- When the sampler is retrieved, the percent recovery will be noted.
- The Shelby tube samplers will be prepared for shipment to the laboratory in accordance with ASTM Method K1587-83.

The following geotechnical tests will be run on the samples: Atterberg limits, specific gravity, moisture content, grain size, pH and total organic content.

4.2.7 Sampling Location Survey

Surveying will be conducted in accordance with Section 4.3.2.3.12 of the FWSAP.

- Monitoring well survey vertical control will be within 0.01 ft accuracy and horizontal control will be within one-ft accuracy.
- Vertical datum will be in 1929 NGVD and Ohio State plane coordinates will be in NAD83.
- Corners of incremental sampling and discrete soil/sediment locations and surface water locations will be surveyed as above or recorded using GPS equipment.

A summary of the surveyor's report will be included in the Draft and Final AOC Characterization Reports. Per the 11 May 2004 SOW, the Ohio plane coordinates and elevations will be noted on the boring logs.

4.3 SCHEDULE

Figure 4 shows the schedule for the pre-sampling, sampling, and reporting activities.

5.0 FIELD DOCUMENTATION

MKM will follow the guidelines set forth in Section 5.0 of the FWSAP for project documentation and QA/QC sampling requirements. Information required on the SAIC-generated forms will be included, although the information has been re-organized to streamline the documentation effort. The field forms that will be used for the 14 AOC characterizations are found on the pages that follow.

To ensure adequate information regarding field activities and IDW are captured, field crew members will document the following information:

- If refusal is met during drilling or when soil/sediment samples are being augered, the fact that refusal was met, the depth where refusal was met and corrective action taken (if any) will be noted in the field log book or boring log (monitoring well or geoprobe boreholes).
- Each time IDW is placed into a roll-off container or drum, the origin of the waste, the container identification number, and date the waste was generated will be noted in the field log book.

Field Equipment Calibration Log

Project Name: RVAAP – 14 AOC Characterization **Location: Ravenna, Ohio**

Field Reference Number: ______________________________________

Equipment Type: ____

Model Name: ____

Serial Number: ____

Date of Last Calibration by Manufacturer: ________________________

Did Manufacturers Instructions Accompany Equipment: Yes / No

Date Equipment Arrived Onsite:________________________

Calibration Frequency: Daily / Prior to each Reading

Calibration Standard(s): (1) _________________________

(2) _________________________

(3) _________________________

Initial Calibration Verified: Yes / No

Date/Time of Calibration	Calibration Standard 1	Calibration Standard 2	Calibration Standard 3	Calibration Accept / Reject	Calibration By	Comments
				Accept / Reject		
				Accept / Reject		
				Accept / Reject		
				Accept / Reject		
				Accept / Reject		
				Accept / Reject		
				Accept / Reject		
				Accept / Reject		
				Accept / Reject		
				Accept / Reject		
				Accept / Reject		
				Accept / Reject		
				Accept / Reject		

Field Sampling Report

Location ID: ____________________________________

Ravenna Army Ammunition Plant
Characterization of 14 RVAAP AOCs

Date: ____________________________________

Sampling Information

Source	**Groundwater / Product**		**Surface Water**		**Soils / Sediments / Sludge**			
Method	Bailer		Sample Bottle		Scoop		Trowel	
	Pump		Bacon Bomb		Bowl		Hand Auger	
					Push Probe			
Type/Construction								
Miscellaneous	**Well Purging Form** Yes - No							

Sample Collection: _______ hrs **Sample Type:** Composite - MI - Grab **Location:** Plotted on Map - Staked in Field
If MI, # of increments taken: ____________ Estimated - Measured - Surveyed
Sample Depth: __________ FT (below surface) **Decon:** Dedicated - Each Day - Each Location

Field Parameters (at time of sample)		**Analytical Parameters**				**Other Parameters**			
PID / FID Readings: Background:	ppm	VOC		TPH GRO		Corrosivity			
		SVOC		TPH DRO		Reactivity Sulfide/Cyanide			
		Explosives		Chromium +6		Ignitability			
Sample:	ppm	Propellants		Nitrate					
Water Level	FT	TAL Metals				**QA Samples**			
Temperature	°C	Pesticides/PCBs				MS/MSD	Yes / No	NA	
Sp. Conductance:	uMHOs	Cyanides				Duplicate ID		NA	
pH	units	TOC				Equipment Rinse ID		NA	
Turbidity	N.T.U.	Grain Size				Trip Blank ID		NA	

Sample Description

____
____
____
____
____
____
____

Soil sample description should include:

Munsell Color Odor Staining Texture Sorting Plasticity Moisture

Water sample description should include:

Color Odor Sheen Turbidity

Split Sample

Split Sample ID: ______________________________

Name: ______________________________
Agency/Company: ______________________________
Address:
____
____
____

QA/QC Provided: MS/MSD - Duplicate - Trip Blanks - Field Blanks
Parameters: Same as Above - As Listed

____
____
____

Logged By: ______________________________ (Please Print) Reviewed by: ______________________________ (Please Print)

Signature: ______________________________ Signature: ______________________ Date: ___________

HTRW DRILLING LOG (CONTINUATION SHEET)

HOLE NUMBER		
PROJECT	INSPECTOR	SHEET OF SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	BLOW COUNT (g)	REMARKS (h)

PROJECT	HOLE NO.

ENG FORM 5056A-R, AUG 94 (Proponent: CECW-EG)

HTRW DRILLING LOG

DISTRICT		HOLE NUMBER
1. COMPANY NAME	2. DRILL SUBCONTRACTOR	SHEET OF SHEETS
3. PROJECT	4. LOCATION	
5. NAME OF DRILLER	6. MANUFACTURERS DESIGNATION OF DRILL	
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT	8. HOLE LOCATION	
	9. SURFACE ELEVATION	
	10. DATE STARTED	11. DATE COMPLETED
12. OVERBURDEN THICKNESS	15. DEPTH GROUNDWATER ENCOUNTERED	
13. DEPTH DRILLED INTO ROCK	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED	
14. TOTAL DEPTH OF HOLE	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY)	

18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES			
20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY %
22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR		

LOCATION SKETCH/COMMENTS

SCALE:

PROJECT	HOLE NO.

ENG FORM 5056-R, AUG 94

(Proponent: CECW-EG)

Well Development Record

Well ID: ________________________________

Date: __________________

Ravenna Army Ammunition Plant-
RVAAP 14 AOC Characterization

Project: ______________________________________

Development Company: _____________________

Development Method: _______________________________

Comments: ____

Well TD: ___________ **FT TIC** **Depth to Water:** _________ **FT**
Water Column Height: _______ **FT** **One Well Volume:** ________ **Gals**

Well Volume (gallons/foot): 2-inch =0.16, 4-inch =0.65, 6-inch = 1.47, 8-inch = 2.61

Time	Well Dev. Code	Depth to Water (ft)	Purge Rate (gpm)	Purge Volume (gal)	Field Measurements				Turbidity	Comments
	FINAL									

WELL DEVELOPMENT CODES

DPB - Begin Pumping
DPE - End Pumping
DSB - Begin Surge Blocking
DSE - End Surge Blocking
DFM - Field Measurements
DBB - Begin Bailing
DBE - End Bailing
DXB - Begin Other
DXE - End Other
Other:

FIELD MEASUREMENT CODES

MTP - Temperature
MSC - Specific Conductance
MPD - Photoionizer (eg. HNu)
MFD - Flame Ionizer (eg. OVA)
MDO - Dissolved Oxygen
MPH - pH
MEH - eH
MOT - Other ___________________________

TURBIDITY

Enter Turbidity Meter Reading
(Final should be < 5 NTU)
OR
Enter Qualattaive Observations

H - High: Muddy/Silty
M - Medium: Cloudy/Translucent
L - Low: Transparent
N - None: Clear/No Sediment

Logged By: _______________________ (Please Print) Reviewed By: _______________________

Signature: _______________________ Date: ___________________

Monitoring Well Purging Form

Well ID: ______________________ **Ravenna Army Ammunition Plant**
Ravenna, Ohio

Date : ___________

WELL OBSERVATIONS

Protective Casing: Intact · Damaged **Locked:** Yes · No **Key No:**

Concrete Base: Intact · Damaged **Inner Casing:** 2″ · 4″ · 6″ · 8″ **Other:**

Stickup Height: ______________(ft) **TIC · TOC Difference:** __________ (ft)

Vapor Readings : HNu · OVA Background: __________ Inside Well Casing:

	Present	Depth	Sampled	Sample ID
LNAPL	Yes · No	_________________	Yes · No	
DNAPL	Yes · No	_________________	Yes · No	

CALCULATIONS

(A)	**Depth to Well Bottom**	_________ **(ft) TOC · TIC · BGS**	**Measured · Previously Measured** (circle one)
(B)	**Depth to Water**	_________ **(ft) TOC · TIC · BGS**	**Time Measured:** ___________
(C)	**Water Column Height (A-B)**	_________ **(ft)**	
(D)	**Well Diameter Factor**	_________ **(gal/ft) (2″ = 0.16, 4″ = 0.65, 6″ = 1.47, 8″ = 2.61 GAL/FT)**	
(E)	**One Well Volume (C*D)**	_________ **(gal)**	
(F)	**Volumes to be Evacuated**	_________	

(G) TOTAL VOLUME TO BE EVACUATED (E * F) _________ **(gal)**

EVACUATION METHOD

Well Evacuation Method: Bailer · Submersible Pump · Other: ________ **Device Number:** ________

Purge Water Disposition: **1.** Discharged Onsite **2.** Collected And: Stored · Disposed Onsite · Offsite

Collected In: Tanks · Drums No. of Containers:_________________

Comments:____

TIME	DEPTH TO WATER (ft)	PURGE RATE (gpm)	Field Measurements						Comments
			HNu	Spec Cond	Temp	pH	Turb		

Logged By: ____________________________(Please Print) Reviewed By:___________________________

Signature: ____________________________ Date :____________________

6.0 SAMPLE PREPARATION, PACKAGING AND SHIPPING

This section discusses the procedures used to process MI samples and the packaging and shipping of all samples.

6.1 MI SAMPLE PROCESSING

Attachment 2 describes the procedures that will be used to collect and process MI samples. The following clarifications/modifications to those methods will be incorporated:

- After being received from the sampling crew, MI samples will be dried on trays that are lined with plastic. The sample number will be written on a label that is attached to the tray.
- The trays will be placed on racks in a small, enclosed room in Building 1036. A dehumidifier will be placed in the drying room to facilitate the removal of water from the sample media. If additional drying space is required, additional drying `rooms' will be constructed using 4x4 studs and plastic sheeting. If additional drying is required, samples may be dried in an oven. Samples will be placed on un-lined stainless steel trays if oven-drying is required.
- To meet laboratory hold times, MI samples will be dried and processed for no longer than two days.
- Each sample will be sieved through a Number 4 screen, then through a Number 10 screen, to remove stones and residual organic material.
- Grinders equipped with a removable stainless steel cup and blade will be used to grind samples. The grinders will be decontaminated after each sample.
- MI samples will be sieved, ground and containerized under an exhaust hood to eliminate the dust inhalation hazard and to avoid cross-contamination of samples. The exhaust hoods will be vented to the outside through filters to prevent the expulsion of potentially contaminated soils to the area outside Building 1036.

Several sediment/surface soil samples will be analyzed for VOCs as part of the full suites. VOC samples will be collected from the composited MI sample in the field before the sample is dried.

6.2 SAMPLE PACKAGING AND SHIPPING

Samples will be prepared, packaged and shipped in accordance with Section 6.0 of the FWSAP. Exceptions to the FWSAP procedures include:

- No tape will be placed on the volatile sample containers; and
- All sample containers will be wrapped in either foam, bubble wrap or paper towels to reduce the potential for breakage during shipping.

7.0 INVESTIGATION-DERIVED WASTE

All IDW, including auger cuttings, personal protective equipment, disposable sampling equipment, and decontamination fluids will be segregated, handled, labeled, characterized, managed and disposed in accordance with the federal, state, and local rules, regulations and laws and Section 7.0 of the FWSAP. Based on site history, analytical results from IDW associated with extensive activities previously conducted at the site (installation of 141 monitoring wells and numerous soil borings), and generator knowledge of the waste stream, soil and sediment IDW will be considered to be (and thus will be handled as) non-hazardous wastes. Documents that demonstrate the non-hazardous nature of previously-generated RVAAP IDW can be found in Building 1037.

IDW will be segregated by type of media and will be containerized as follows:

- Auger cuttings, both saturated and unsaturated, surface soils, and residual sediment will be containerized in Department of Transportation (DOT) -approved 55-gallon steel drums or 20 yard roll offs and staged at the temporary waste accumulation area pending sample and waste characterization analysis. The roll-off containers for all AOCs except Pistol Range will be staged outside Load Line 6, which is a central location for most of the AOCs included in this study. Soil and sediment IDW from all AOCs, with the exception of Pistol Range, will be co-mingled in a container. IDW from the Pistol Range will be containerized separately.
- Personal protective equipment and disposable sampling equipment will be containerized and disposed as solid waste.
- Filters from exhaust hoods will be containerized in DOT approved 55-gallon steel drums and staged at the temporary waste accumulation area pending sample analysis.
- Monitoring well purge water, development water, and water used to decontaminate large and small equipment will be containerized in poly tank(s) and staged at the temporary waste accumulation area pending sample and waste characterization analysis. The poly tanks that will contain water generated during field activities will be staged outside Load Line 6. Water from all AOCs where wells are installed potentially could be co-mingled in a single tank. Additionally, one poly tank will be located behind Building 1036 to contain IDW from equipment decontamination. A 2-inch Teflon™ bailer will be used to collect the water samples from the poly tanks. The bailer will be submerged to the bottom of the tank to ensure that a representative sample (that characterizes the entire water column) is collected.
- Any suspect soil found during the investigation will be containerized separately in a labeled container. The suspect soil will be sampled, then, based on analytical results, disposed at an appropriately-permitted disposal facility.

Each time IDW is placed into a container, the origin of the soil or sediment will be noted in the field log book. After a roll-off is full, a bucket hand auger will be used to collect a sub-sample from each quadrant of the roll-off container. The four sub-samples (or aliquots) will be combined into one sample to characterize the contents of that container. After the IDW characterization sample has been collected, the container will be labeled with the words: `Container on hold pending analysis'. Final disposition of the container contents will be determined by the TCLP results.

At the conclusion of the field activities for the AOC characterization, the characterization results, classification and disposition of the IDW will be documented. Characterization, transportation and disposal of the IDW will comply with federal, state and local rules laws and regulations, as well as the permit requirements for the receiving facility as applicable.

All off-site IDW shipments will be coordinated through the RVAAP Industrial Specialist and Facility Manager. Disposition will be based on the results of the laboratory analyses for the bulk quantity in accordance with all federal, state and local rules, laws and regulations. Labeling of all IDW containers will comply with the procedures discussed during the September 16, 2004 conference call with the USACE and Ohio EPA.

8.0 CHEMICAL QUALITY CONTROL

The chemical quality control will be conducted in accordance with Sections 8.0 and 9.0 of the FWSAP and as discussed at the September 21, 2004 meeting with Ohio EPA and the USACE. Quality control samples will be collected by media for each AOC. For further details on chemical QA/QC see the QAPP addendum in this work plan.

9.0 DELIVERABLES

Deliverables will include work plans, data reports such as surveyor's data and Quality Control Summary Report, the draft and final AOC Characterization Reports, and project status reports.

9.1 DRAFT AND FINAL WORK PLANS

The Draft SAP Addendum, Draft SSHP and the Draft QAPP were submitted to USACE-Louisville District, the RVAAP Facility Manager and the Ohio EPA for review and approval. The distribution list at the front of this document lists other recipients of the document. Based on comments received, corrections and revisions have been incorporated and are being submitted in these Final Work Plan Addenda. The SAP and QAPP Addenda for this project follow the guidelines established in the RVAAP Facility-Wide Plans.

A copy of the Final Work Plan Addenda will be placed in each of the two RVAAP repositories (Reed Memorial Library in Ravenna, Ohio and the Newton Falls Public Library) and will be available for public review.

9.2 SURVEYOR'S REPORT

A surveyor's report, summarizing and tabulating the survey data for all survey locations, will be provided by a registered professional land surveyor and included as an appendix to the characterization report.

9.3 DATA VERIFICATION OUTPUT

The data verification task will be completed within 30 days of receipt of the last data package from the laboratory. The results of the verification task will be conveyed to USACE.

9.4 DRAFT AND FINAL AOC CHARACTERIZATION REPORT

A draft report will be prepared and submitted to the recipients listed in the 11 May 2004 SOW. The report will summarize and present all pertinent results, observations, survey data, analytical results, data validation, the results of the human health and ecological screens, conclusions and recommendations. Analytical results will be tabulated in a manner that shows detection limit associated with each sample; this will allow the reader to interpret the concentration associated with the analytical results that are reported as `non-detect'.

The report and its appendices will include project documentation such as field reports and logs, copies of field change orders, survey data, tabulated analytical results, chains-of-custody, required manifests, the laboratory's executive summary for each analytical batch, and photographs documenting the major project tasks. Data such as monitoring well measurements (well depths, screen depths, depth to groundwater) and geophysical data will be tabulated. Other data (potentiometric surface maps, groundwater plume maps, etc.) will be summarized on figures and/or cross sections. Significant findings will be discussed in the text.

If comments on the draft report are received, a response to comments will be prepared and a meeting will be held with the USACE and the regulators to resolve any outstanding issues. The document will be revised to incorporate the comments into the document and a final report will be submitted.

A copy of the final document will be placed in each of the repositories noted in Section 9.1. The final document will become part of the permanent Administrative Record.

9.5 PROJECT STATUS REPORTS

Monthly status reports will be prepared and submitted to USACE. The reports will summarize the activities completed in the previous month; activities that will be completed in the upcoming month; changes in key personnel (if any); and any problems encountered or anticipated and suggested resolutions for those problems. An updated schedule will be attached to each monthly status report. Any deviations to the schedule will be discussed in the `problems/problem resolution' section of the status report. The status of analytical laboratory activities will be included in the reports. Laboratory-related information that will be summarized includes: numbers of samples collected and AOC where samples were collected; date samples were submitted to the laboratory; and status of samples (waiting analytical results or results received). During the months when samples are being collected, a weekly status report will be submitted. The weekly reports will focus on activities completed in each AOC, numbers of samples collected from each AOC, any problems and resolutions of problems including a discussion of the potential schedule impacts resulting from unanticipated field conditions.

10.0 CONCEPTUAL SITE MODEL

The purpose of this section is to identify the known or expected conditions for each of the RVAAP 14 AOCs and aid in the identification of sampling locations, frequencies and required analyses. The information included in this section includes, but is not limited to, geology, hydrology, expected contaminants, exposure pathways and potential receptors that are common to all 14 AOCs. AOC-specific information is included in Appendices A through N.

10.1 GEOLOGY AND SOILS

RVAAP lies in the glaciated Allegheny Plateau section of the Allegheny Plateau Province. The surface soils of RVAAP and the surrounding area consist of boulder clay, sand and gravel. Boulder clay is an unsorted, unstratified mixture of varying amounts of sand, silt and clay, containing pebbles, cobbles and boulders. The predominant soil texture is silty clay that inhibits infiltration; however, significant areas of sandy soil which underlie RVAAP may allow vertical migration. Due to the low permeability of the surface soils, surface drainage is the primary avenue of dissipation of rainfall events, yielding a high potential for surface migration of contaminants. Elevations range from 1220 ft above mean sea level in the west to 930 ft in the east.

10.2 HYDROLOGY

RVAAP is located within the Glaciated Allegheny Plateau physiographic region of Ohio. Pennsylvanian bedrock is overlain by Wisconsinian-Age glacial deposits. The thickness of the glacial deposits varies across the facility. The Lavery Till is found in the western part of the facility and the younger Hiram Till is found in the remaining eastern portion. Subsurface lithology at RVAAP consists mostly of clay to sand-rich silt tills with interbedded sands scattered throughout. These deposits are generally firm, moderately plastic, and tend to hold water where encountered. Sandier deposits generally control the elevation of the shallow water table zone. Saturated sands and gravels are found within the glacial outwash and suspected buried valley sediments in Portage County. Wells drilled into these saturated zones may provide sufficient potable water for residential use. These shallow zone aquifers are recharged from infiltration of surface water (streams, ponds, etc.) and precipitation. Data from monitoring wells indicate the depth to groundwater in the primary bedrock aquifer ranges between 1 ft and 60 ft.

10.3 SURFACE HYDROLOGY

RVAAP is located within the Ohio River Basin. The West Branch of the Mahoning River represents the major surface stream in the RVAAP. This stream flows south, adjacent to the west end of the facility, before entering the Michael J. Kirwin Reservoir (West Branch Reservoir). The western and northern portions of the plant display low hills and a dendritic surface drainage pattern. Eastern and southern portions are characterized by an undulating to moderately level surface, reflecting less stream dissection of the original glacial drift surface. The facility contains abundant marshy areas and flowing and intermittent streams, whose headwaters are located in the small hills on the facility. Three major creeks drain RVAAP: the South Fork of Eagle Creek, Sand Creek and Hinkley Creek. All these water courses have many associated tributaries.

In addition, there are two, large manmade wetland areas and numerous smaller natural (kettles formed through glacial action) and manmade ponds. Many of the manmade ponds were constructed within the natural drainage patterns to function as settling ponds or basins for process effluent and runoff.

10.4 EXPECTED CONTAMINANTS

This characterization study addresses five of the twelve RVAAP load lines including areas where explosives were stored, burned, destroyed and/or tested. Appendices A through N describe the activities that were conducted at each of the 14 AOCs.

In addition, RVAAP conducted various industrial operations indirectly linked to munitions processes that have been identified as potential sources of contaminants. These operations include sewage treatment, waste-water treatment, vehicle maintenance, building maintenance, storage tanks, waste storage areas, equipment storage areas, furnaces, and evaporation units. Contaminants associated with these operations include, but are not limited to, primary and secondary explosives, metals (especially arsenic, chromium, mercury, and lead), polychlorinated biphenyls (PCBs) from transformers and electric motor oils, volatile and semi-volatile organic compounds from waste oils, petroleum fuels, lubricating oils/greases, and solvents, and pesticides routinely used to control rodent populations.

Paint utilized during construction of the facility contained lead and PCBs. Additionally, asbestos containing materials (ACMs) were used widely throughout the facility for a variety of purposes. In 1991, an asbestos survey was conducted and all friable ACMs were removed from buildings and pipelines at the RVAAP. Removal of non-friable ACMs (i.e. transite, floor tile and mastic, rolled roofing materials, floor liners) was not included in the 1991 abatement activities. Many of the buildings at the facility still have significant quantities of ACM materials in the form of corrugated transite roofs and flat panel transite siding.

As a result of on-site activities, RVAAP historically handled hazardous wastes and operated several waste management units in support of its operations. Potentially hazardous materials were stored, treated, deposited in landfills, or burned at the facility.

10.5 EXPOSURE PATHWAYS

Potential exposure pathways at RVAAP include groundwater, surface water, surface soil and sediment. Each potential pathway is discussed below.

10.5.1 Groundwater

The depth to groundwater in the primary bedrock aquifers is between 3 ft and 60 ft bgs. In addition, shallow groundwater tables exist in unconsolidated geologic materials on RVAAP. The groundwater on

RVAAP was used for industrial and drinking water production at the installation through the 1980's. Currently, one drinking water well provides water to the administration buildings (Buildings 1034, 1037, 1038 and Post 1).

Due to the potential for groundwater migration of contaminants from the AOCs to reach receptors, this pathway will be evaluated at ten (10) of the fourteen (14) AOCs: C-Block Quarry (RVAAP-06); Load Line 12 (RVAAP-12); Building 1200 (RVAAP-13); Landfill North of Winkelpeck Burning Grounds (RVAAP-19); NACA Test Area (RVAAP-38); Load Line 5 (RVAAP-39); Load Line 7 (RVAAP-40); Load Line 8 (RVAAP-41); Load Line 10 (RVAAP-43); and Atlas Scrap Yard (RVAAP-50).

10.5.2 Surface Water

Leachate or soil transported by runoff potentially could contaminate surface waters which may then be available to contact receptors. Natural and manmade ponds, ditches streams and/or springs will be evaluated at six (6) AOCs: Load Line 8 (RVAAP-RVAAP-41), Building 1200 (RVAAP-13), Pistol Range (RVAAP-36), Building F-15/F-16 (RVAAP-46), C-Block Quarry (RVAAP-6) and the Landfill North of Winklepeck Burning Ground (RVAAP-19).

Additionally, washout from buildings may have deposited contaminants in sumps and catch basins. Surface water located in sumps and/or catch basins will be evaluated at three (3) AOCs: Load Line 5 (RVAAP-39), Load Line 7 (RVAAP-40) and Load Line 10 (RVAAP-43). Surface water in sanitary sewers will also be evaluated at five (5) AOCs: Load Line 5 (RVAAP-39), Load Line 7 (RVAAP-40), Load Line 8 (RVAAP-41), Load Line 10 (RVAAP-43) and Atlas Scrap Yard (RVAAP-50).

10.5.3 Surface Soil

Much of the RVAAP has young forest and vegetative covering, but areas of exposed surface soil do exist within the AOCs. Due to the potential for human exposure (i.e. hunters, fishermen, OHARNG personnel) on or near AOCs, the surface soil pathway will be evaluated at twelve (12) of the fourteen (14) AOCs: C-Block Quarry (RVAAP-06), Building 1200 (RVAAAP-13), Landfill north of Winklepeck Burning Grounds (RVAAP-19); Pistol Range (RVAAP-36); Load Line 5 (RVAAP-39); Load Line 7 (RVAAP-40); Load Line 10 (RVAAP-43); Wet Storage (RVAAP-45); Buildings F-15/F-16 (RVAAP-46); Anchor Test Area (RVAAP-48); and Atlas Scrap Yard (RVAAP-50).

Surface soils located in dry ditches will also be evaluated at eight (8) AOCs: Building 1200 (RVAAP-13); Load Lines 5, 7, 8, and 10 (RVAAP AOCs 39, 40, 41 and 43); Wet Storage Area (RVAAP-45); Buildings F15/16 (RVAAP-46); and Atlas Scrap Yard (RVAAP-50).

10.5.4 Sediment

Leachate or soil transported by runoff may have resulted in contamination of sediments associated with surface water. Sediments impacted by RVAAP operations may have been deposited in naturally-occurring or engineered ponds, ditches, streams, sumps and/or catch basins or sanitary sewers. Sediments will be collected from:

- Natural and man-made ponds, ditches and streams/springs located at Load Line 8 (RVAAP-RVAAP-41), Building 1200 (RVAAP-13), Pistol Range (RVAAP-36), Building F-15/F-16 (RVAAP-46), C-Block Quarry (RVAAP-6) and Landfill North of Winklepeck Burning Ground (RVAAP-19).
- Sumps and/or catch basins located at Load Lines 5, 7 and 10 (RVAAP-39, 40 and 43).
- Sanitary sewers located at five AOCs: Load Line 5 (RVAAP-39), Load Line 7 (RVAAP-40), Load Line 8 (RVAAP-41), Load Line 10 (RVAAP-43) and Atlas Scrap Yard (RVAAP-50).

11.0 REFERENCES

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2. Phase I Remedial Investigation Report for the High Priority Areas of Concern at the Ravenna Army Ammunition Plant, Ravenna, OH. Prepared by SAIC for the U.S. Army Corps of Engineers, Nashville District. 1998.

3. Facility-Wide Sampling and Analysis Plan for the Ravenna Army Ammunition Plant, Ravenna, OH (Revised 2001). Prepared by SAIC for the U.S. Army Corps of Engineers, Louisville District.

4. Facility-Wide Health and Safety Plan, for the Ravenna Army Ammunition Plant, Ravenna, OH (Revised 2001). Prepared by SAIC for the U.S. Army Corps of Engineers, Louisville District. 1999.

5. USACE (U.S. Army Corps of Engineers). 1994a. Requirements for the Preparation of Sampling and Analysis Plans, EM 200-1-3.

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8. USATHAMA (U.S. Army Toxic and Hazardous Material Agency). 1978. Installation Assessment of Ravenna Army Ammunition Plant, Report No. 132.

9. USATHAMA 1988-1992. Ravenna Army Ammunition Plant Water Quality Surveillance Program (data only).

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APPENDIX A

C-BLOCK QUARRY (RVAAP-06)

APPENDIX A
C-BLOCK QUARRY (RVAAP-06)

1.1 Description

The C-Block Quarry is located in the northwestern portion of the facility north of Newton Falls Road within the central portion of the C-Block storage area. (See Figure 2 of the Sampling and Analysis Plan Addendum.) C-Block Quarry is an unlined borrow pit (approximately 150 ft by 600 ft or 0.3 acres) that was used during the 1950's as a disposal area for annealing process wastes. Spent pickle liquors from brass finishing that contained lead, mercury, chromium, and sulfuric acid were disposed in the pit. The quantity of waste disposed is unknown. Based upon preliminary site assessments conducted by MKM, fill dirt and some construction and demolition (C&D) type materials were placed and/or disposed in the quarry. Some of the types of C&D materials identified include:

- Transite siding;
- Rubble (i.e. concrete fragments);
- Rusted drums;
- Aluminum bottles; and
- Wooden debris and naturally occurring tree components.

Observations suggest the fill material ranges in depth from 1.5 to 5 feet with deeper amounts where piles exist. No structures were built in the quarry.

Currently, C-Block Quarry is densely populated by trees and ground level vegetation. Depth to bedrock in the vicinity ranges from two to five feet. The quarry area is located on a local bedrock high area with surface drainage moving away from the area in a radial pattern. Surface water in the pit flows radially inward toward the topographic low point in the quarry area. The quarry walls are composed of sandstone bedrock outcroppings. Observations of fractures in those outcroppings indicate the existence of a defined fracture pattern.

1.2 Previous Investigations

The following evaluation and investigation have been conducted at C-Block Quarry:

- Facility assessment (1989).
- February 1996 Preliminary Assessment.
- October/November 1996 USACHPPM Relative Risk Site Evaluation Report (USACHPPM RRSE).
- August 2001 - USACE collected additional samples from the quarry.

Information from these assessments, evaluations and investigations plus institutional knowledge about the disposal that occurred at the quarry was used to determine the sampling locations, media and numbers of samples for this characterization activity. The characterization activities, as specified in USACE's 11 May 2004 Scope of Work, are summarized in Section 1.3.

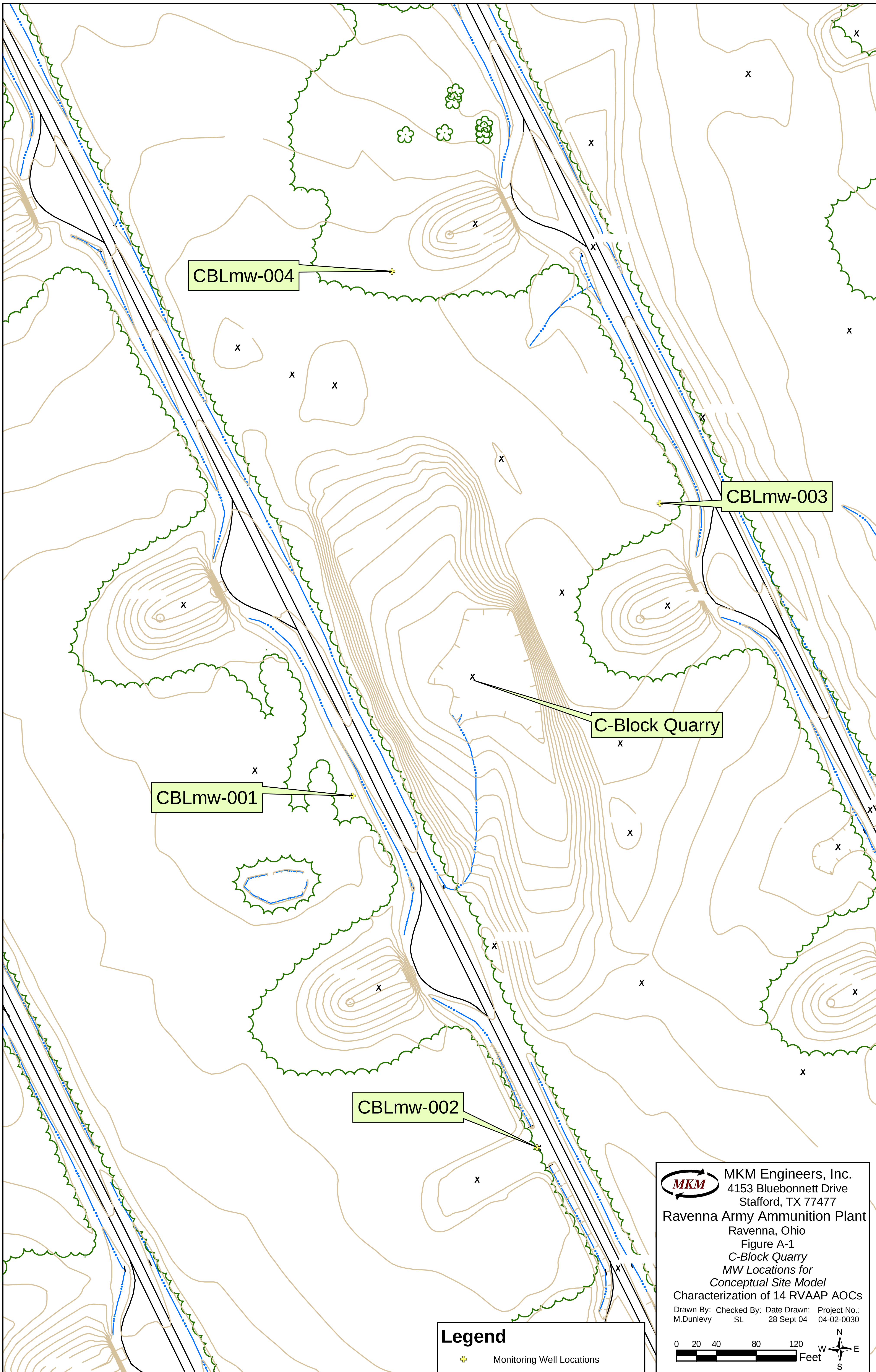
1.3 Summary of Characterization Activities

Six multi-incremental (MI) surface soils, three MI sediment and three surface water samples will be collected from C-Block Quarry. The sediment and surface water samples will be collected from springs. Four bedrock groundwater monitoring wells will be installed; the anticipated depth of the wells is 35 ft or less. Bedrock topographic maps at this AOC indicate that bedrock is anticipated to be encountered. Four groundwater monitoring wells will be installed. Two of the four monitoring well boreholes will be cored. After the wells have been installed and developed, a groundwater sample will be collected each of the newly-installed monitoring wells. The rationale for sample locations, the placement of groundwater monitoring wells and selection of wells to be cored are summarized in the following table.

C-Block Quarry Characterization Activities		
Type of Sample	**No. of Samples**	**Rationale**
MI Surface Soil	6	In the bed of the quarry
MI Spring Sediment	3	Downgradient runoff collection area from bedrock outflow
Spring Surface Water	3	Downgradient bedrock outflow
Groundwater (MW-1) *	1	Down gradient location; possible western flow direction
Groundwater (MW-2)	1	South, possible on gradient
Groundwater (MW-3) *	1	Possible structural orientation with the lowest elevation in the quarry; possible down gradient location; possible eastern flow direction
Groundwater (MW-4)	1	North, possible on gradient

* Monitoring well borehole to be cored

A complete list of the sampling and analytical requirements for C-Block Quarry can be found in Table 1-1 of the QAPP. Figure A-1 shows the groundwater monitoring well locations. Figure A-2 shows the soil, sediment and surface water sampling locations.



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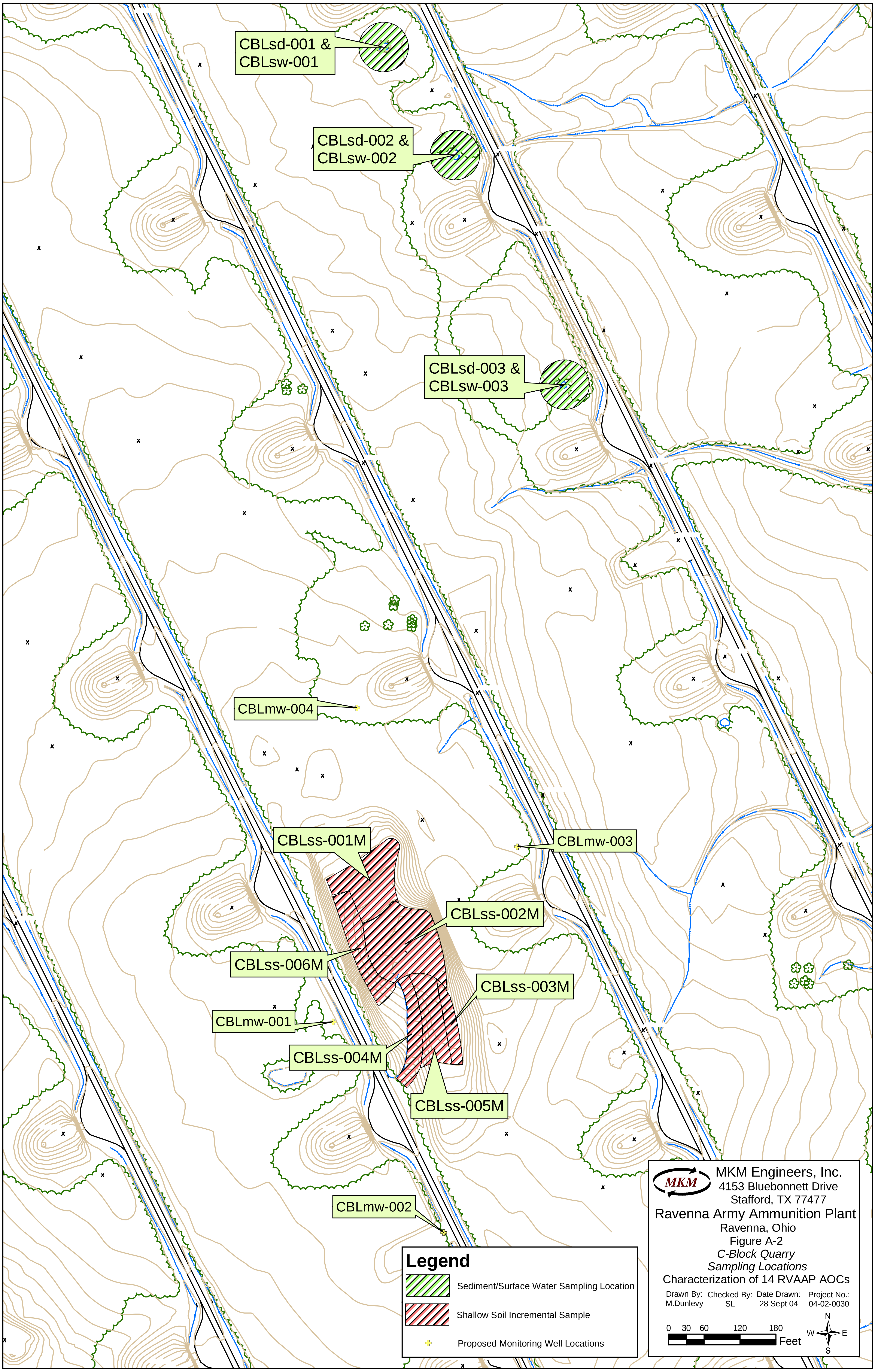
Stafford, TX 77477

Ravenna Army Ammunition Plant
Ravenna, Ohio

Figure A-1
C-Block Quarry
MW Locations for
Conceptual Site Model
Characterization of 14 RVAAP AOCs

Drawn By:	Checked By:	Date Drawn:	Project No.:
M.Dunlevy	SL	28 Sept 04	04-02-0030


CBLsd-001 &
CBLsw-001
CBLsd-002 &
CBLsw-002
CBLsd-003 &
CBLsw-003
CBLmw-004
CBLmw-003
CBLss-001M
CBLss-002M
CBLss-006M
CBLss-003M
CBLmw-001
CBLss-004M
CBLss-005M
CBLmw-002
Legend
Sediment/Surface Water Sampling Location
Shallow Soil Incremental Sample
Proposed Monitoring Well Locations
MKM
MKM Engineers, Inc.
4153 Bluebonnett Drive
Stafford, TX 77477
Ravenna Army Ammunition Plant
Ravenna, Ohio
Figure A-2
C-Block Quarry
Sampling Locations
Characterization of 14 RVAAP AOCs
Drawn By: M.Dunlevy
Checked By: SL
Date Drawn: 28 Sept 04
Project No.: 04-02-0030
0 30 60 120 180
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APPENDIX B

LOAD LINE 12 (RVAAP-12)

APPENDIX B
LOAD LINE 12 (RVAAP-12)

1.1 Description

Load Line 12 is located in the southeastern part of the facility at the northeast corner of the intersection of South Service Road and Paris-Windham Road (See Figure 2 of the Sampling and Analysis Plan Addendum). Load Line 12 was constructed in 1940 to 1941 as an ammonium nitrate plant. The plant was operated by the Atlas Powder Company from 1941 to May, 1943. After the termination of ammonium nitrate production, Load Line 12 was used for various production, renovation and demilitarization operations.

Load Line 12 was leased by the Silas Mason Company from 1946 to 1949 for the production of fertilizer-grade ammonium nitrate. In 1944, Buildings 900, 904 and 905 were converted and used for the demilitarization of munitions. The demilitarization operations used a hot-water washout process which was later converted to a steam melt-out process. Spillage from the demilitarization activities was cleaned from the floors and equipment with hot water/steam and allowed to flow from the buildings onto the ground. Later, a system of gutters was installed around the perimeter of the process buildings' floors to collect the contaminated washout water. From 1965 to 1967, Hercules Alcor, Inc. leased Building FF-19 for the production of aluminum chloride. The Army terminated the lease terminated due to concerns about air emissions and a fish-kill in Cobb's Pond that was attributed to the release of aluminum chloride (SAIC 2004).

In the late 1970's, contaminated pink water washout was collected in settling sumps and treated through sawdust filters. In 1981, the Army constructed the Load Line 12 Pink Water Treatment Plant which operated until 1999. The Pink Water Treatment Plant consisted of a dual mode activated carbon filtration system for filtering pink water. The effluent was pumped through a bag pre-filter that removed the particulate matter. After the pre-filter, the effluent was pumped through a series of two activated carbon units into another holding tank. Approximately 30 minutes of carbon bed contact time was maintained during the treatment process. Refer to the Phase II Remedial Investigation Report for Load Line 12 (SAIC 2004) for details on production history.

The Army declared Load Line 12 inactive in 1992. Demolition and salvage operations were completed by MKM in June 2000. All buildings, associated structures including the pink water plant and walkways were removed. The AOC currently consists of relatively level ground covered by seasonal vegetative growth consisting of native weeds and immature trees and bushes.

Surface water in Load Line 12 flows south-southeast towards the constructed drainage system (i.e. drainage ditches). Two ponds exist within the load line. A settling pond is located in the north-central portion of the AOC and is fed by a naturally occurring stream channel which runs east to west. A second pond, located in the southeastern portion of Load Line 12, is fed by the main drainage ditch that runs north to south along the east side of the eastern railroad bed. Groundwater flow is similar to that of the surface water flow, in the direction of the bedrock topography underlying the soil overburden.

1.2 Previous Investigations

The following assessments and/or investigations have been conducted at Load Line 12:

- 1996 USACHPPM Relative Risk Site Evaluation (USACHPPM RRSE).
- Preliminary Assessment for the Ravenna Army Ammunition Plant (USACE 1996).
- Phase I Remedial Investigation for High-Priority Areas of Concern at the Ravenna Army Ammunition Plant (SAIC 1998).
- August 2001 additional USACE sampling.
- Phase II Remedial Investigation (SAIC 2004).

The results of these assessments, evaluations and investigations, in conjunction with knowledge about the AOC's operations history, were used to select sampling locations, media and numbers of samples for this characterization activity. The sampling activities, as specified in USACE's 11 May 2004 Scope of Work, are summarized in Section 1.3

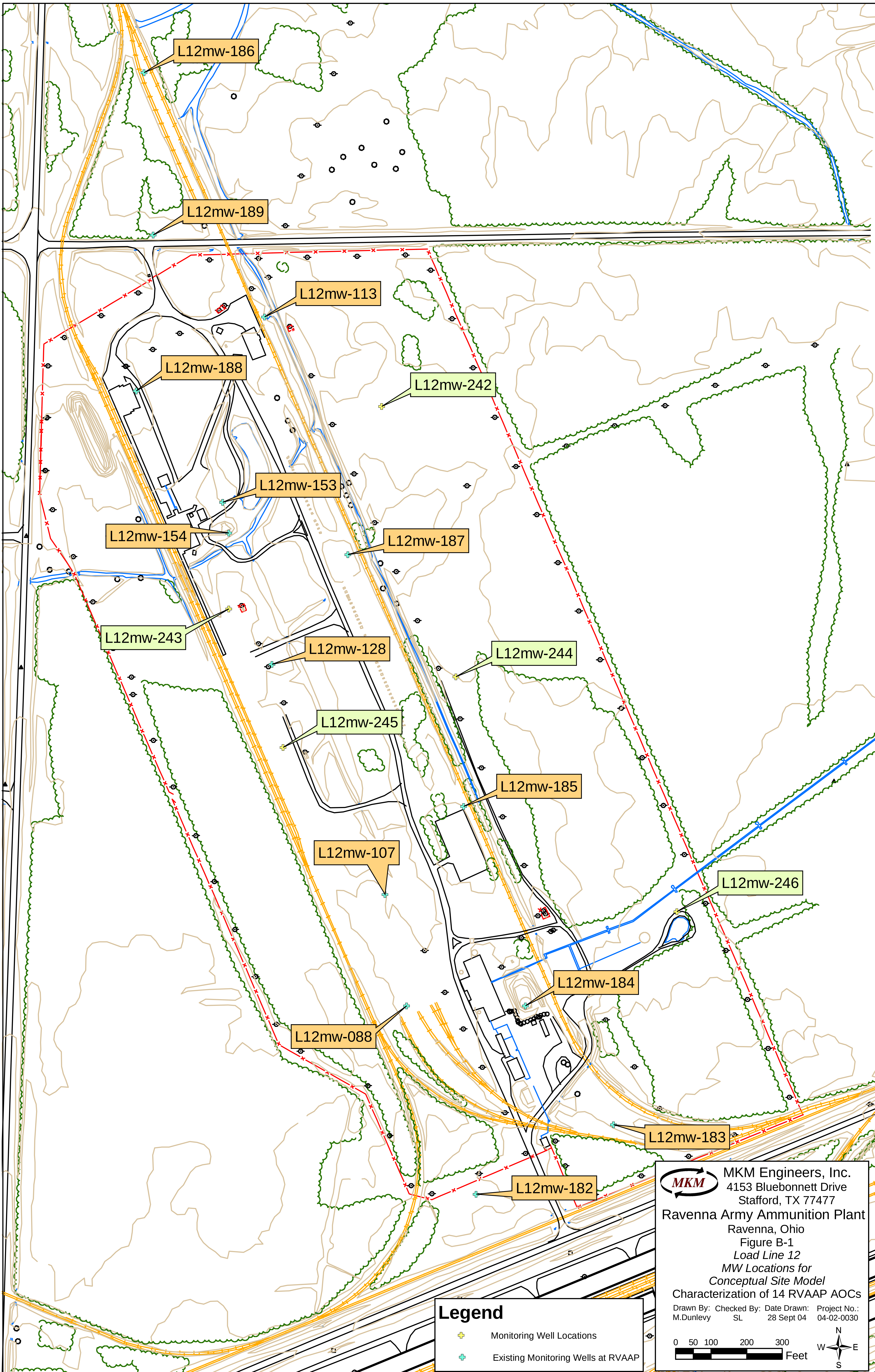
1.3 Summary of Characterization Activities

Because extensive soil data already exists for Load Line 12, no soil, sediment or surface water samples will be collected during this characterization effort. Bedrock topographic maps and historical data at this AOC indicate that bedrock is not anticipated to be encountered. Five groundwater monitoring wells will be installed, the anticipated depths of the wells range from 23 to 36 ft bgs. During drilling activities, geotechnical samples will be collected using Shelby tubes. Currently, approximately three geotechnical samples will be collected from this AOC; however field observations will determine the exact number of geotechnical samples collected. The specific location (i.e. specific borehole) of the geotechnical sample will be determined in the field. After the monitoring wells have been installed and developed, a groundwater sample will be collected from each of the newly-installed groundwater monitoring wells. Additionally, groundwater samples will be collected from fourteen existing monitoring wells that are located within Load Line 12. Rationale for samples and placement of the groundwater monitoring wells are summarized in the following table.

Load Line 12 Characterization Activities

Type of Sample	No. of Samples/ Locations	Rationale
Groundwater (MW-242)	1	Area where nitrate was detected in the groundwater during previous investigation
Groundwater (MW-243)	1	Near the center of metals exceedance area identified during previous investigation
Groundwater (MW-244)	1	Area where nitrate was detected in the groundwater during previous investigation
Groundwater (MW-245)	1	Potentiometric surface location/down gradient
Groundwater (MW-246)	1	Down gradient location
Groundwater	14	Existing monitoring well locations
Geotechnical	≈ 3	Locations to be determined in the field

A complete list of the sampling and analyses for Load Line 12 can be found in Table 1-2 of the QAPP. Figure B-1 shows the locations of the groundwater monitoring wells to be installed and the locations of the existing monitoring wells to be sampled.


L12mw-186
L12mw-189
L12mw-113
L12mw-188
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L12mw-244
L12mw-245
L12mw-185
L12mw-107
L12mw-246
L12mw-184
L12mw-088
L12mw-183
L12mw-182
Legend
Monitoring Well Locations
Existing Monitoring Wells at RVAAP
MKM
MKM Engineers, Inc.
4153 Bluebonnett Drive
Stafford, TX 77477
Ravenna Army Ammunition Plant
Ravenna, Ohio
Figure B-1
Load Line 12
MW Locations for
Conceptual Site Model
Characterization of 14 RVAAP AOCs
Drawn By: M.Dunlevy
Checked By: SL
Date Drawn: 28 Sept 04
Project No.: 04-02-0030
0 50 100 200 300
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APPENDIX C

BUILDING 1200 (RVAAP-13)

APPENDIX C
BUILDING 1200 (RVAAP-13)

1.1 Description

Building 1200 was the Ammunition Sectioning Area. The building construction is half reinforced concrete and half transite sided with dimensions of approximately 30 ft. by 20 ft. with a 12 ft. peak. From approximately 1941 to 1971, ammunition was sectioned and checked for flaws and then demilled at this building by steaming munitions rounds. The steam decontamination generated pink water effluent, which drained to a man-made crushed slag gravel bed. The gravel bed discharged into a 0.5-acre sedimentation pond, located approximately 415 ft. northeast of Building 1200, and the overflow from this pond discharged into Eagle Creek. At the present, the roof is partially collapsed and the AOC is slightly overgrown with brush and small trees.

Contaminants of concern at this unit are explosive compounds (TNT, HMX, Composition B and others) and heavy metals (including lead, chromium, and mercury) and organics (PAHs and pesticides).

Surface water flows northeast and south, following the drainage ditches. Groundwater flow direction is not known, due to the lack of groundwater data for the site. According to USGS topographic maps and bedrock topology maps, the depth of to bedrock ranges from 10 to 50 feet. A well log was obtained from the existing background monitoring well located within the AOC which indicates weathered bedrock at 5 ft bgs and competent bedrock at 15 ft bgs.

1.2 Previous Investigations

As early as 1978, USATHAMA assessed conditions at Building 1200 as part of an RVAAP installation assessment. Other investigations conducted at Building 1200 include:

- Preliminary Review and Visual Site Inspection conducted in 1989 by U.S. EPA.
- Preliminary Assessment for RVAAP (February, 1996).
- Relative risk site evaluation conducted by CHPPM (1996).
- A 1998 Phase I Remedial Investigation conducted as part of a larger investigation at RVAAP areas that were considered high priority AOCs (SAIC 1998).

The results of those investigations, and/or evaluations coupled with knowledge about Building 1200's operational history and potential source area locations were used to identify sampling locations, select media to be sampled and determine the number of samples to be collected as part of this characterization activity. Sampling requirements for Building 1200, as specified in USACE's 11 May 2004 Scope of Work, are summarized in Section 1.3

1.3 Summary of Characterization Activities

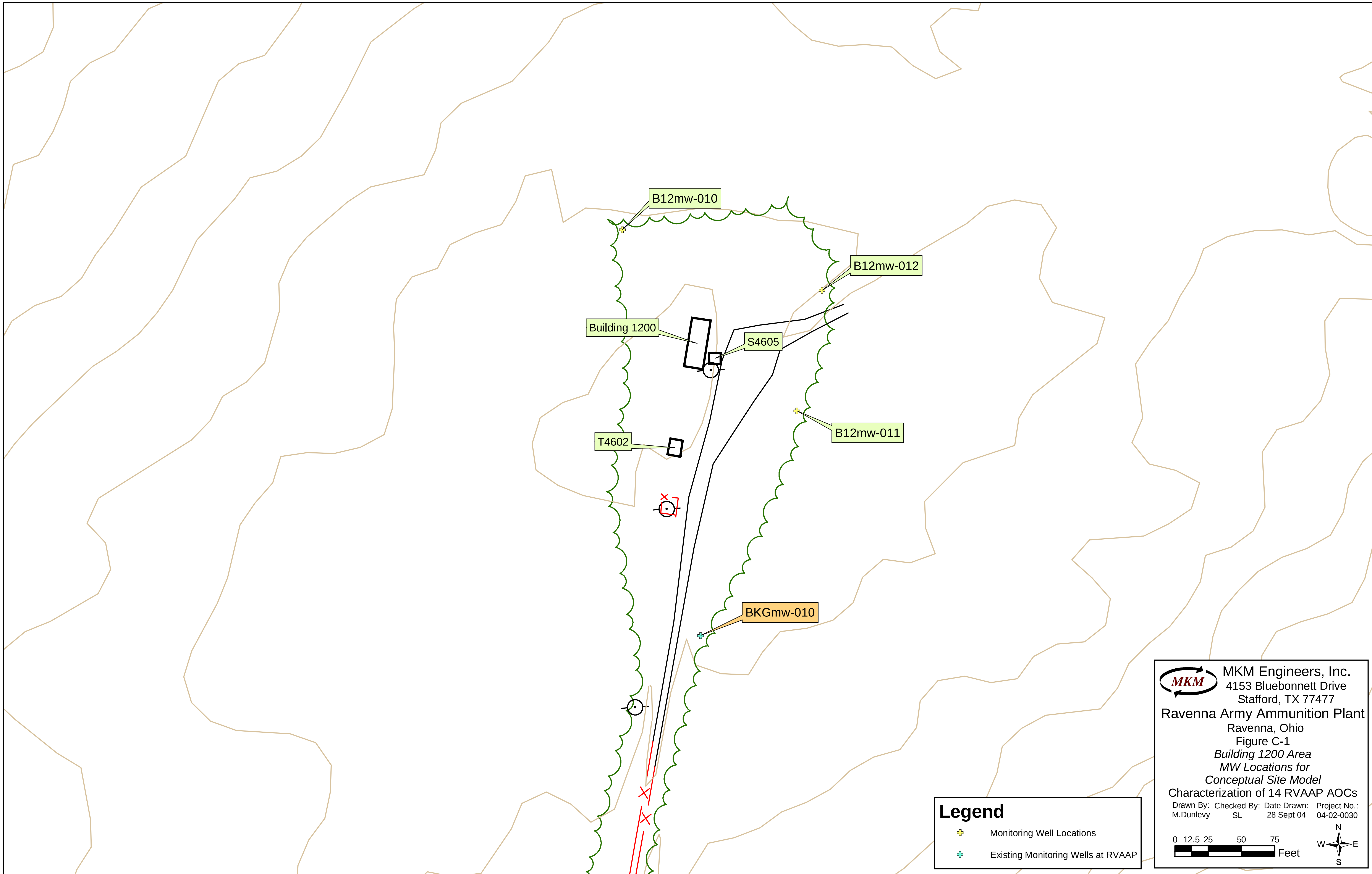
Six surface soil MI, four MI dry ditch (surface soil) and two sediment samples will be collected. Two surface water samples will be collected from a downstream runoff collection area. Prior to well installation, one test trench will be excavated to determine depth to first groundwater and to collect lithologic data. Bedrock topographic maps and historical data at this AOC indicate that bedrock is anticipated to be encountered. The well logs for BKGMW-010 indicate that weathered bedrock is expected at approximately five feet and competent bedrock is expected at approximately fifteen feet. Three groundwater monitoring wells will be installed to an anticipated depth of 25 ft. Two of the three monitoring well boreholes will be cored. During the drilling activities, geotechnical samples will be collected by advancing Shelby tubes. Currently, approximately three geotechnical samples will be collected from this AOC; however field observations will determine the exact number of geotechnical samples collected. The specific location (i.e. specific borehole) of the geotechnical sample will be determined in the field. After the monitoring wells have been installed and developed, a groundwater sample will be collected from each of the newly-installed groundwater monitoring wells and one groundwater sample will be collected from an existing background monitoring well (BKGMW-010). A well inspection report indicates that BKGMW-010 has accumulated more than two ft of silt in the bottom of the screen. If field measurements confirm that silt has filled more than ten percent of the well screen, the background well will be redeveloped before samples are collected. The rationale for the sample locations, placement of groundwater monitoring wells, test trench location and selection of wells to be cored are summarized in the following table.

Building 1200 Characterization Activities		
Type of Sample	**No. of Samples/ Locations**	**Rationale**
MI Surface Soils	6	Operational demil areas including the gravel bed, areas north, south and east of the building, and around the Control Building
MI Surface Soil - Dry Ditch	4	Slag runoff ditches that drained "pink water" to the gravel bed and east side of Building 1200
Sediment MI	2	One pond sample and one between "pink water" sedimentation pond and creek
Surface Water	2	One pond sample and one between "pink water" sedimentation pond and creek
Test Trench	1	Near monitoring well location on the north side of Building 1200
Groundwater (MW-10) *	1	Possible upgradient location; well used for triangulation
Groundwater (MW-11)	1	Upgradient location, between existing MW and new MW-3
Groundwater (MW-12) *	1	Downgradient of discharge area (into surface ditch)
BKGMW-010	1	Existing background monitoring well

Geotechnical	≈ 3	To be determined in the field

* Groundwater monitoring wells to be cored

A complete list of the sampling and analytical requirements for Building 1200 can be found in Table 1-3 of the QAPP. Figure C-1 shows the groundwater monitoring well locations. Figure C-2 shows the soil, sediment and surface water sampling locations. Figure C-3 shows the test trench location.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Building 1200
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B12mw-011
T4602
BKGmw-010
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Monitoring Well Locations
Existing Monitoring Wells at RVAAP
MKM
MKM Engineers, Inc.
4153 Bluebonnett Drive
Stafford, TX 77477
Ravenna Army Ammunition Plant
Ravenna, Ohio
Figure C-1
Building 1200 Area
MW Locations for
Conceptual Site Model
Characterization of 14 RVAAP AOCs
Drawn By: M.Dunlevy
Checked By: SL
Date Drawn: 28 Sept 04
Project No.: 04-02-0030
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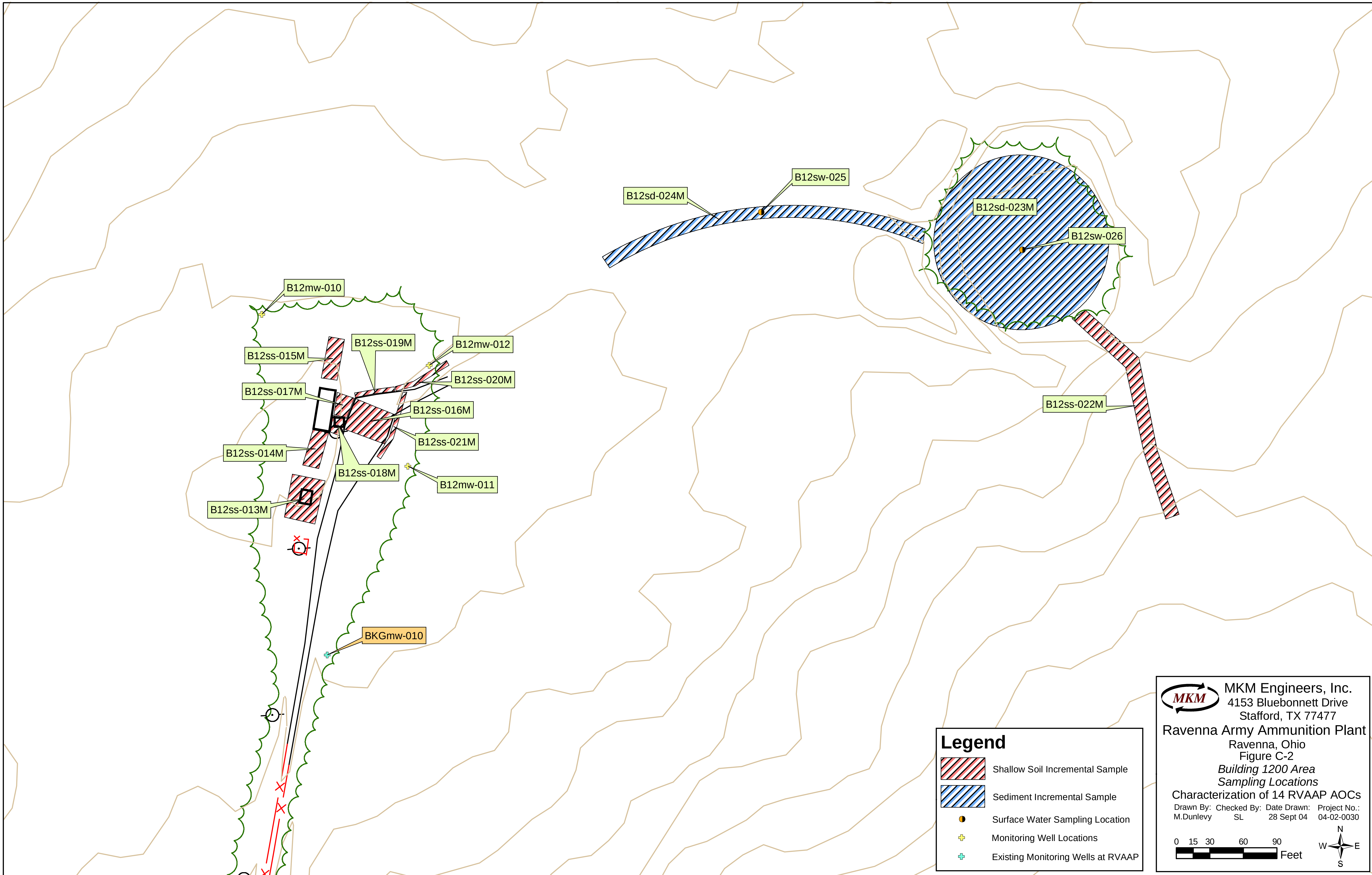
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B12mw-011
B12ss-013M
BKGmw-010
B12sd-024M
B12sw-025
B12sd-023M
B12sw-026
B12ss-022M
Legend
Shallow Soil Incremental Sample
Sediment Incremental Sample
Surface Water Sampling Location
Monitoring Well Locations
Existing Monitoring Wells at RVAAP
MKM
MKM Engineers, Inc.
4153 Bluebonnett Drive
Stafford, TX 77477
Ravenna Army Ammunition Plant
Ravenna, Ohio
Figure C-2
Building 1200 Area
Sampling Locations
Characterization of 14 RVAAP AOCs
Drawn By: M.Dunlevy
Checked By: SL
Date Drawn: 28 Sept 04
Project No.: 04-02-0030
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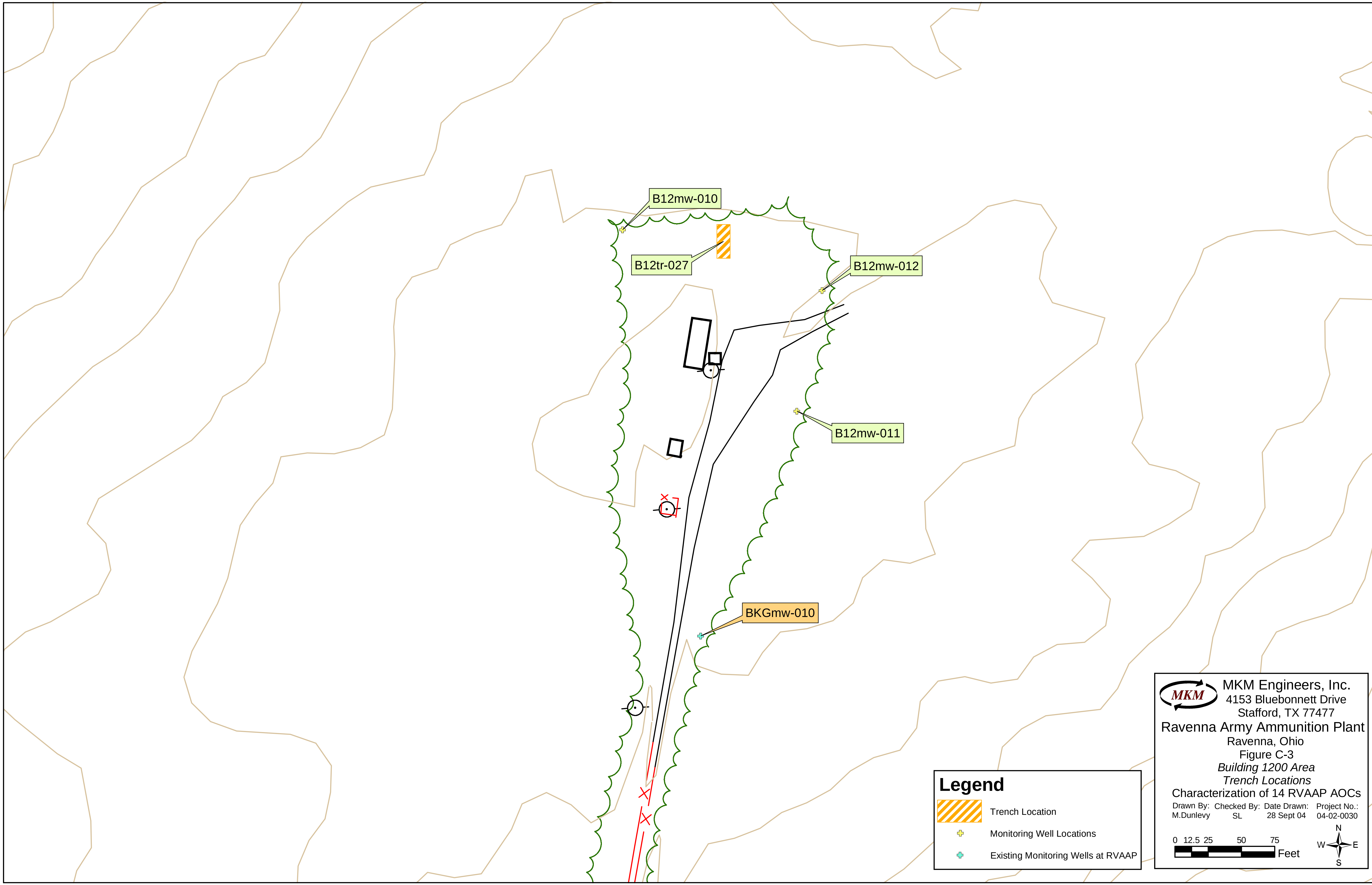
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B12mw-012
B12mw-011
BKGmw-010
Legend
Trench Location
Monitoring Well Locations
Existing Monitoring Wells at RVAAP
MKM
MKM Engineers, Inc.
4153 Bluebonnett Drive
Stafford, TX 77477
Ravenna Army Ammunition Plant
Ravenna, Ohio
Figure C-3
Building 1200 Area
Trench Locations
Characterization of 14 RVAAP AOCs
Drawn By: M.Dunlevy
Checked By: SL
Date Drawn: 28 Sept 04
Project No.: 04-02-0030
0 12.5 25 50 75
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MKM

APPENDIX D

LANDFILL NORTH OF WINKLEPECK BURNING GROUNDS

(RVAAP-19)

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

1.1 Description

The landfill located north of Winklepeck Burning Grounds is an unlined 10-acre landfill used for general refuse and burning operations. The landfill lies east of George Rd. and north of Winklepeck Burning Grounds (See Figure 2 of the Sampling and Analysis Plan Addendum). The landfill was operational from 1969 to 1978. An unknown quantity of material was landfilled at this AOC including booster cups, aluminum liners, sanitary waste and possibly explosives and munition waste and ash. Debris and garbage protrude through the landfill surface in several areas. The appearance and location of the landfill suggests a trench and fill method of operation.

There are no structures at the landfill. Originally, the landfilled area gradient was steep, but now, as a result of the landfill activities, the AOC is relatively flat. However, on the east side of the landfill, the terrain drops sharply toward a streambed. The area is covered by seasonal vegetative growth consisting of native weeds and immature trees and bushes.

1.2 Previous Investigations

The landfill north of Winkelpeck was included in the following site-wide assessments/evaluations:

- USATHAMA's 1978 installation assessment.
- Preliminary Review and Visual Site Inspection conducted in 1989 by U.S. EPA.
- Jacobs Engineering (1989)
- Preliminary Assessment for RVAAP (February, 1996).
- A 1998 Phase I Remedial Investigation conducted as part of a larger investigation at RVAAP areas that were considered high priority AOCs (SAIC 1998).

Information gathered during the investigations, assessments and evaluations was used to identify sampling locations, type of media to be sampled, analyses to be run and the number of samples to be collected as part of this characterization activity. The sampling activities, as specified in USACE's 11 May 2004 Scope of Work, are summarized in Section 1.3

1.3 Summary of Characterization Activities

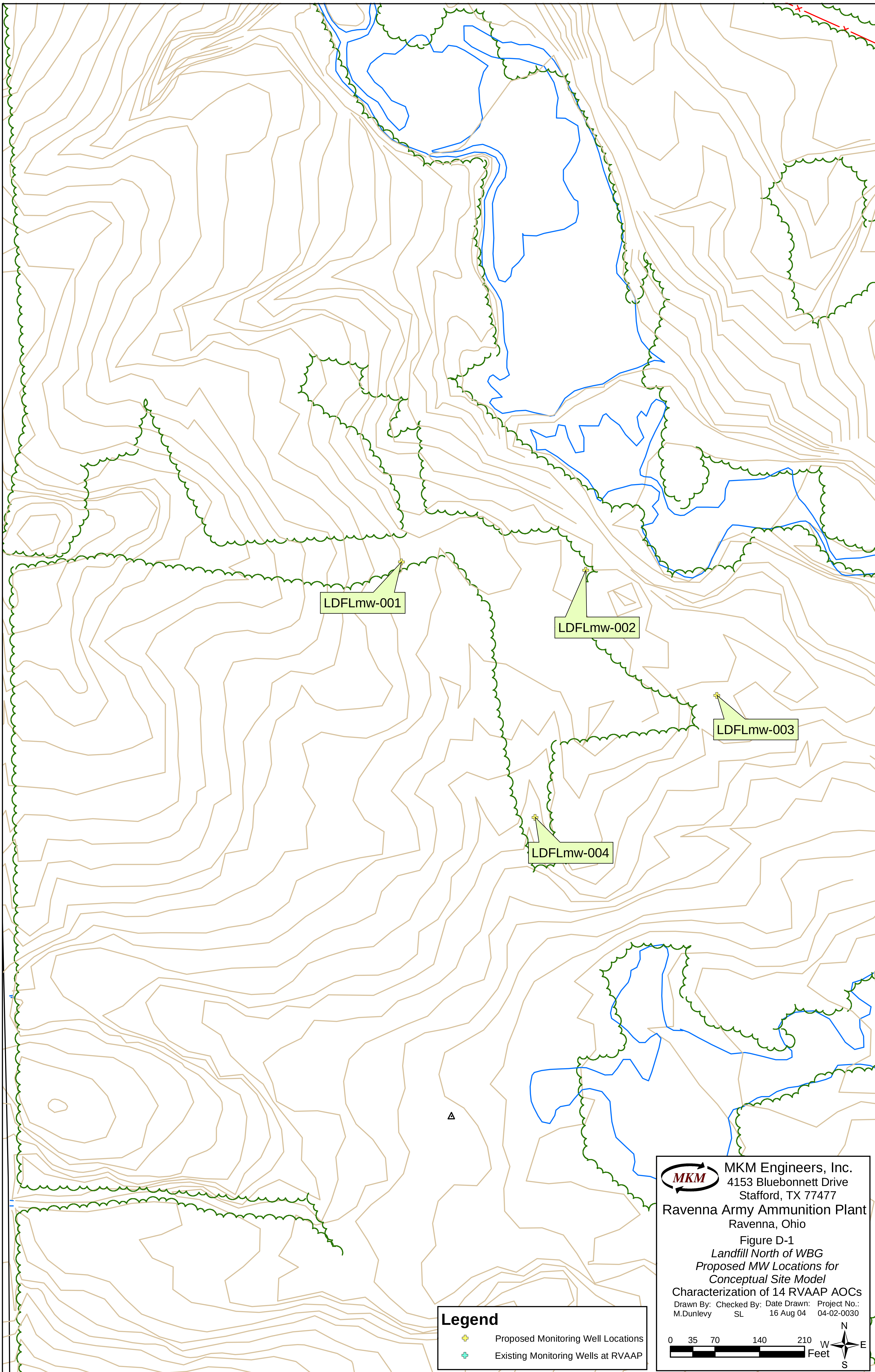
Fourteen MI surface soil samples, five surface water samples, and four MI sediment samples will be collected from the landfill located north of Winkelpeck Burning Grounds. Eighteen geoprobe borings will be advanced to an approximate depth of 10 ft. Geoprobe data will be used to confirm or alter the landfill boundaries. One test trench will be excavated to determine depth to first groundwater and to collect lithologic data. Bedrock topographic maps at this AOC indicate that bedrock is anticipated to be encountered. Four groundwater monitoring wells will be installed to an approximate depth of 23 ft bgs. Two of the four monitoring well boreholes will be cored. During drilling activities, geotechnical samples will be collected using Shelby tubes. Currently, approximately three geotechnical samples will be collected from this AOC; however field observations will determine the exact number of geotechnical samples collected. The specific location (i.e. specific borehole) of the geotechnical sample will be determined in the field. After the monitoring wells have been installed and developed, a groundwater sample will be collected from each of the newly-installed groundwater monitoring wells. Groundwater monitoring well MW-2 is currently located within the landfill boundaries. This groundwater monitoring well will be relocated outside the limits of the landfill using the information gathered during the geoprobe investigation of the landfill boundaries. The rationale for the sample locations, test trench location, placement of groundwater monitoring wells and selection of wells to be cored are summarized in the following table.

Landfill North of Winkelpeck Characterization Activities

Type of Sample	No. of Samples/ Locations	Rationale
Surface Soils MI	14	Twelve samples located within the confines of the landfill boundaries and two samples in the potential tracer burning area
Sediment MI	4	Downgradient of the landfill in the direction of runoff and in the steam channel
Surface Water	5	Stream channel downgradient of the landfill
Geoprobe	18	Placed approximately 25 ft outside the suspected limits of the landfill boundaries
Test Trench	1	Located near the potential tracer burning area
Groundwater (MW-1) *	1	Upgradient location, high potential for encountering bedrock
Groundwater (MW-2)	1	Downgradient of landfill
Groundwater (MW-3)	1	Downgradient of landfill
Groundwater (MW-4) *	1	Upgradient of landfill, high potential for encountering bedrock
Geotechnical	≈ 3	Locations to be determined in the field

* Groundwater monitoring wells to be cored

A list of the sampling and analytical requirements for the Landfill North of Winklepeck Burning Grounds can be found in Table 1-4 of the QAPP Addendum. Figure D-1 shows the groundwater monitoring well locations. Figure D-2 shows the soil, sediment and surface water sample locations. Figure D-3 shows the geoprobe and test trench locations.



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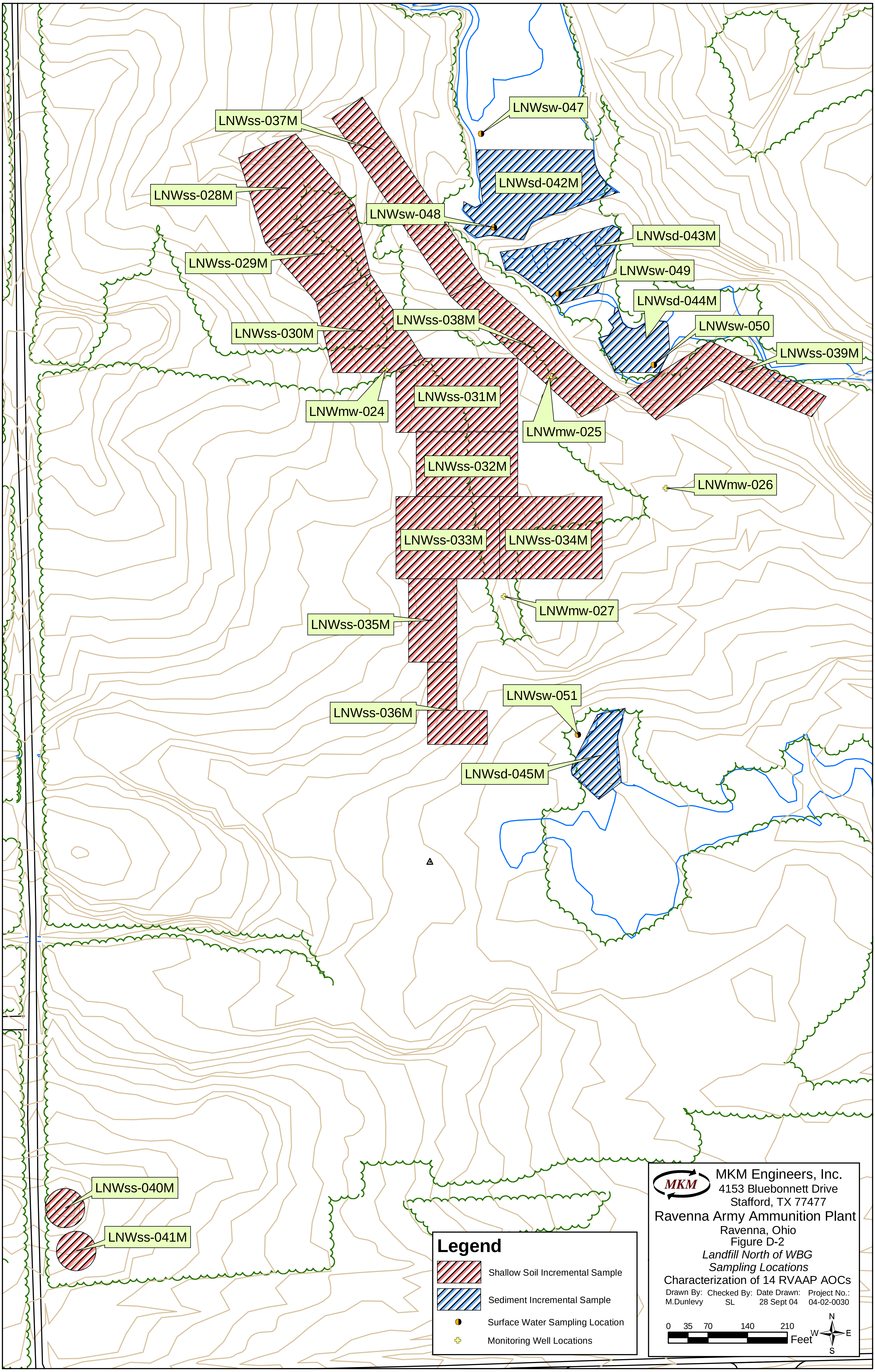
Ravenna, Ohio

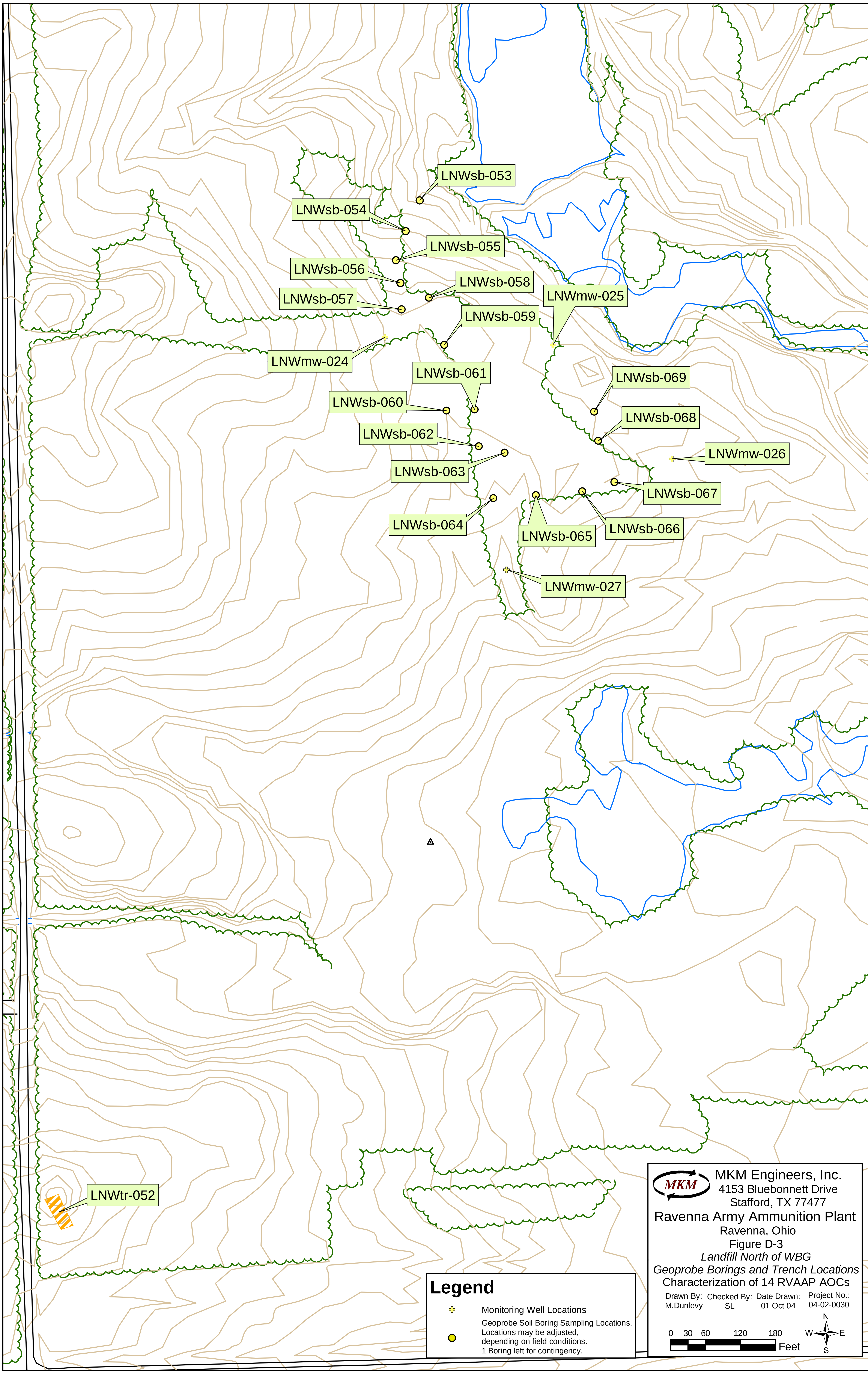
Figure D-1
Landfill North of WBG
Proposed MW Locations for
Conceptual Site Model

Characterization of 14 RVAAP AOCs

Drawn By:	Checked By:	Date Drawn:	Project No.:
M.Dunlevy	SL	16 Aug 04	04-02-0030



LNWss-037M
LNWsw-047
LNWsd-042M
LNWss-028M
LNWsw-048
LNWsd-043M
LNWss-029M
LNWsw-049
LNWsd-044M
LNWss-038M
LNWsw-050
LNWss-030M
LNWss-039M
LNWss-031M
LNWmw-024
LNWmw-025
LNWss-032M
LNWmw-026
LNWss-033M
LNWss-034M
LNWmw-027
LNWss-035M
LNWsw-051
LNWss-036M
LNWsd-045M
LNWss-040M
LNWss-041M
Legend
Shallow Soil Incremental Sample
Sediment Incremental Sample
Surface Water Sampling Location
Monitoring Well Locations
MKM
MKM Engineers, Inc.
4153 Bluebonnett Drive
Stafford, TX 77477
Ravenna Army Ammunition Plant
Ravenna, Ohio
Figure D-2
Landfill North of WBG
Sampling Locations
Characterization of 14 RVAAP AOCs
Drawn By: M.Dunlevy
Checked By: SL
Date Drawn: 28 Sept 04
Project No.: 04-02-0030
0 35 70 140 210
Feet
N
W E
S


LNWsb-053
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LNWsb-061
LNWsb-069
LNWsb-060
LNWsb-068
LNWsb-062
LNWmw-026
LNWsb-063
LNWsb-067
LNWsb-064
LNWsb-065
LNWsb-066
LNWmw-027
LNWtr-052
Legend
Monitoring Well Locations
Geoprobe Soil Boring Sampling Locations.
Locations may be adjusted,
depending on field conditions.
1 Boring left for contingency.
MKM
MKM Engineers, Inc.
4153 Bluebonnett Drive
Stafford, TX 77477
Ravenna Army Ammunition Plant
Ravenna, Ohio
Figure D-3
Landfill North of WBG
Geoprobe Borings and Trench Locations
Characterization of 14 RVAAP AOCs
Drawn By: M.Dunlevy
Checked By: SL
Date Drawn: 01 Oct 04
Project No.: 04-02-0030
0 30 60 120 180
Feet
N
W
E
S

APPENDIX E

PISTOL RANGE (RVAAP-36)

APPENDIX E
PISTOL RANGE (RVAAP-36)

1.1 Description

The 1.2 acre Pistol Range is located in the north-central region of RVAAP, west of George Road, east of Greenleaf Road and due north of the Winklepeck Burning Grounds. (See Figure 2 of the Sampling and Analysis Plan Addendum.) The Pistol Range was initially constructed for use by the installation's security personnel who were completing their pistol qualifications. The shooting qualifier stood on the south side of the creek and shot over the creek toward targets on the north side. A soil embankment or berm on the north side of the creek acted as a backstop for the bullets. The embankment is approximately 165 ft. long by 48 ft. high and is located 150 to 200 feet from the edge of the creek. The Pistol Range was used regularly from 1941 to 1993 by the Army and the local police departments, and currently is inactive.

Another prominent structure at the Pistol Range is a target storage shed (Building T-3406) on the extreme south end of the AOC. Between the shed and soil embankment is an unnamed creek. The firing points are located south of the creek 7 to 50 yards from the soil embankment (see Figure E-1). The target stands that were positioned at the base of the soil embankment have been removed. Currently, the Pistol Range is overgrown with primarily grass and interspersed with small saplings.

The direction of surface water flow is bi-directional at the AOC. The unnamed creek bisects the AOC approximately in half. Surface water flows toward the creek from both the north and south. The creek flows east and is a small tributary of Sand Creek.

1.2 Previous Investigations

The following assessments and/or investigations have been conducted at the Pistol Range:

- USATHAMA's 1978 installation assessment.
- Preliminary Assessment for RVAAP (February, 1996).
- 1996 USACHPPM Relative Risk Site Evaluation Report (USACHPPM RRSE)

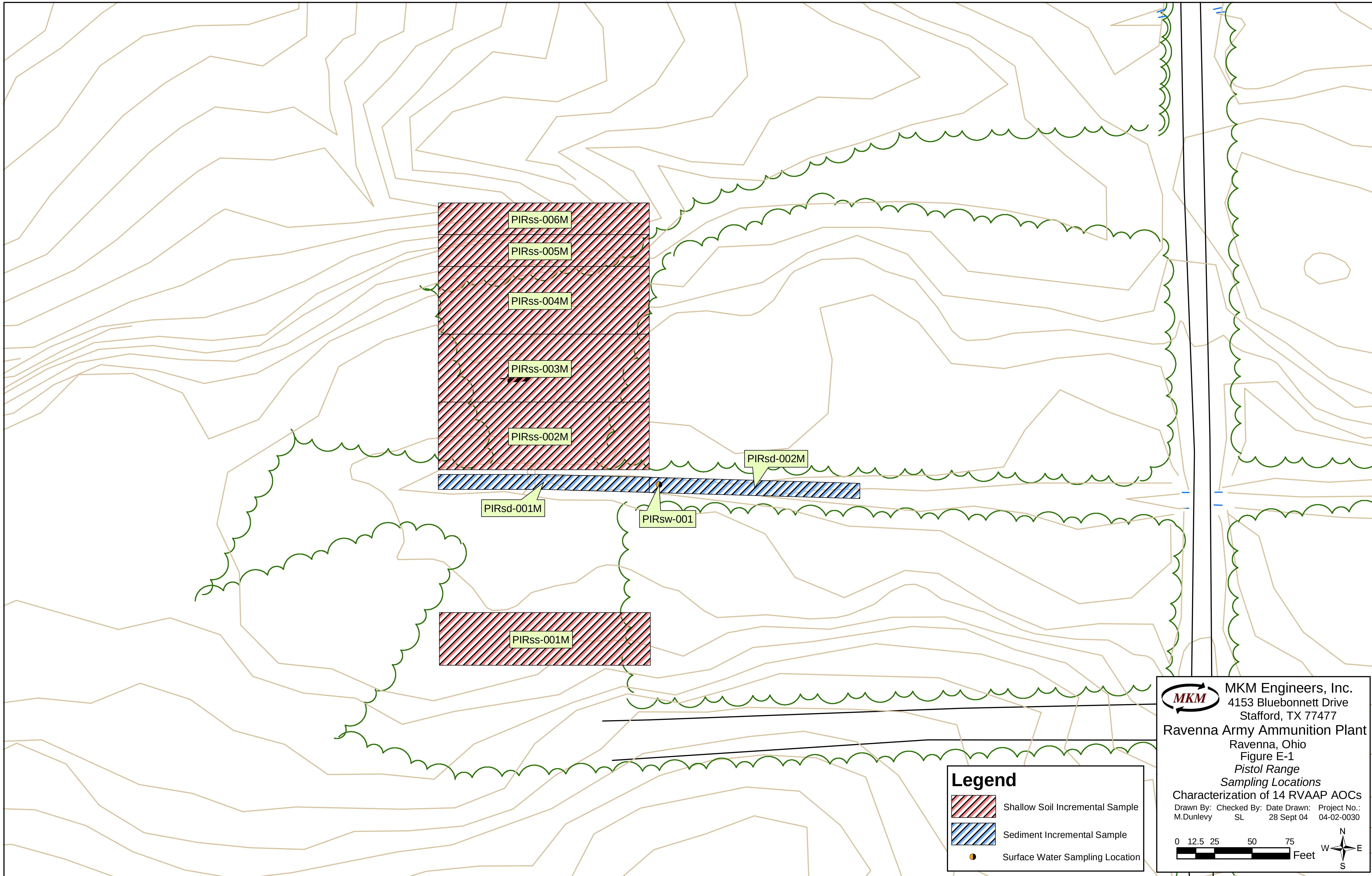
The results of these assessments and evaluations, knowledge about the past use of the Pistol Range, and information about potential source areas were used to select sampling locations, media to be sampled, analyses to be run and numbers of samples for this characterization activity. The sampling requirements, as specified in USACE's 11 May 2004 Scope of Work, are summarized in Section 1.3

1.3 Summary of Characterization Activities

Six MI surface soil, two MI sediment and one surface water sample will be collected at the Pistol Range. The sediment and surface water samples will be collected from the small stream that bisects the Pistol Range. The stream collects run-off from both the firing point side and the target side of the stream. The rationale for the sample locations are summarized in the following table.

Pistol Range Characterization Activities		
Type of Sample	**No. of Samples**	**Rationale**
MI Surface Soils	6	Six segmented areas that capture the firing point and downrange soils and entrapment berms
Sediment MI	2	Stream that bisects Pistol Range
Surface Water	1	Stream that bisects Pistol Range

Table 1-5 of the QAPP Addendum lists the sampling and analytical requirements for the Pistol Range. Figure E-1 shows the soil, sediment and surface water sampling locations.



PIRss-006M
PIRss-005M
PIRss-004M
PIRss-003M
PIRss-002M
PIRsd-002M
PIRsd-001M
PIRsw-001
PIRss-001M
Legend
Shallow Soil Incremental Sample
Sediment Incremental Sample
Surface Water Sampling Location
MKM
MKM Engineers, Inc.
4153 Bluebonnett Drive
Stafford, TX 77477
Ravenna Army Ammunition Plant
Ravenna, Ohio
Figure E-1
Pistol Range
Sampling Locations
Characterization of 14 RVAAP AOCs
Drawn By: M.Dunlevy
Checked By: SL
Date Drawn: 28 Sept 04
Project No.: 04-02-0030
0 12.5 25 50 75
Feet
N
W
E
S

APPENDIX F

NACA TEST AREA (RVAAP-38)

APPENDIX F
NACA TEST AREA (RVAAP-38)

1.1 Description

The NACA Test Area is located west of Greenleaf Road at the end of Demolition Road. The test area was originally designed by NACA to field test explosion-proof fuel tanks and fuel for aircraft during the 1960s. During testing, airplanes were loaded with the test tanks and/or fuel and attached to a conveyor or catapult system. The planes were then sent down the runway and collided into an obstacle that sheared off the left side landing gear to intentionally cause crashes.

Ordnance Demolition Area #1 (OD-1) is incorporated in the NACA Test Area AOC and is located south of the central portion of the runway. From 1941 through 1949, munitions were thermally disposed at OD-1 in a circular-shaped bermed area. Bare areas of ground, fragments of metal, small arms primers and fuzes have been found outside the perimeter of the OD-1 berm in previous surveys. MKM Engineers, Inc. conducted a UXO clearance and sifting operation at OD-1 which was completed in July 2001. The AOC at OD-1 consisted of an area 600 ft. by 400 ft. OD-1 was divided into ninety-six (96) 50 ft. by 50 ft. grids. Twenty (20) grids showed evidence of both UXO and environmental concern. Approximately 20 percent (20 grids) of OD-1 was cleared for ordnance to a depth of 4 ft. Additionally, areas of environmental concern within these grids were excavated and backfilled with clean fill.

The fueling area, located at the east end of the runway, is a potential area for VOC and SVOC contamination. The area west of the runway (crash-impact area) and the pushout area are likely locations for VOC, SVOC and TAL metals contamination. Additionally, TAL metals and explosives contamination from the OD-1 area may have impacted the NACA Test Area AOC. Currently the NACA Test Area is primarily a grassy field, which is irregularly shaped and surrounded by forestation.

The NACA Test Area overlies a surface and groundwater divide; therefore the direction of surface water and groundwater flow maybe multi-directional.

1.2 Previous Investigations

The following assessments and/or investigations have been conducted at NACA Test Area:

- USATHAMA's 1978 installation assessment.
- Preliminary Assessment for RVAAP (February, 1996).
- 1996 USACHPPM Relative Risk Site Evaluation Report (USACHPPM RRSE)
- OD-1 OE/UXO Removal and Interim Removal Action (MKM 2001)

The results of these assessments, evaluations and data collected during a removal action coupled with knowledge about the NACA Test Area's operational history and potential source area locations were used to identify sampling locations, media to be sampled, analyses to be run and number of samples to be collected for this characterization activity. The sampling requirements, as specified in USACE's 11 May 2004 Scope of Work, are summarized in Section 1.3

1.3 Summary of Characterization Activities

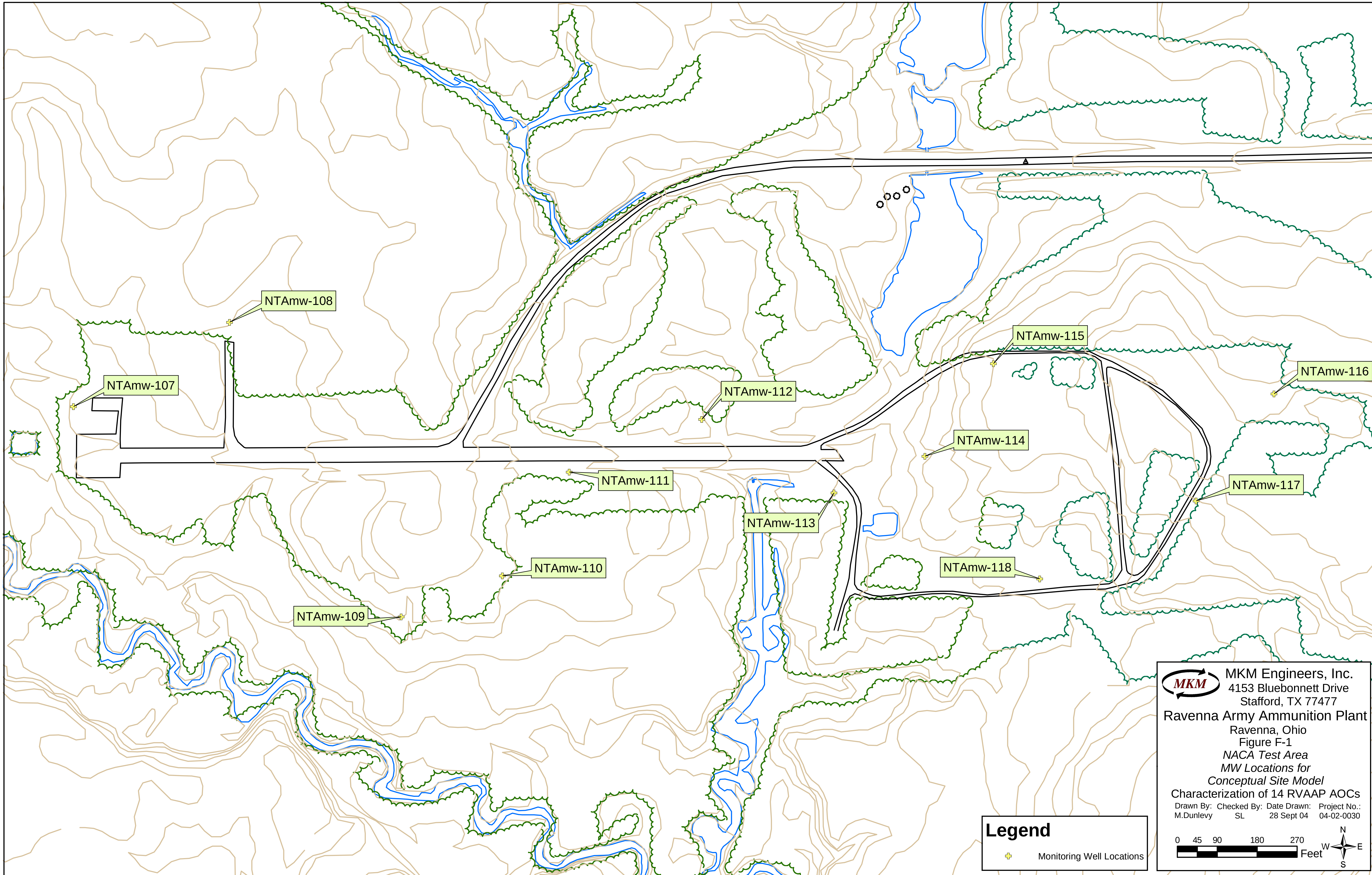
Seven test trenches will be excavated to determine the depth to first groundwater and to collect lithologic data. Bedrock topographic maps and historical data at this AOC indicate that bedrock is not anticipated to be encountered. Twelve groundwater monitoring wells will be installed. If bedrock is encountered, six of the twelve monitoring well boreholes will be cored. During drilling activities, geotechnical samples will be collected using Shelby tubes. Currently, approximately three geotechnical samples will be collected from this AOC; however field observations will determine the exact number of geotechnical samples collected. The specific location (i.e. specific borehole) of the geotechnical sample will be determined in the field. After the monitoring wells have been installed and developed, a groundwater sample will be collected from each of the newly-installed groundwater monitoring wells. The rationale for the test trench locations, placement of groundwater monitoring wells and selection of wells to be cored are summarized in the following table.

NACA Test Area Characterization Activities

Type of Sample	No. of Samples/Locations	Rationale
Groundwater (MW-107) *	1	Airplane staging area/fueling area, stratigraphic correlation across the site
Groundwater (MW-108)	1	Upgradient of OD-1 and airplane staging area
Groundwater (MW-109) *	1	OD-1 area, stratigraphic correlation across the site
Groundwater (MW-110)	1	Downgradient of OD-1 area
Groundwater (MW-111) *	1	Along catapult area, downgradient, stratigraphic correlation across the site
Groundwater (MW-112) *	1	Upgradient or on gradient along catapult area, stratigraphic correlation across the site
Groundwater (MW-113)	1	Possible downgradient of airplane crash area
Groundwater (MW-114) *	1	Airplane crash area, stratigraphic correlation across the site
Groundwater (MW-115)	1	North of airplane crash area, possible north gradient
Groundwater (MW-116) *	1	Airplane push out area, stratigraphic correlation across the site
Groundwater (MW-117)	1	Downgradient of airplane crash and push out area
Groundwater (MW-118)	1	South of airplane crash area, downgradient
Test Trenches	7	Near monitoring well locations
Geotechnical	≈ 3	To be determined in the field

* Groundwater monitoring wells to be cored if bedrock is present

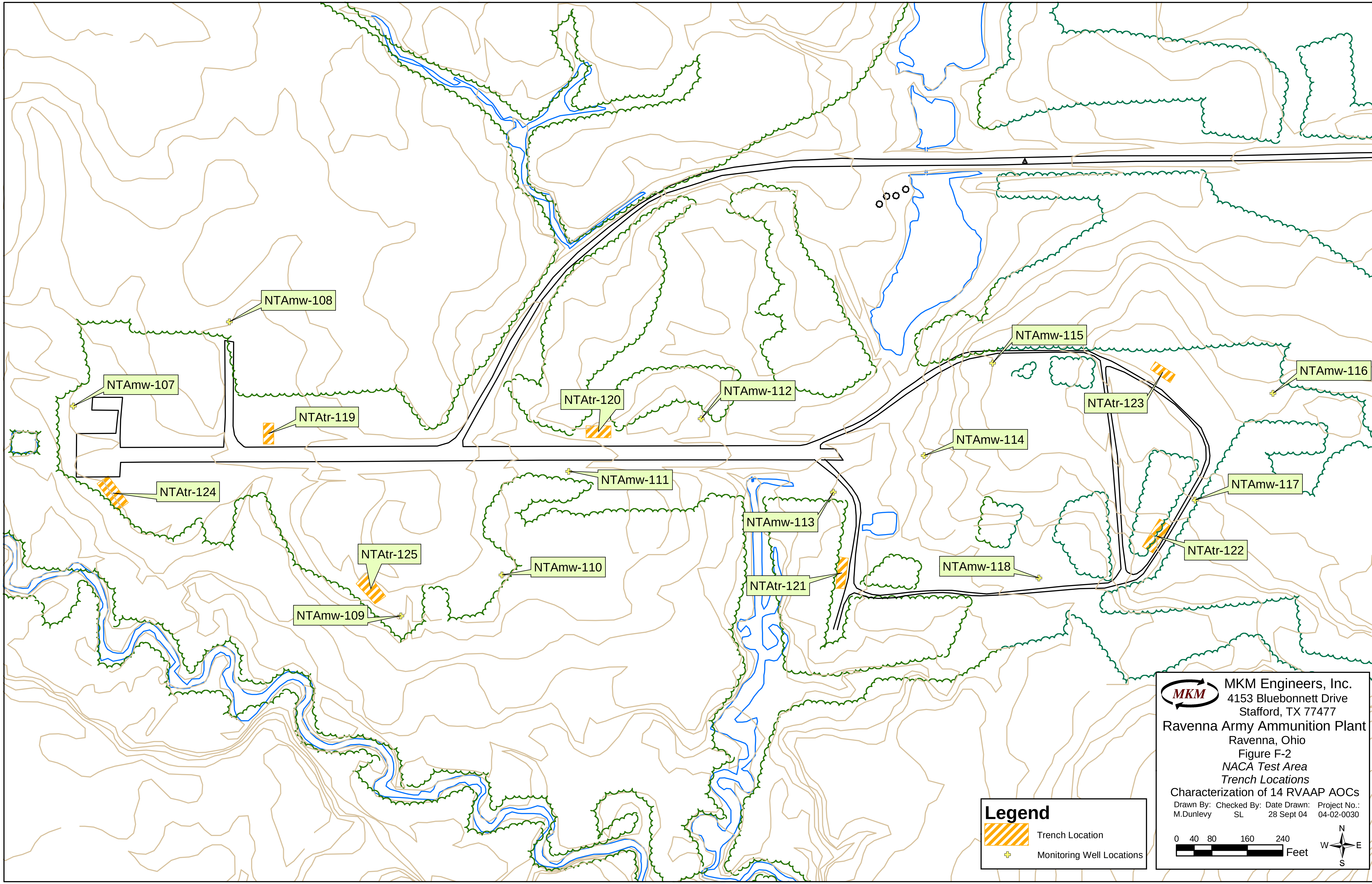
A complete list of the sampling and analytical requirements for the NACA Test Area can be found in Table 1-6 of the QAPP. Figure F-1 shows the groundwater monitoring well locations and Figure F-2 shows the test trench locations.



MKM Engineers, Inc.
4153 Bluebonnett Drive
Stafford, TX 77477

Ravenna Army Ammunition Plant
Ravenna, Ohio
Figure F-1
NACA Test Area
MW Locations for
Conceptual Site Model
Characterization of 14 RVAAP AOCs

Drawn By:	Checked By:	Date Drawn:	Project No.:
M.Dunlevy	SL	28 Sept 04	04-02-0030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NTAmw-108
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NTAtr-124
NTAmw-113
NTAmw-117
NTAtr-122
NTAtr-125
NTAmw-110
NTAmw-118
NTAtr-121
NTAmw-109
Legend
Trench Location
Monitoring Well Locations
MKM
MKM Engineers, Inc.
4153 Bluebonnett Drive
Stafford, TX 77477
Ravenna Army Ammunition Plant
Ravenna, Ohio
Figure F-2
NACA Test Area
Trench Locations
Characterization of 14 RVAAP AOCs
Drawn By: M.Dunlevy
Checked By: SL
Date Drawn: 28 Sept 04
Project No.: 04-02-0030
0 40 80 160 240
Feet
N
W
E
S

APPENDIX G

LOAD LINE 5 (RVAAP-39)

APPENDIX G
LOAD LINE 5 (RVAAP 39)

1.1 Description

Load Line 5 is located in an area known as Fuze and Booster Hill, which consists of Load Lines 5, 6, 7, 8, 9, 10 and 11 collectively. Fuze and Booster Hill is located in the south central part of the RVAAP facility. Load Line 5 is located south of Fuze and Booster Road, east of Load Line 6 and west of Load Line 10. (See Figure 2 of the Sampling and Analysis Plan Addendum.)

Load Line 5, which was active from 1941 to 1945, consists of 18 process buildings ranging in size between 120 sq ft and 32, 910 sq ft. Load Line 5 was a finished product assembly line. Five of the buildings (1F-1, 1F-3, 1F-4, 1F-9 and 1F-18) manufactured primers; five buildings (1F-6, 1F-7, 1F-8, 1F-19 and 1F-20) manufactured delay components; Building 1F-10 was used to manufacture detonator service magazines; and Buildings 1F-11 and 1F-12 were used to assemble and test the final products.

Load Line 5 has been inactive for more than 50 years and is overgrown with vegetation consisting of young trees, bushes and weeds. A detailed process summary for Load Line 5 can be found in the Army SOW.

Explosives contamination (mercury fulminate, black powder and lead azide) is potentially present on the facilities' interior surfaces, in surface soils, and in the sumps which comprised the wastewater treatment system. Additionally, the surface water and sediments in the storm sewers and surface water discharge points (drainage ditches) are potentially contaminated as well.

The direction of transport of potential COPCs in surface water is towards the constructed drainage system within the load line (i.e. drainage ditches). Generally, the surface water on this load line flows in a south-southeasterly direction. Both surface water flow direction and bedrock topography were utilized to predict the groundwater flow direction. Groundwater flow direction is anticipated to flow in a south-southeasterly direction.

1.2 Previous Investigations

The following assessments and/or investigations have been conducted at Load Line 5:

- USATHAMA's 1978 installation assessment.
- 1989 Preliminary Review and Visual Site Inspection.
- 1994 Preliminary Assessment Screening of the Boundary Load Line Areas
- 1998 relative risk evaluation conducted by USACHPPM for AOCs identified after the 1996 CHPPM evaluation.

The results of these assessments and evaluations coupled with knowledge about Load Line 5's operational history and potential source area locations were used to select sampling locations, sampling media, analyses and numbers of samples for this characterization activity. The sampling requirements, as specified in USACE's 11 May 2004 Scope of Work, are summarized in Section 1.3.

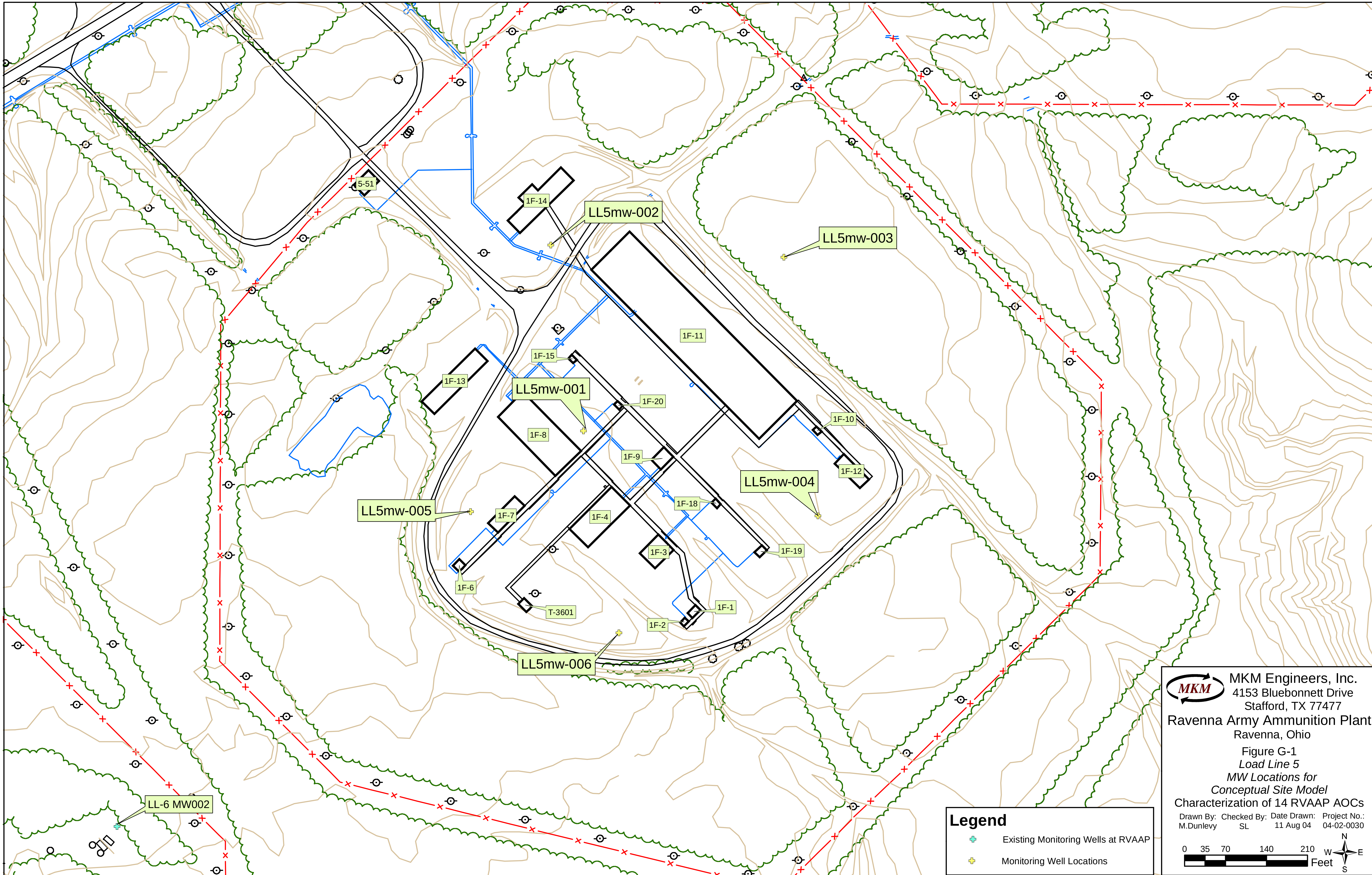
1.3 Summary of Characterization Activities

Seventeen MI surface soil, one discrete surface soil, two basement water, twelve MI dry ditch (surface soil), one sump water, one sump sediment, ten sewer water and ten sewer sediment samples will be collected. Three test trenches will be excavated to determine depth to first groundwater and to collect lithologic data. Bedrock topographic maps at this AOC indicate that bedrock is not anticipated to be encountered. Six groundwater monitoring wells will be installed. Six groundwater monitoring wells will be advanced to an anticipated depth of 23 ft bgs. If bedrock is encountered, three of the six monitoring well boreholes will be cored. During drilling, geotechnical samples will be collected using Shelby tubes. Currently, approximately three geotechnical samples will be collected from this AOC; however field observations will determine the exact number of geotechnical samples collected. The specific location (i.e. specific borehole) of the geotechnical sample will be determined in the field. After the monitoring wells have been installed and developed, a groundwater sample will be collected from each of the newly-installed groundwater monitoring wells. The rationale for the sampling locations, test trench locations, placement of groundwater monitoring wells and selection of wells to be cored are summarized in the following table.

Load Line 5 Characterization Activities		
Type of Sample	**No. of Samples /Locations**	**Rationale**
Surface Soils MI	17	Perimeter areas of process buildings
Surface Soils Discrete	1	Adjacent to the solvent/paint storage building
Basement Water	2	Basement of 1F-13 and 1F-14 (Change Houses)
Surface Soil/Dry Ditch MI	12	Dry stormwater drainage ditches within the process area
Sump Water	1	Building 1F-6 (black powder dry house) sump
Sump Sediment	1	Building 1F-6 (black powder dry house) sump
Sewer Water	10	Sanitary sewer manholes
Sewer Sediment	10	Sanitary sewer manholes
Test Trenches	3	Near monitoring well locations
Groundwater (MW-1)	1	Center of explosives processing area
Groundwater (MW-2)	1	Explosives processing area
Groundwater (MW-3) *	1	Northeast boundary of explosives processing area
Groundwater (MW-4) *	1	Downgradient of explosives processing area
Groundwater (MW-5) *	1	Downgradient of explosives processing area
Groundwater (MW-6)	1	Downgradient of Load Line 5
Geotechnical	≈ 3	To be determined in the field

* Groundwater monitoring wells to be cored if bedrock is present

A complete list of the sampling and analytical requirements for Load Line 5 can be found in Table 1-7 of the QAPP Addendum. Figure G-1 shows the groundwater monitoring well locations. Figures G-2 and G-3 show the soil, sediment and surface water sampling locations. Figure G-4 shows the test trench locations.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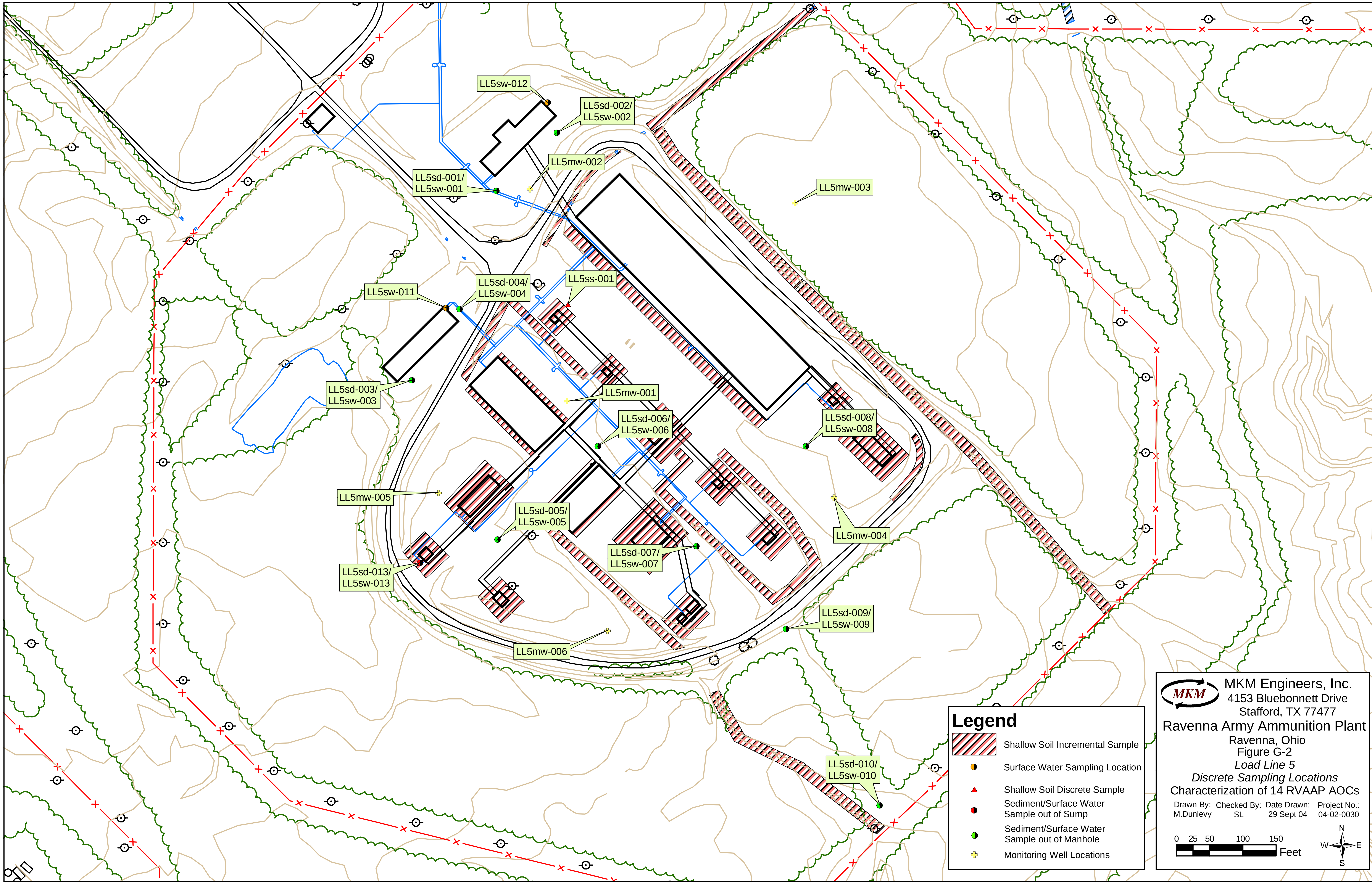
LL5mw-005
LL5mw-006
LL-6 MW002
5-51
1F-14
1F-11
1F-15
1F-13
1F-20
1F-10
1F-8
1F-9
1F-12
1F-18
1F-7
1F-4
1F-19
1F-3
1F-6
T-3601
1F-1
1F-2
Legend
Existing Monitoring Wells at RVAAP
Monitoring Well Locations
MKM
MKM Engineers, Inc.
4153 Bluebonnett Drive
Stafford, TX 77477
Ravenna Army Ammunition Plant
Ravenna, Ohio
Figure G-1
Load Line 5
MW Locations for
Conceptual Site Model
Characterization of 14 RVAAP AOCs
Drawn By: M.Dunlevy
Checked By: SL
Date Drawn: 11 Aug 04
Project No.: 04-02-0030
0 35 70 140 210
Feet
N
W
E
S



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LL5sw-002
LL5mw-002
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LL5sw-001
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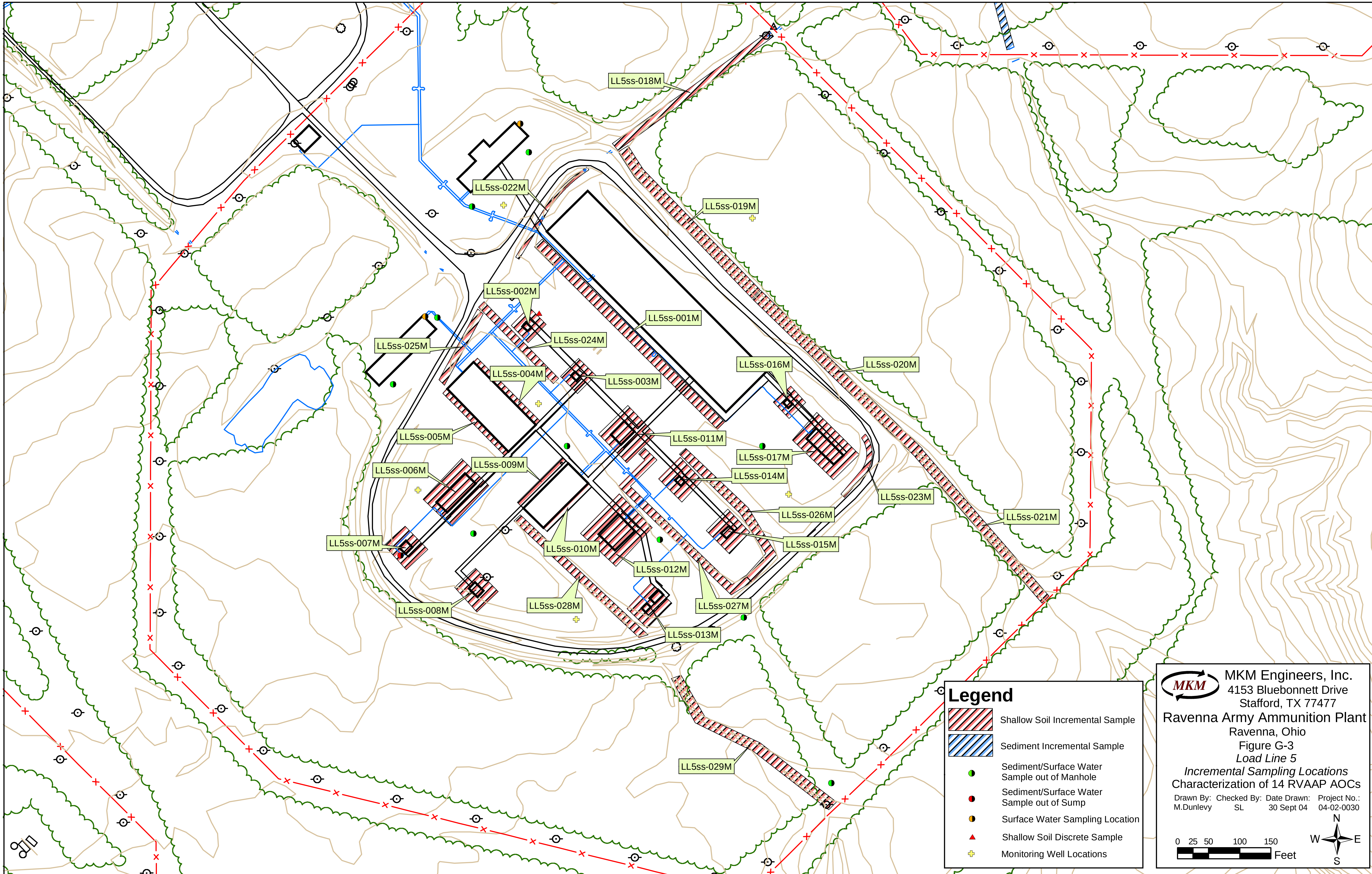
LL5sd-005/
LL5sw-005
LL5mw-004
LL5sd-007/
LL5sw-007
LL5sd-013/
LL5sw-013
LL5sd-009/
LL5sw-009
LL5mw-006
LL5sd-010/
LL5sw-010
Legend
Shallow Soil Incremental Sample
Surface Water Sampling Location
Shallow Soil Discrete Sample
Sediment/Surface Water
Sample out of Sump
Sediment/Surface Water
Sample out of Manhole
Monitoring Well Locations
MKM
MKM Engineers, Inc.
4153 Bluebonnett Drive
Stafford, TX 77477
Ravenna Army Ammunition Plant
Ravenna, Ohio
Figure G-2
Load Line 5
Discrete Sampling Locations
Characterization of 14 RVAAP AOCs
Drawn By: M.Dunlevy
Checked By: SL
Date Drawn: 29 Sept 04
Project No.: 04-02-0030
0 25 50 100 150
Feet
N
W
E
S



LL5ss-018M
LL5ss-022M
LL5ss-019M
LL5ss-002M
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LL5ss-025M
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LL5ss-008M
LL5ss-028M
LL5ss-027M
LL5ss-013M
LL5ss-029M
Legend
Shallow Soil Incremental Sample
Sediment Incremental Sample
Sediment/Surface Water Sample out of Manhole
Sediment/Surface Water Sample out of Sump
Surface Water Sampling Location
Shallow Soil Discrete Sample
Monitoring Well Locations
MKM
MKM Engineers, Inc.
4153 Bluebonnett Drive
Stafford, TX 77477
Ravenna Army Ammunition Plant
Ravenna, Ohio
Figure G-3
Load Line 5
Incremental Sampling Locations
Characterization of 14 RVAAP AOCs
Drawn By: M.Dunlevy
Checked By: SL
Date Drawn: 30 Sept 04
Project No.: 04-02-0030
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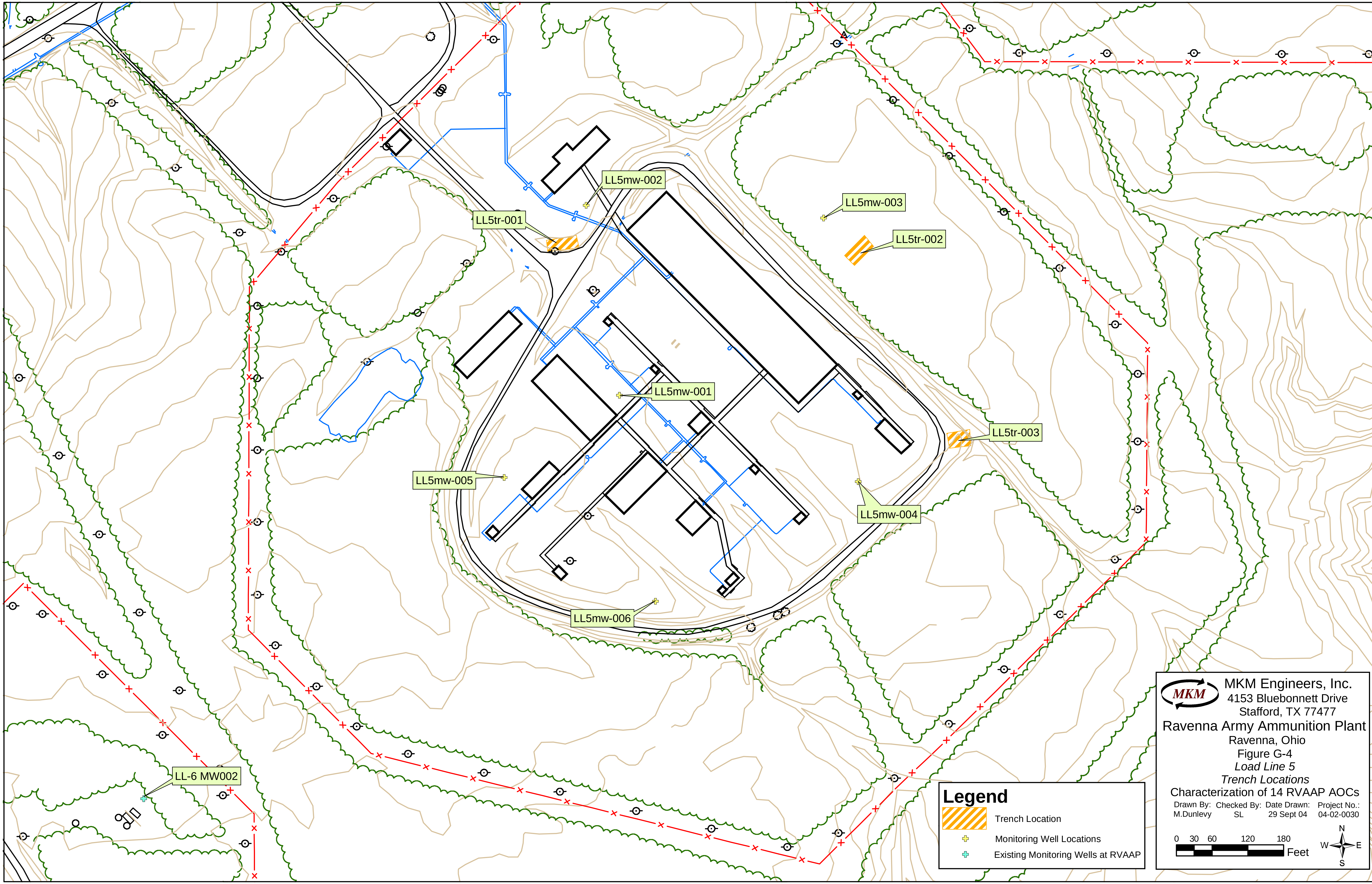
Feet
N
W
E
S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LL5mw-004
LL5mw-006
LL-6 MW002
Legend
Trench Location
Monitoring Well Locations
Existing Monitoring Wells at RVAAP
MKM
MKM Engineers, Inc.
4153 Bluebonnett Drive
Stafford, TX 77477
Ravenna Army Ammunition Plant
Ravenna, Ohio
Figure G-4
Load Line 5
Trench Locations
Characterization of 14 RVAAP AOCs
Drawn By: M.Dunlevy
Checked By: SL
Date Drawn: 29 Sept 04
Project No.: 04-02-0030
0 30 60 120 180
Feet
N
W
E
S

APPENDIX H

LOAD LINE 7 (RVAAP-40)

APPENDIX H
LOAD LINE 7 (RVAAP-40)

1.1 Description

Load Line 7 is located in the Fuze and Booster Hill area which consists of Load Lines 5, 6, 7, 8, 9, 10 and 11 collectively. Fuze and Booster Hill is located in the south central part of the RVAAP facility. Load Line 7 is located on Fuze and Booster Spur Road north of Load Line 6 and south of Load Line 11. (See Figure 2 of the Sampling and Analysis Plan Addendum.)

Load Line 7 consists of 18 process buildings ranging in size between 120 sq ft and 13,104 sq ft. From 1941 until 1945, Load Line 7 was a booster loading and assembly line for artillery projectiles. From 1968 through 1970, Load Line 7 produced M-406 High Explosive and M-407A1 practice 40 mm rounds. After production ceased, the line was removed. From 1989 through 1993, pink water associated with the TNT process was treated. For a short time, the line was reactivated for the research and development of high explosive shaped charges. As part of the explosives loading and assembling processes, the following solvents were used at Load Line 7: isobutyl acetate (IBA), isobutyl alcohol (IBA), toluene, xylenes and isopropyl alcohol (IPA).

Building usage changed depending on the munitions that were being processed. Building use is summarized below:

- 1B-1: Explosives processing, booster storage and pellet magazine
- 1B-2: Explosives screen and blend, main charge storage, melt/pour and curing
- 1B-3: Explosives processing – blended tetryl rest house
- 1B-4: Pellet manufacturing and processing, main charge storage, melt/pour and curing
- 1B-4NE: Tetryl pelleting
- 1B-4SW Tetryl pelleting
- 1B-4VP1 Tetryl pelleting
- 1B-5: Detonator storage
- 1B-6: Assembly and shipping; washout and treatment
- 1B-6 Annex: Washout and treatment
- 1B-6A: Main charge storage, melt/pour and curing
- 1B-7: Testing
- 1B-12: Pellet manufacturing and processing; M-42 primer storage and case assembly
- 1B-13: Pellet manufacturing and processing; M-42 primer storage and case assembly; tetryl cupping
- 1B-17: Pellet manufacturing and processing; M-551 fuze storage; tetryl rest house
- 1B-18: Testing (Barre Test), booster storage, pellet magazine
- 1B-22: Solvent storage; M-9 propellant storage

Explosives contamination is potentially present on the facilities' interior surfaces, in surface soils, and in the sumps associated with the wastewater treatment system. Additionally, the surface water and sediments in the storm sewers and surface water discharge points (drainage ditches) are potentially contaminated.

Load Line 7, which has been inactive for more than a decade, is not maintained, and is overgrown with young trees, bushes and weeds.

The direction of transport of potential COPCs in surface water is towards the constructed drainage system within the load line (i.e. drainage ditches). Generally, the surface water on this load line flows in an east-northeast direction. Both surface water flow direction and bedrock topography were utilized to predict the groundwater flow direction. Groundwater flow direction is anticipated to flow in an east-northeasterly direction.

1.2 Previous Investigations Data

The following assessments and/or investigations have been conducted at Load Line 7:

- USATHAMA's 1978 installation assessment.
- 1989 Preliminary Review and Visual Site Inspection.
- 1994 Preliminary Assessment Screening of the Boundary Load Line Areas.
- 1998 USACHPPM RRSE for additional RVAAP sites.

The results of these investigations, assessments and evaluations combined with knowledge of Load Line 7's operational history and potential source area locations were used to select sampling locations, sampling media, analyses and numbers of samples for this characterization activity. The sampling requirements, as specified in USACE's 11 May 2004 Scope of Work, are summarized in Section 1.3

1.3 Summary of Characterization Activities

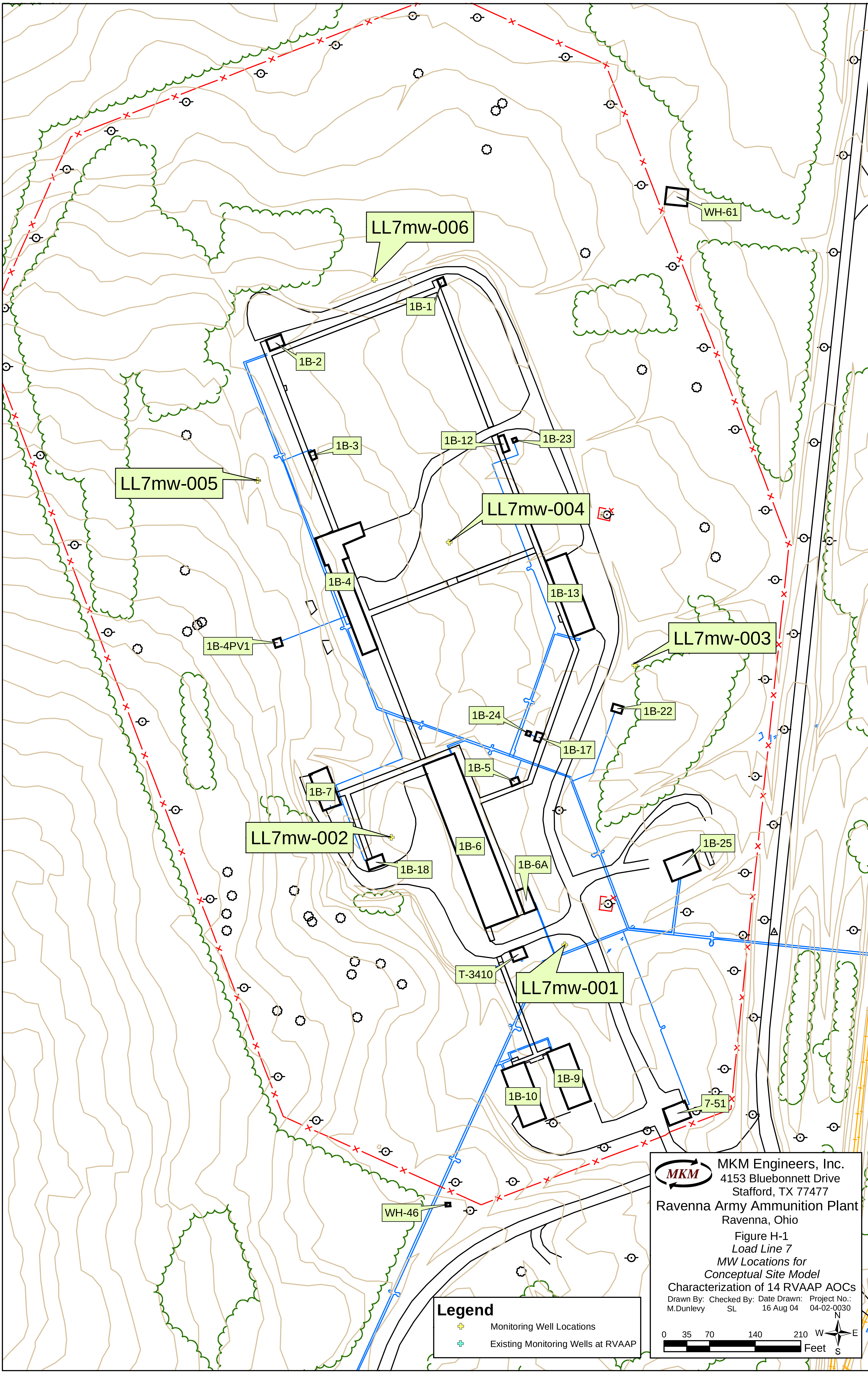
Twenty-six MI surface soil, one discrete surface soil, fourteen MI dry ditch (surface soil), one sump water, two sump sediment, ten sewer water and ten sewer sediment samples will be collected. Six test trenches will be excavated to determine depth to first groundwater and to collect lithologic data. Bedrock topographic maps at this AOC indicate that bedrock is not anticipated to be encountered. Six groundwater monitoring wells will be installed to an anticipated depth of 23 ft bgs. If bedrock is encountered, three of the six monitoring well boreholes will be cored. During drilling activities, geotechnical samples will be collected by advancing Shelby tubes. Currently, approximately three geotechnical samples will be collected from this AOC; however field observations will determine the exact number of geotechnical samples collected. The specific location (i.e. specific borehole) of the geotechnical sample will be determined in the field. After the monitoring wells have been installed and developed, a groundwater sample will be collected from each of the newly-installed groundwater monitoring wells. The rationale for the sampling locations, test trench locations, placement of groundwater monitoring wells and selection of wells to be cored are summarized in the following table.

Load Line 7 Characterization Activities

Type of Sample	No. Samples /Locations	Rationale
Surface Soils MI	26	Perimeter areas of process buildings
Surface Soils Discrete	1	Adjacent to the solvent/paint storage building
Surface Soil/Dry Ditch MI	14	Dry stormwater drainage ditches within the process area
Sump Water	1	Sump associated with melt/pour Building 1B-4
Sump Sediment	2	Sump associated with melt/pour Building 1B-4
Sewer Water	10	Sanitary sewer manholes
Sewer Sediment	10	Sanitary sewer manholes
Test Trenches	6	Near monitoring well locations; one near the waste water treatment plant
(Groundwater) MW-1	1	South end of explosives handling area
(Groundwater) MW-2 *	1	Downgradient of explosives handling area; triangulation and correlation area
(Groundwater) MW-3 *	1	Downgradient of the load line and solvent building
(Groundwater) MW-4	1	Central explosives processing area
(Groundwater) MW-5	1	Upgradient of explosives handling area
(Groundwater) MW-6 *	1	Downgradient of load line and explosives processing area
Geotechnical	≈ 3	To be determined in the field

* Groundwater monitoring wells to be cored if bedrock is present

A list of the sampling and analytical requirements for Load Line 7 can be found in Table 1-8 of the QAPP Addendum. Figure H-1 shows the groundwater monitoring well locations. Figures H-2 and H-3 show the soil, sediment and surface water sampling locations. Figure H-4 shows the test trench locations.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1B-2
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1B-5
1B-6
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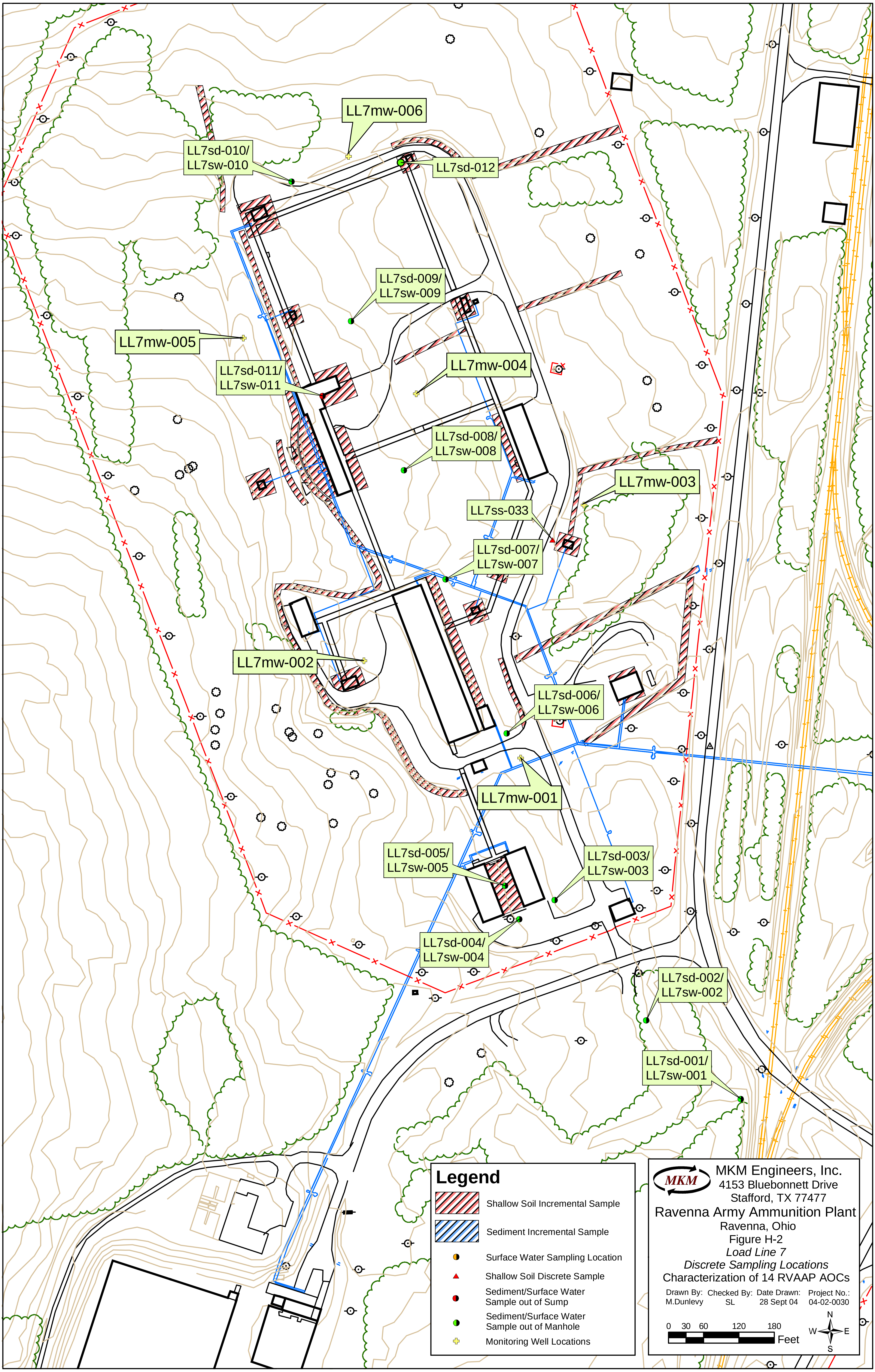
1B-17
1B-18
1B-22
1B-23
1B-24
1B-25
7-51
T-3410
WH-46
WH-61
Legend
Monitoring Well Locations
Existing Monitoring Wells at RVAAP
MKM
MKM Engineers, Inc.
4153 Bluebonnett Drive
Stafford, TX 77477
Ravenna Army Ammunition Plant
Ravenna, Ohio
Figure H-1
Load Line 7
MW Locations for
Conceptual Site Model
Characterization of 14 RVAAP AOCs
Drawn By: M.Dunlevy
Checked By: SL
Date Drawn: 16 Aug 04
Project No.: 04-02-0030
0 35 70 140 210
Feet
N
S
E
W



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LL7sw-001
Legend
Shallow Soil Incremental Sample
Sediment Incremental Sample
Surface Water Sampling Location
Shallow Soil Discrete Sample
Sediment/Surface Water
Sample out of Sump
Sediment/Surface Water
Sample out of Manhole
Monitoring Well Locations
MKM
MKM Engineers, Inc.
4153 Bluebonnett Drive
Stafford, TX 77477
Ravenna Army Ammunition Plant
Ravenna, Ohio
Figure H-2
Load Line 7
Discrete Sampling Locations
Characterization of 14 RVAAP AOCs
Drawn By: M.Dunlevy
Checked By: SL
Date Drawn: 28 Sept 04
Project No.: 04-02-0030
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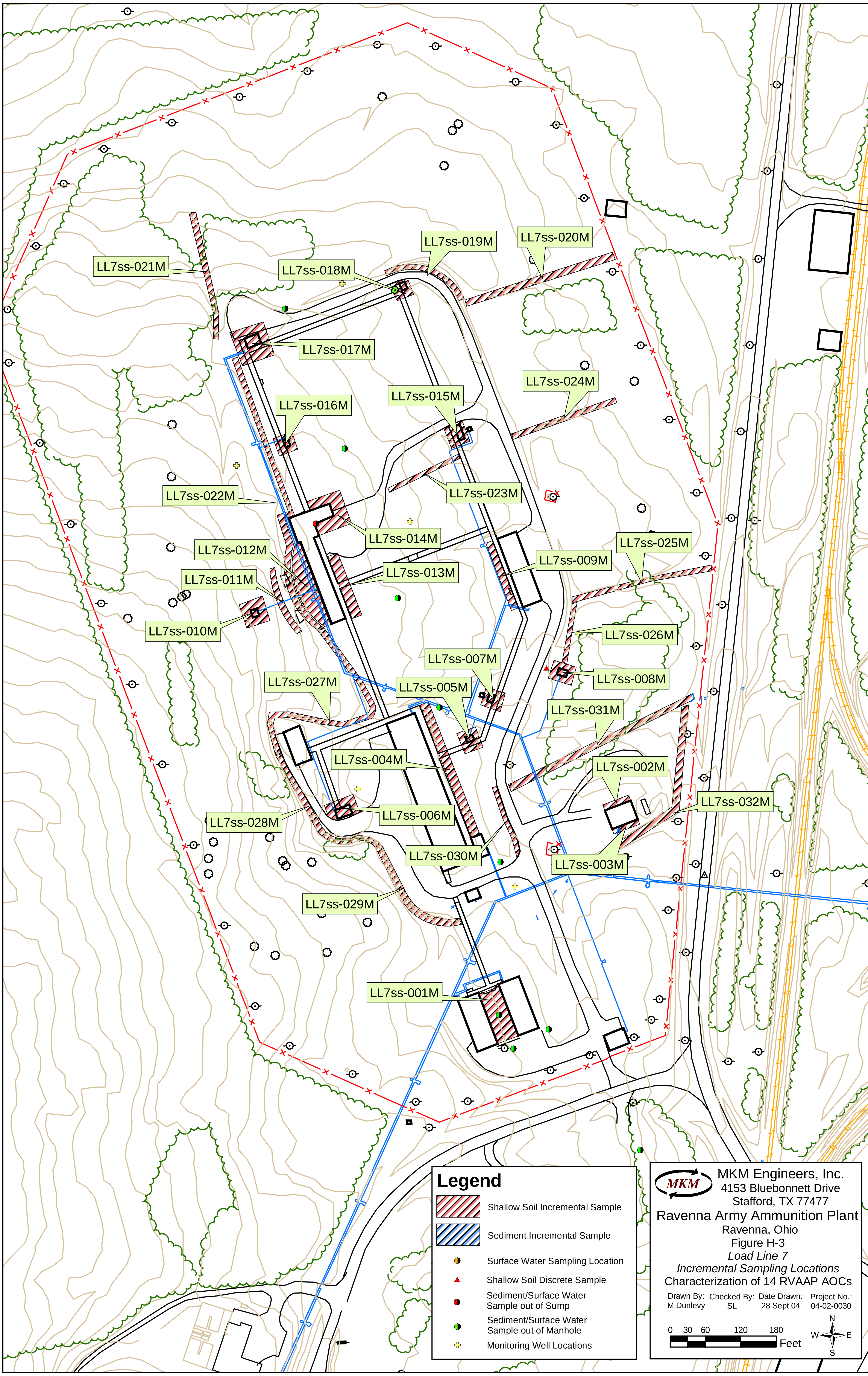
Feet
N
W E
S



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LL7ss-030M
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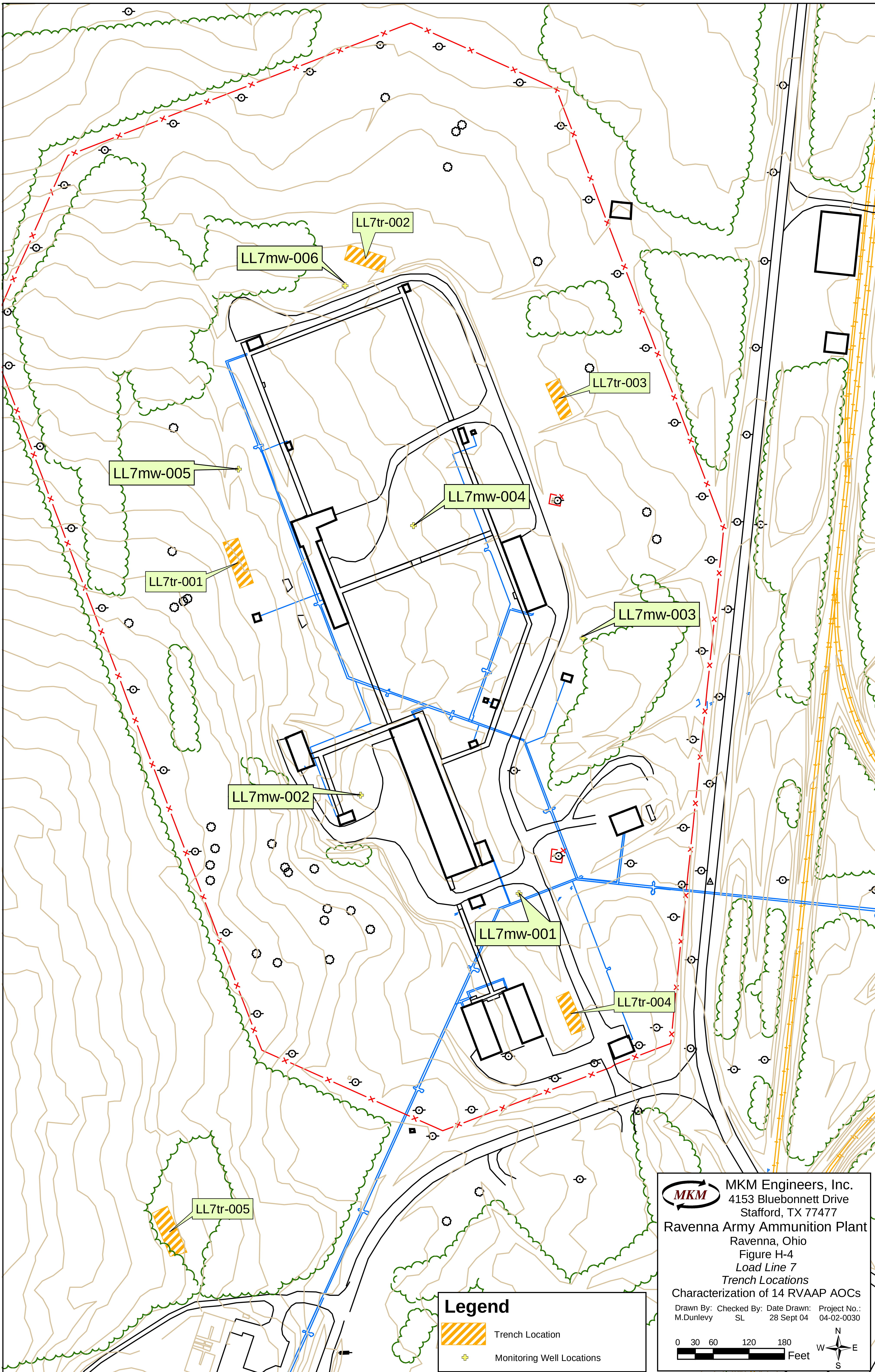
LL7ss-029M
LL7ss-001M
Legend
Shallow Soil Incremental Sample
Sediment Incremental Sample
Surface Water Sampling Location
Shallow Soil Discrete Sample
Sediment/Surface Water Sample out of Sump
Sediment/Surface Water Sample out of Manhole
Monitoring Well Locations
MKM
MKM Engineers, Inc.
4153 Bluebonnett Drive
Stafford, TX 77477
Ravenna Army Ammunition Plant
Ravenna, Ohio
Figure H-3
Load Line 7
Incremental Sampling Locations
Characterization of 14 RVAAP AOCs
Drawn By: M.Dunlevy
Checked By: SL
Date Drawn: 28 Sept 04
Project No.: 04-02-0030
0 30 60 120 180
Feet
N
W
E
S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LL7mw-002
LL7mw-001
LL7tr-004
LL7tr-005
Legend
Trench Location
Monitoring Well Locations
MKM
MKM Engineers, Inc.
4153 Bluebonnett Drive
Stafford, TX 77477
Ravenna Army Ammunition Plant
Ravenna, Ohio
Figure H-4
Load Line 7
Trench Locations
Characterization of 14 RVAAP AOCs
Drawn By: M.Dunlevy
Checked By: SL
Date Drawn: 28 Sept 04
Project No.: 04-02-0030
0 30 60 120 180
Feet
N
W
E
S

APPENDIX I

LOAD LINE 8 (RVAAP-41)

APPENDIX I
LOAD LINE 8 (RVAAP-41)

1.1 Description

Load Line 8 is located in an area known as Fuze and Booster Hill which consists of Load Lines 5, 6, 7, 8, 9, 10 and 11 collectively. Load Line 8 is located on Fuze and Booster Road west of Load Line 6 and south of the 40 mm Test Area (See Figure 2 of the Sampling and Analysis Plan Addendum). Load Line 8 consists of 15 process buildings ranging in size between 120 sq ft and 13, 104 sq ft.

Load Line 8, which is also known as Booster Line 2, was a booster loading and assembly line that operated from 1941 to 1945. Primary explosive products were delivered to Load Line 8 as sealed, finished sub assemblies (for example, detonators). Load Line 8 buildings were used for the following:

- Building 2B-1: Tetryl magazine
- Building 2B-2: Tetryl screen and blend building
- Building 2B-3: Blended tetryl rest house
- Buildings 2B-4E and 2B-4W: Tetryl pelleting building
- Building 2B-5: Detonator magazine
- Buildings 2B-6E/W, 2B-21E/W: Assembly and shipping
- Buildings 2B-7 and 2B-18: Testing
- Building 2B-12: Tetryl pellet storage
- Buildings 2B-13-E and 2B-13W: Tetryl cupping building
- Buildings 2B-17: Tetryl pellet rest house
- Building 2B-22: Solvent storage

Explosives contamination is potentially present on the facilities' interior surfaces, in surface soils, and in the sumps that were associated with the wastewater treatment system. Additionally, the surface water, sewer sediments, and sediments in surface water discharge points (drainage ditches) are potentially contaminated.

The direction of transport of COPCs in surface water is towards the constructed drainage system within the load line (i.e. drainage ditches). Generally, the surface water in this load line flows in the south-southwest direction. Both surface water flow direction and bedrock topography were utilized to predict the groundwater flow direction. Groundwater flow direction is anticipated to flow in a south-southeasterly direction.

Load Line 8 has not been used since 1945 and is overgrown by trees, bushes and weeds.

1.2 Previous Investigations

The following assessments, evaluations and/or investigations have been conducted at Load Line 8:

- 1978 USATHAMA Installation Risk Assessment.
- Preliminary Review/Visual Site Inspection conducted in 1989 as part of a RCRA Facility Assessment.
- 1994 Preliminary Assessment Screening of the boundary load lines.

- 1998 CHPPM evaluation of relative risk at additional RVAAP AOCs.

The results of these investigations, assessments and evaluations as well as knowledge about Load Line 8's operational history and potential source areas were used to select sampling locations, sampling media, analyses and numbers of samples for this characterization activity. The sampling activities, as specified in USACE's May 11, 2004 Scope of Work, are summarized in Section 1.3.

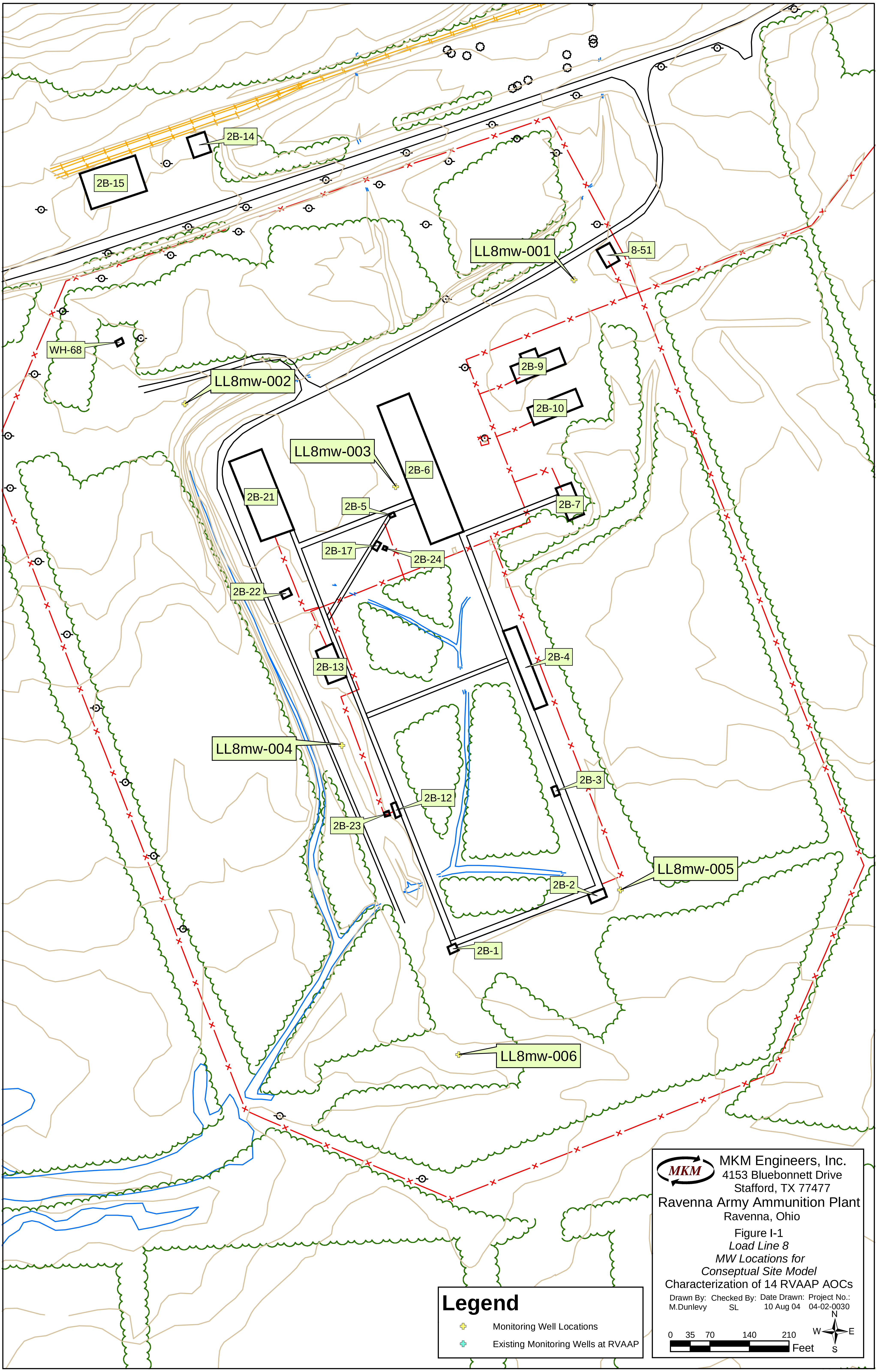
1.3 Summary of Characterization Activities

Sixteen MI surface soil, one discrete surface soil, two MI floor sweep, two basement water, two MI dry ditch (surface soil), eleven sewer water, eleven sewer sediment, six wet ditch surface water, and six wet ditch sediment samples will be collected. Six test trenches will be excavated to determine depth to first groundwater and to collect lithologic data. Bedrock topographic maps at this AOC indicate that bedrock is not anticipated to be encountered. Six groundwater monitoring wells will be installed to an anticipated depth of 23 ft bgs. If bedrock is encountered, three of the six monitoring well boreholes will be cored. During drilling activities, geotechnical samples will be collected by advancing Shelby tubes. Currently, approximately three geotechnical samples will be collected from this AOC; however field observations will determine the exact number of geotechnical samples collected. The specific location (i.e. specific borehole) of the geotechnical sample will be determined in the field. After the monitoring wells have been installed and developed, a groundwater sample will be collected from each of the newly-installed groundwater monitoring wells. The rationale for the sampling locations, test trench locations, placement of groundwater monitoring wells and selection of wells to be cored are summarized in the following table.

Load Line 8 Characterization Activities		
Type of Sample	**No. Samples / Locations**	**Rationale**
Surface Soils MI	16	Perimeter areas of process buildings
Surface Soils Discrete	1	Adjacent to the solvent/paint storage bldg
Basement Water	2	Basement of 2B-9 and 2B-10 (change houses)
Surface Soil/Dry Ditch MI	2	Dry stormwater drainage ditches within the process area
Sewer Water	11	Manholes within sanitary sewer system
Sewer Sediment	11	Manholes within sanitary sewer system
Wet Ditch Surface Water	6	Wet drainage ditches associated with the process area
Wet Ditch Sediment	6	Wet drainage ditches associated with the process area
Test Trenches	6	Near monitoring well locations
Groundwater (MW-1) *	1	Upgradient location, stratigraphic correlation
Groundwater (MW-2)	1	Upgradient/ongradient to central explosives processing area
Groundwater (MW-3)	1	Central explosives processing area
Groundwater (MW-4) *	1	Central explosives processing area, correlation across AOC
Groundwater (MW-5)	1	Downgradient of explosives processing area
Groundwater (MW-6) *	1	Downgradient of AOC, downgradient stratigraphic correlation

Geotechnical	≈ 3	Locations to be determined in the field

A list of the sampling and analytical requirements for Load Line 8 can be found in Table 1-9 of the QAPP Addendum. Figure I-1 shows the groundwater monitoring well locations. Figures I-2 shows the soil, sediment and surface water sampling locations. Figure I-3 shows the test trench locations.



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8-51
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2B-9
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2B-5
2B-7
2B-17
2B-24
2B-22
2B-4
2B-13
LL8mw-004
2B-3
2B-12
2B-23
LL8mw-005
2B-2
2B-1
LL8mw-006
Legend
Monitoring Well Locations
Existing Monitoring Wells at RVAAP
MKM
MKM Engineers, Inc.
4153 Bluebonnett Drive
Stafford, TX 77477
Ravenna Army Ammunition Plant
Ravenna, Ohio
Figure I-1
Load Line 8
MW Locations for
Conseptual Site Model
Characterization of 14 RVAAP AOCs
Drawn By: M.Dunlevy
Checked By: SL
Date Drawn: 10 Aug 04
Project No.: 04-02-0030
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Feet
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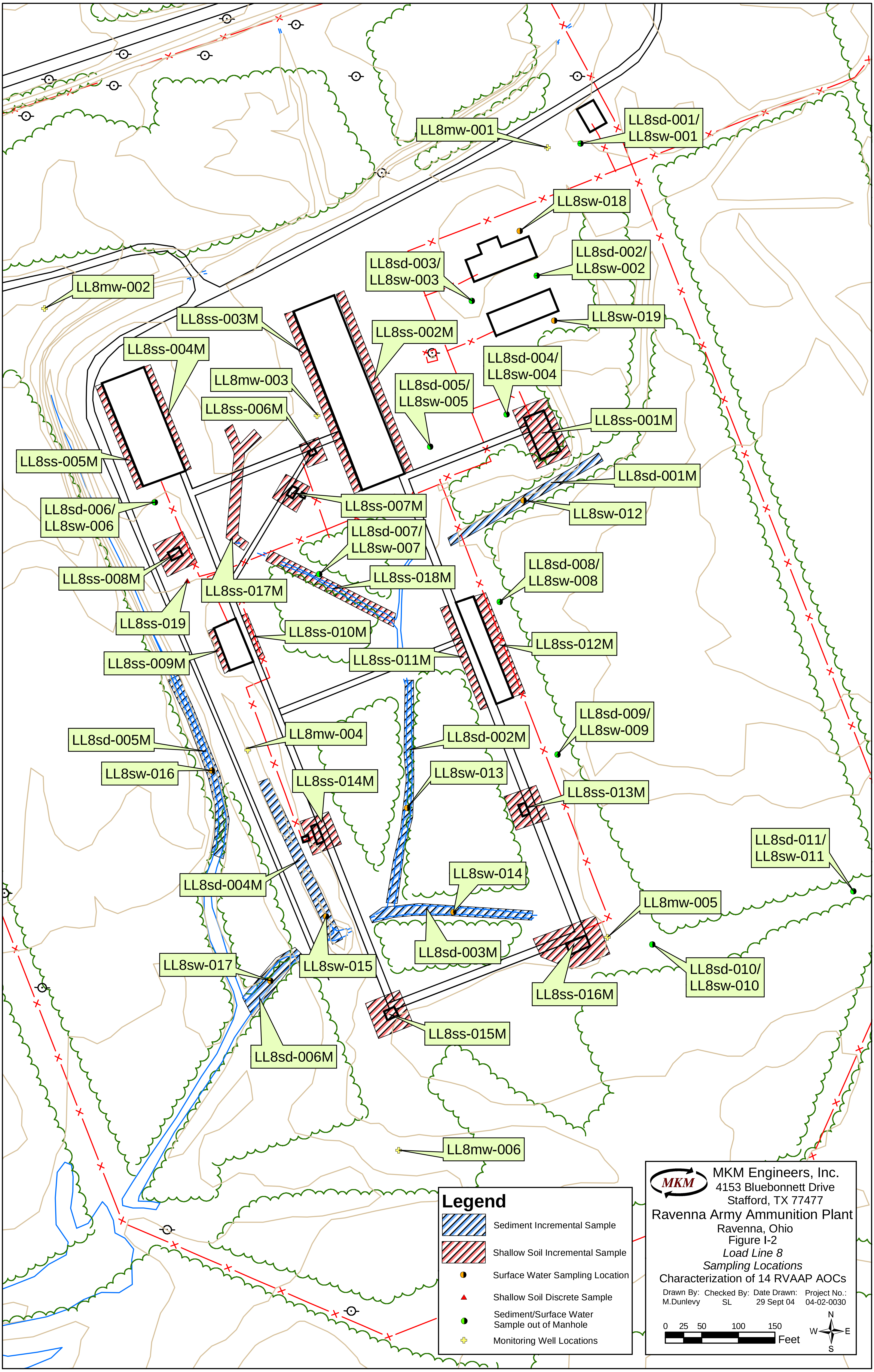
W
E
S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LL8sw-010
LL8ss-016M
LL8ss-015M
LL8sd-006M
LL8mw-006
Legend
Sediment Incremental Sample
Shallow Soil Incremental Sample
Surface Water Sampling Location
Shallow Soil Discrete Sample
Sediment/Surface Water
Sample out of Manhole
Monitoring Well Locations
MKM
MKM Engineers, Inc.
4153 Bluebonnett Drive
Stafford, TX 77477
Ravenna Army Ammunition Plant
Ravenna, Ohio
Figure I-2
Load Line 8
Sampling Locations
Characterization of 14 RVAAP AOCs
Drawn By:
M.Dunlevy
Checked By:
SL
Date Drawn:
29 Sept 04
Project No.:
04-02-0030
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Feet
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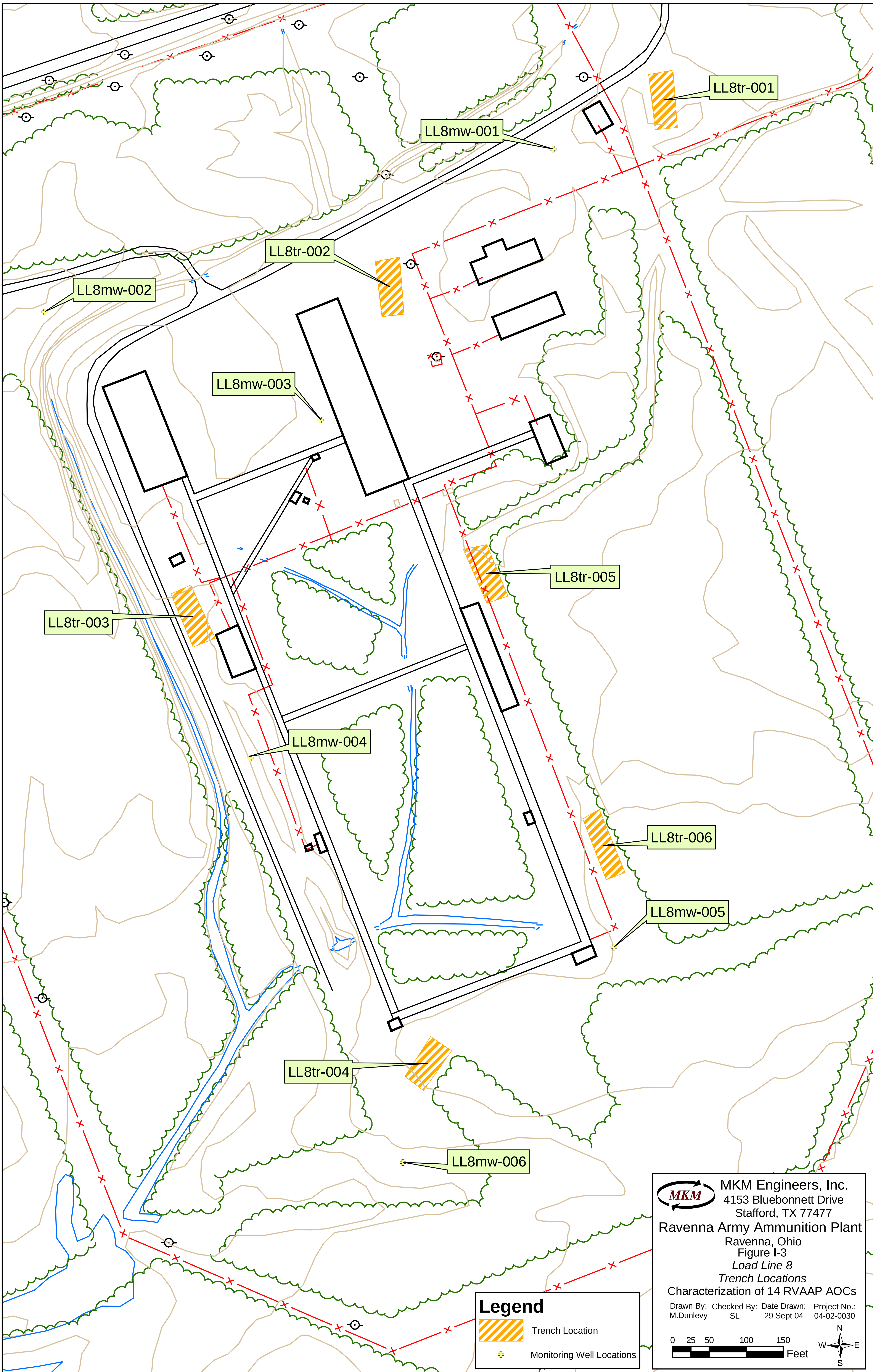
W
E
S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LL8mw-002
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LL8tr-003
LL8mw-004
LL8tr-006
LL8mw-005
LL8tr-004
LL8mw-006
MKM
MKM Engineers, Inc.
4153 Bluebonnett Drive
Stafford, TX 77477
Ravenna Army Ammunition Plant
Ravenna, Ohio
Figure I-3
Load Line 8
Trench Locations
Characterization of 14 RVAAP AOCs
Drawn By: M.Dunlevy
Checked By: SL
Date Drawn: 29 Sept 04
Project No.: 04-02-0030
Legend
Trench Location
Monitoring Well Locations
0 25 50 100 150
Feet
N
W
E
S

APPENDIX J

LOAD LINE 10 (RVAAP-43)

APPENDIX J
LOAD LINE 10 (RVAAP 43)

1.1 Description

Load Line 10 is located in an area known as Fuze and Booster Hill which includes Load Lines 5, 6, 7, 8, 9, 10 and 11 collectively. Fuze and Booster Hill is located in the south central part of RVAAP. Load Line 10 is located on Fuze and Booster Road west of Load Line 9 and east of Load Line 5. (See Figure 2 of the Sampling and Analysis Plan Addendum.) Load Line 10 consists of 29 process buildings ranging in size between 36 sq ft and 13, 413 sq ft.

Load Line 10, which was known as the Percussion Element Manufacturing Line, operated from 1941 to 1945 to produce percussion elements, from 1951 to 1957 to produce primers and percussion elements and from 1969 to 1971 to produce primers. Secondary explosives (TNT and PETN) were handled in this area. Building use changed during different periods of time; the uses are summarized below:

- PE-1: Mix and percussion element processing and packing
- PE-4, PE-5, PE-6, PE-7, PE-8, PE-9: Dry houses and final dry house
- PE-10SE and PE-10NW: Test, pack and shipping
- PE-11: Rest house
- PE-12 and PE-13: Sieve and weigh house
- PE-12, PE-18 and PE-28: Initiator processing
- PE-13, PE-17, PE-19: Primer component processing
- PE-14: Wet mix
- PE-15: Mixture inspection
- PE-12, PE-13, PE-19, PE-29A and B: Fuel compound blending and storage
- PE-16: Binder blending; gum solution preparation
- PE-18: Potassium chlorate magazine
- PE-19: TNT magazine
- PE-2, PE-17, PE-20: Solvent storage
- PE-28 and PE-29: PETN processing
- PE-28 and PE-31: Screen house and heater house
- PE-29 and PE-32: Service house and heater house
- PE-30 and PE-33: Napkin preparation and heater house

Explosives contaminants are potentially present on the facilities' interior surfaces, in surface soils, and in the holding tanks and settling ponds which comprised the wastewater treatment system. Additionally, the surface water and sediments in the storm sewers and surface water discharge points (drainage ditches) are potentially contaminated as well. Potential contaminants include potassium chlorate; TNT; antimony sulfide; lead thiocyanate; PETN; non-chlorinated solvents such as lacquer thinners, alcohols and ketones; and gum Arabic. Locations of potential contaminants depend on the process that occurred in a particular building.

The direction of transport of potential COPCs in surface water is towards the constructed drainage system within the load line (i.e. drainage ditches). Generally, the surface water on this load line flows toward the south/southeast. A portion of the site's surface water (near Buildings PE-1 and 10-51) flows in a north-northwest direction. Both surface water flow direction and bedrock topography were utilized to predict the groundwater flow direction. Groundwater flow direction is generally anticipated to flow in a south-southeasterly direction. A northern flow gradient is a possibility in the northern portion of the Load Line.

Load Line 10 has been inactive since 1971 and is overgrown with trees, bushes and weeds.

1.2 Previous Investigations

The following assessments, evaluations and/or investigations have been conducted at Load Line 10:

- 1978 USATHAMA Installation Risk Assessment.
- Preliminary Review/Visual Site Inspection conducted in 1989 as part of a RCRA Facility Assessment.
- 1994 Preliminary Assessment Screening of the boundary load lines.
- 1998 CHPPM evaluation of relative risk at additional RVAAP AOCs.

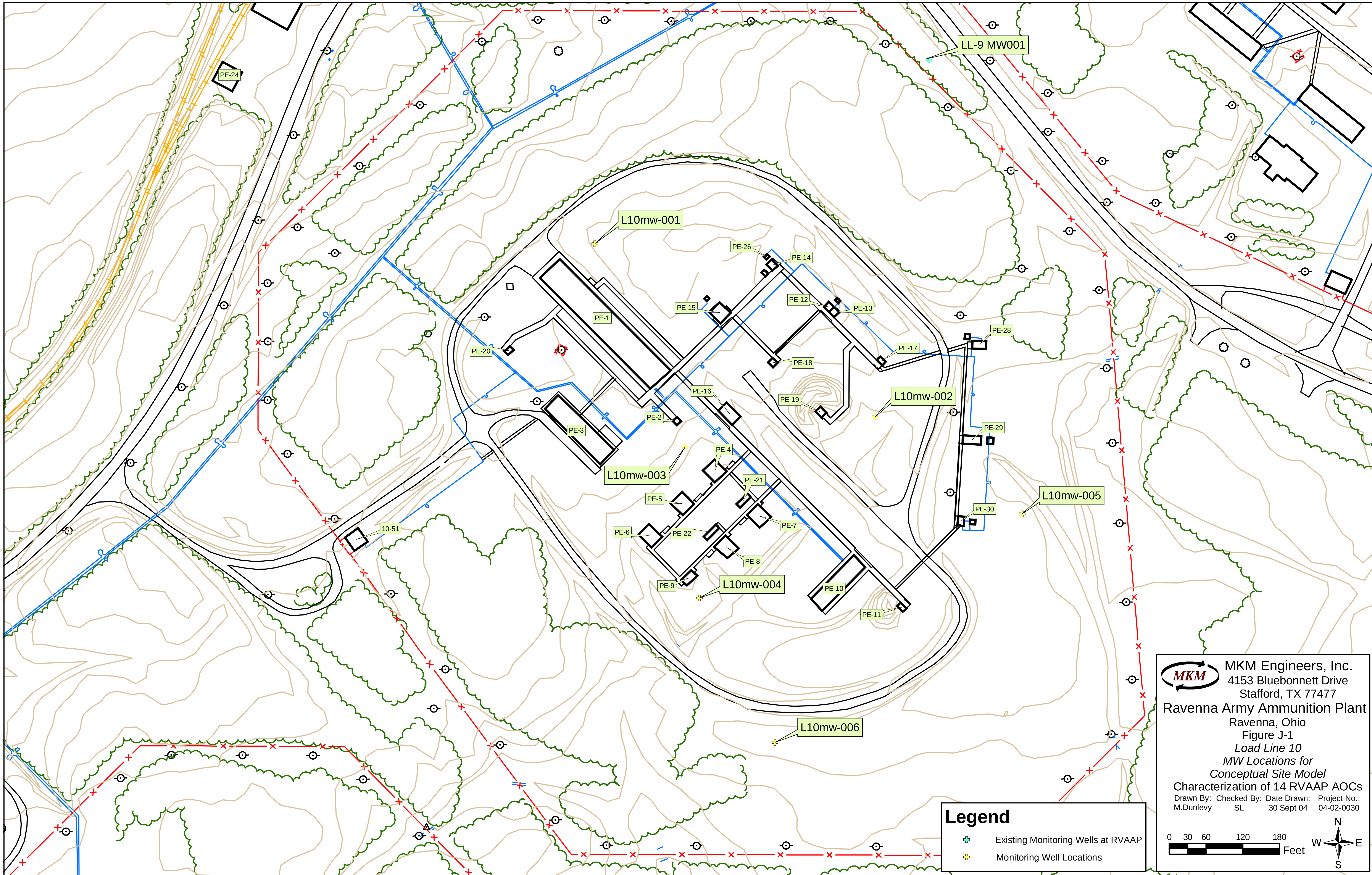
The results of these investigations, assessments and evaluations as well as knowledge about Load Line 10's operational history and potential source areas were used to select sampling locations, sampling media, analyses and numbers of samples for this characterization activity. The sampling activities, as specified in USACE's 11 May 2004 Scope of Work, are summarized in Section 1.3.

1.3 Summary of Characterization Activities

Twenty-three MI surface soil, two discrete surface soil, one basement water, thirteen MI dry ditch (surface soil), fourteen sump water, fourteen sump sediment, ten sewer water and ten sewer sediment samples will be collected. Four test trenches will be excavated to determine depth to first groundwater and to collect lithologic data. Bedrock topographic maps at this AOC indicate that bedrock is not anticipated to be encountered. Six groundwater monitoring wells will be installed to an anticipated depth of 23 ft bgs. If bedrock is encountered, three of the six monitoring well boreholes will be cored. During drilling activities, geotechnical samples will be collected by advancing Shelby tubes. Currently, approximately three geotechnical samples will be collected from this AOC; however field observations will determine the exact number of geotechnical samples collected. The specific location (i.e. specific borehole) of the geotechnical sample will be determined in the field. After the monitoring wells have been installed and developed, a groundwater sample will be collected from each of the newly-installed groundwater monitoring wells. The rationale for the sampling locations, test trench locations, placement of groundwater monitoring wells and selection of wells to be cored are summarized in the following table.

Load Line 10 Characterization Activities		
Type of Sample	**No. Samples / Locations**	**Rationale**
Surface Soils MI	23	Perimeter areas of process buildings
Surface Soils Discrete	2	Collected from soil adjacent to the solvent/paint storage bldg.
Basement Water	1	Collected from the basement of PE-3 (change house)
Surface Soil/Dry Ditch MI	13	Collected from the dry stormwater drainage ditches within the process area
Sump Water	14	Collected from sump or catch basins within process area
Sump Sediment	14	Collected from sump or catch basins within process area
Sewer Water	10	Collected from manhole locations within sanitary sewer system
Sewer Sediment	10	Collected from manhole locations within sanitary sewer system
Test Trenches	4	Near monitoring well locations
Groundwater (MW-1) *	1	Upgradient location, correlation across AOC
Groundwater (MW-2)	1	Downgradient of solvent building
Groundwater (MW-3) *	1	Processing area near solvent building, center of production area stratigraphic sequence
Groundwater (MW-4)	1	Downgradient of process buildings
Groundwater (MW-5) *	1	Downgradient of process buildings, downgradient stratigraphic correlation
Groundwater (MW-6)	1	Downgradient of AOC
Geotechnical	≈ 3	Locations be determined in the field

A complete listing of the sampling and analytical requirements for Load Line 10 can be found in Table 1-10 of the QAPP. Figure J-1 shows the groundwater monitoring well locations. Figures J-2 and J-3 show the soil, sediment and surface water sampling locations. Figure J-4 shows the test trench locations.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PE-24
PE-26
PE-28
PE-29
PE-30
10-51
Legend
Existing Monitoring Wells at RVAAP
Monitoring Well Locations
MKM
MKM Engineers, Inc.
4153 Bluebonnett Drive
Stafford, TX 77477
Ravenna Army Ammunition Plant
Ravenna, Ohio
Figure J-1
Load Line 10
MW Locations for
Conceptual Site Model
Characterization of 14 RVAAP AOCs
Drawn By: M.Dunlevy
Checked By: SL
Date Drawn: 30 Sept 04
Project No.: 04-02-0030
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Feet
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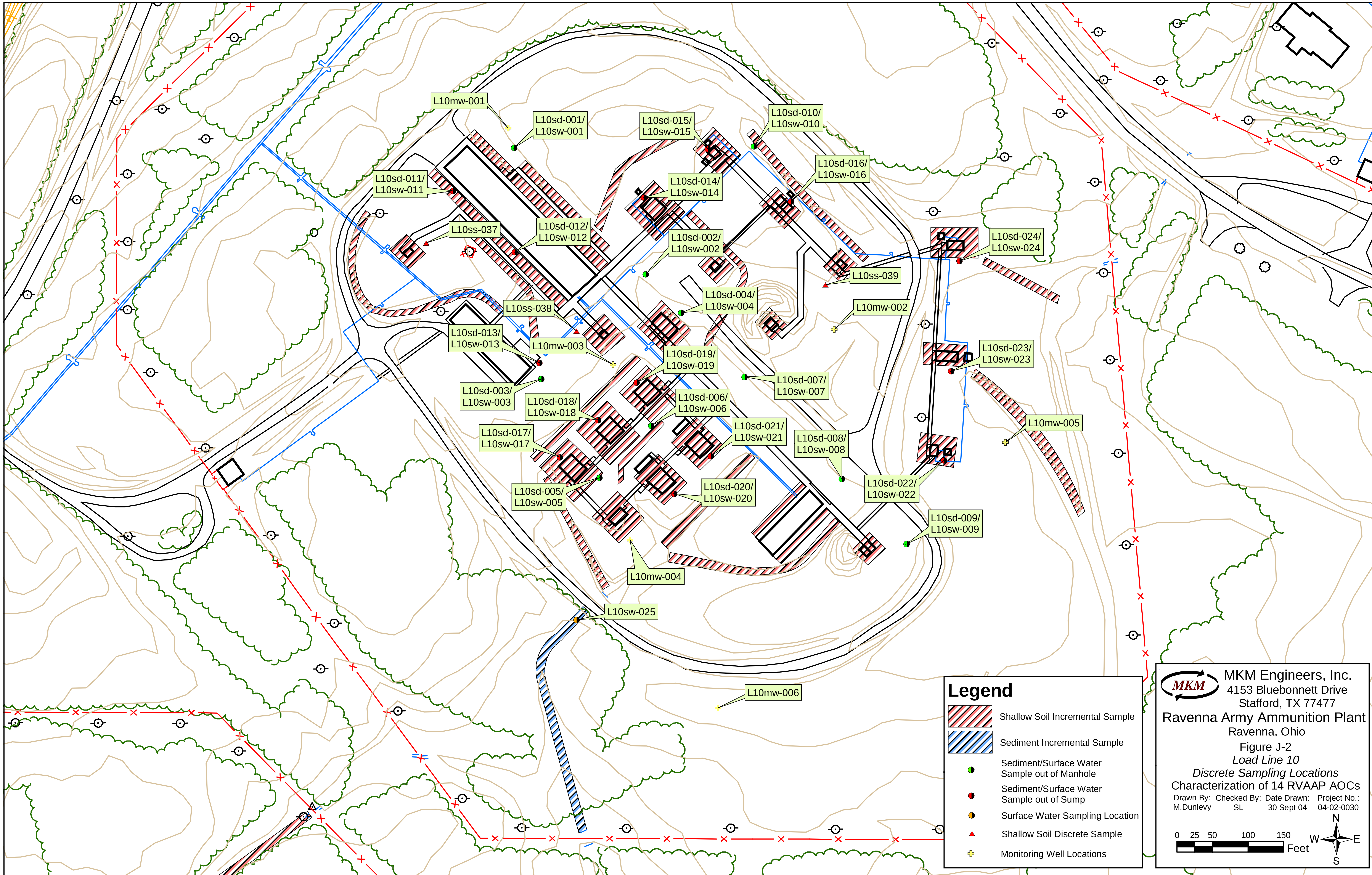
W
E
S



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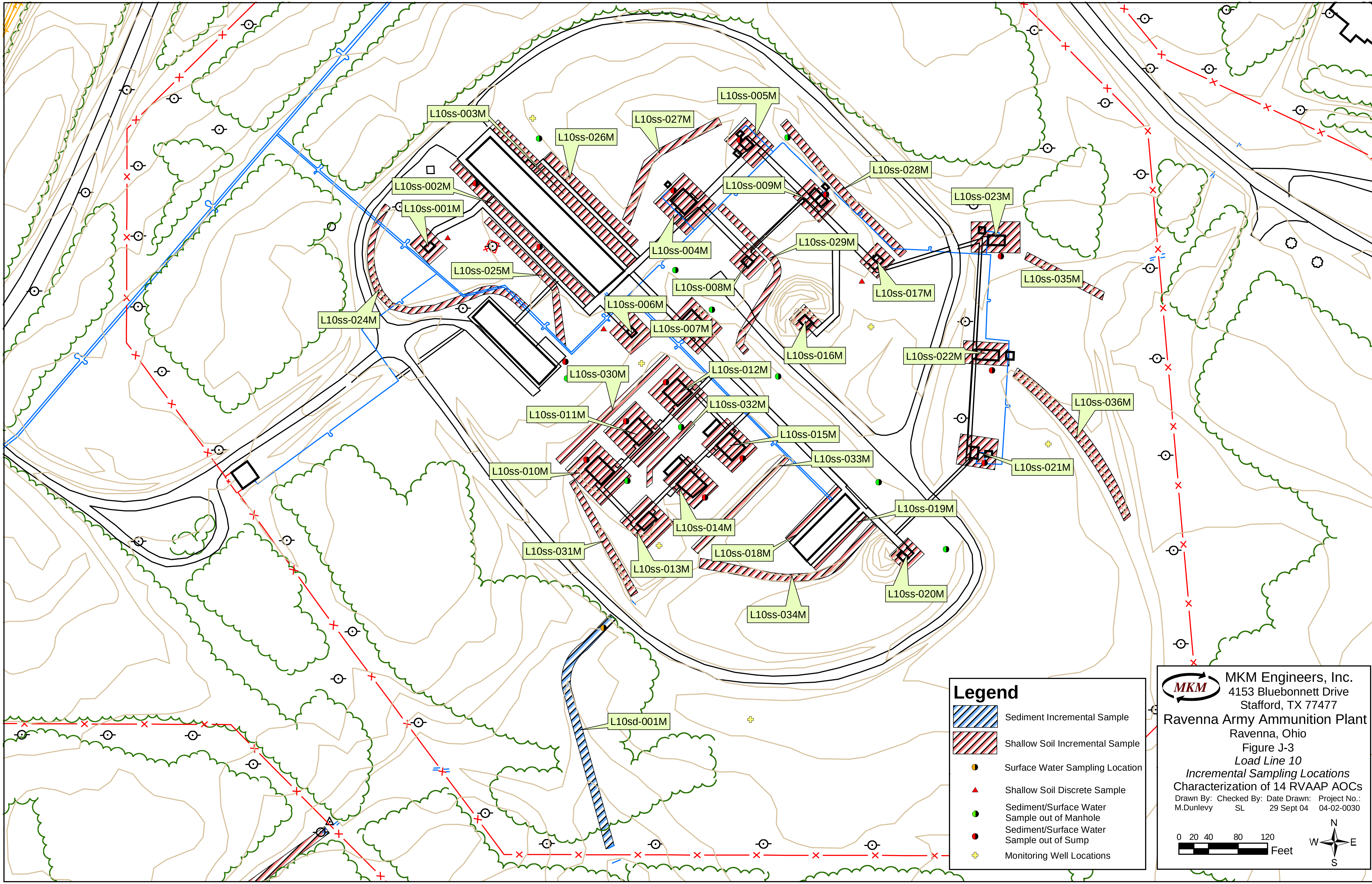
L10sw-025
L10mw-006
Legend
Shallow Soil Incremental Sample
Sediment Incremental Sample
Sediment/Surface Water Sample out of Manhole
Sediment/Surface Water Sample out of Sump
Surface Water Sampling Location
Shallow Soil Discrete Sample
Monitoring Well Locations
MKM
MKM Engineers, Inc.
4153 Bluebonnett Drive
Stafford, TX 77477
Ravenna Army Ammunition Plant
Ravenna, Ohio
Figure J-2
Load Line 10
Discrete Sampling Locations
Characterization of 14 RVAAP AOCs
Drawn By: M.Dunlevy
Checked By: SL
Date Drawn: 30 Sept 04
Project No.: 04-02-0030
0 25 50 100 150
Feet
N
W
E
S


L10ss-003M
L10ss-026M
L10ss-027M
L10ss-005M
L10ss-028M
L10ss-002M
L10ss-009M
L10ss-023M
L10ss-001M
L10ss-004M
L10ss-029M
L10ss-025M
L10ss-035M
L10ss-008M
L10ss-017M
L10ss-006M
L10ss-024M
L10ss-007M
L10ss-016M
L10ss-022M
L10ss-030M
L10ss-012M
L10ss-036M
L10ss-011M
L10ss-032M
L10ss-015M
L10ss-010M
L10ss-033M
L10ss-021M
L10ss-019M
L10ss-014M
L10ss-031M
L10ss-018M
L10ss-013M
L10ss-020M
L10ss-034M
L10sd-001M
Legend
Sediment Incremental Sample
Shallow Soil Incremental Sample
Surface Water Sampling Location
Shallow Soil Discrete Sample
Sediment/Surface Water Sample out of Manhole
Sediment/Surface Water Sample out of Sump
Monitoring Well Locations
MKM
MKM Engineers, Inc.
4153 Bluebonnett Drive
Stafford, TX 77477
Ravenna Army Ammunition Plant
Ravenna, Ohio
Figure J-3
Load Line 10
Incremental Sampling Locations
Characterization of 14 RVAAP AOCs
Drawn By: M.Dunlevy
Checked By: SL
Date Drawn: 29 Sept 04
Project No.: 04-02-0030
0 20 40 80 120
Feet
N
W
E
S

APPENDIX K

WET STORAGE (RVAAP-45)

APPENDIX K
WET STORAGE AREA (RVAAP-45)

1.1 Description

The Wet Storage Area is located at the intersection of George Road and Newton Falls Road near the geographic center of RVAAP. See Figure 2 of the SAP Addendum. The Wet Storage Area is surrounded by a chain link fence.

The Wet Storage Area was used from 1941 to 1945 to store primary explosives including: lead azide, mercury fulminate and tetryl. The highly explosive, shock sensitive materials were stored in drums; the material within the drums was covered with water. The drums were stored in six separate igloos. Four of the igloos (WS-1, WS-1A, WS-2 and WS-2A) located in the western portion of the 37-acre AOC, were decontaminated and then demolished in 2004. The two remaining igloos (WS-3, WS-3A) are located in the eastern portion of the AOC. One of the eastern igloos was refurbished and used to conduct administrative functions.

The four igloos located in the western portion of the AOC (WS-1, WS-1A, WS-2 and WS-2A) were built approximately 150 ft apart. The two igloos located in the eastern portion of the AOC (WS-3 and WS-3A) are separated by approximately 400 ft. When constructed, each storage igloo was covered with earth. In four of the igloos, the floors were covered with a conductive lead lining to dissipate static electricity charges. When the lead floor was removed from the four demolished igloos, ACM liner and mastic were found beneath the lead. The floors, walls and ceilings of all six igloos were constructed from reinforced concrete.

Each igloo has a system of drainage ditches that surround the structure and borders the access road that leads to each structure. The ditches between the sites of former Igloos WS-1 and WS-1A are connected via a ditch; the WS-2 and WS-2A sites are similarly connected. A drainage divide that is oriented in an east/west direction divides the centerline of the igloos. The terrain west of the igloos falls steeply toward Sand Creek. Sand Creek flows in a northeastern direction. Surface water on the eastern portion of the AOC follows the drainage ditch system.

RVAAP Water Supply Well No. 17 is located within approximately 700 ft of the AOC.

According to the 1998 USACHPPM Report, potential contaminants at the Wet Storage Area include lead azide, mercury fulminate, tetryl, explosives, propellants and TAL metals. No information documenting spills from any of the Wet Storage igloos has been found.

1.2 Previous Investigations

The following assessments, evaluations and/or investigations have been conducted at the Wet Storage Area:

- 1978 USATHAMA Installation Risk Assessment.
- 1998 CHPPM evaluation of relative risk at additional RVAAP AOCs.
- Confirmation samples collected beneath the sub-floors of the four igloos that were demolished in 2004.

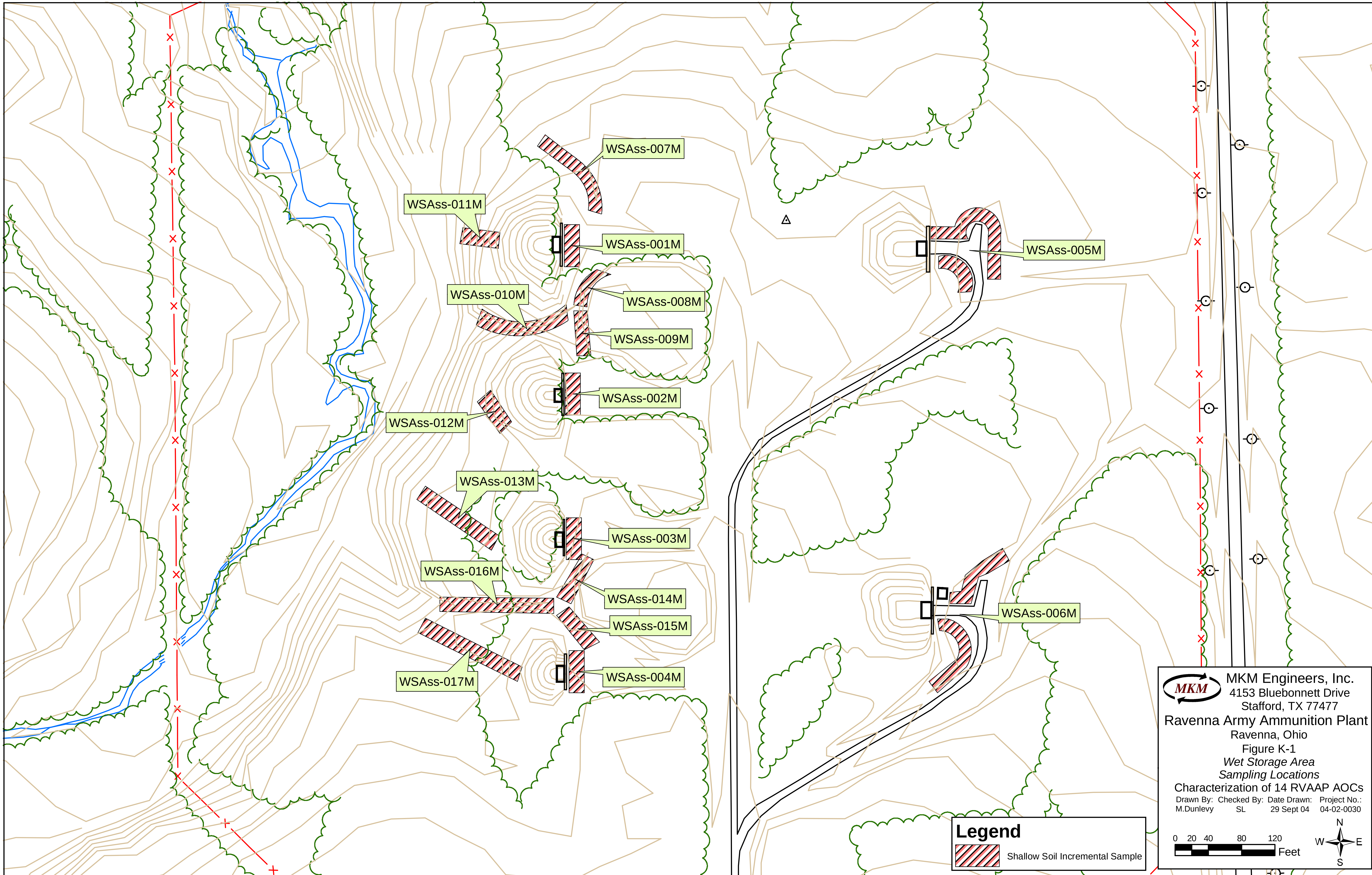
The results of the confirmation samples, assessments and evaluations combined with institutional knowledge about the Wet Storage Area's operational history were used to select sampling locations, sampling media, analyses and numbers of samples for this characterization activity. The sampling activities, as specified in USACE's 11 May 2004 Scope of Work, are summarized in Section 1.3.

Summary of Characterization Activities

Six MI surface soil and thirteen MI dry ditch (surface soil) samples will be collected from the Wet Storage Area. The rationale for the sample locations are summarized in the following table.

Wet Storage Area Characterization Activities		
Type of Sample	**No. of Samples**	**Rationale**
MI Surface Soils	6	Outside the doorway/apron area of each of the six igloos
Surface Soil/Dry Ditch MI	13	Thirteen from ditches on the east side of WS3 and WS3A and the east and west sides of WS1, WS1A, WS2 and WS2A

A list of the sampling and analytical requirements for Wet Storage Area can be found in Table 1-11 of the QAPP Addendum. Figure K-1 shows the soil sampling locations.



MKM Engineers, Inc.
4153 Bluebonnett Drive
Stafford, TX 77477

Ravenna Army Ammunition Plant
Ravenna, Ohio

Figure K-1
Wet Storage Area
Sampling Locations
Characterization of 14 RVAAP AOCs

Drawn By:	Checked By:	Date Drawn:	Project No.:
M.Dunlevy	SL	29 Sept 04	04-02-0030

APPENDIX L

BUILDINGS F-15/F-16 (RVAAP-46)

APPENDIX L
BUILDINGS F-15/F-16 (RVAAP-46)

1.1 Description

Buildings F-15 and F-16 are located west of Block D and east of Slagle Road. The buildings are each approximately 60 ft by 120 ft and were used during World War II, the Korean War, and Vietnam War to test miscellaneous explosives and propellants. Quantities and exact dates of testing are unknown.

Currently the buildings are abandoned. The roof of Building F-15 has partially collapsed. Generally, the surface water on this AOC flows toward the south-southeast.

1.2 Previous Investigations

The following assessment and evaluation have been conducted at Buildings F-15 and F-16:

- 1978 USATHAMA Installation Risk Assessment.
- 1998 CHPPM evaluation of relative risk at additional RVAAP AOCs.

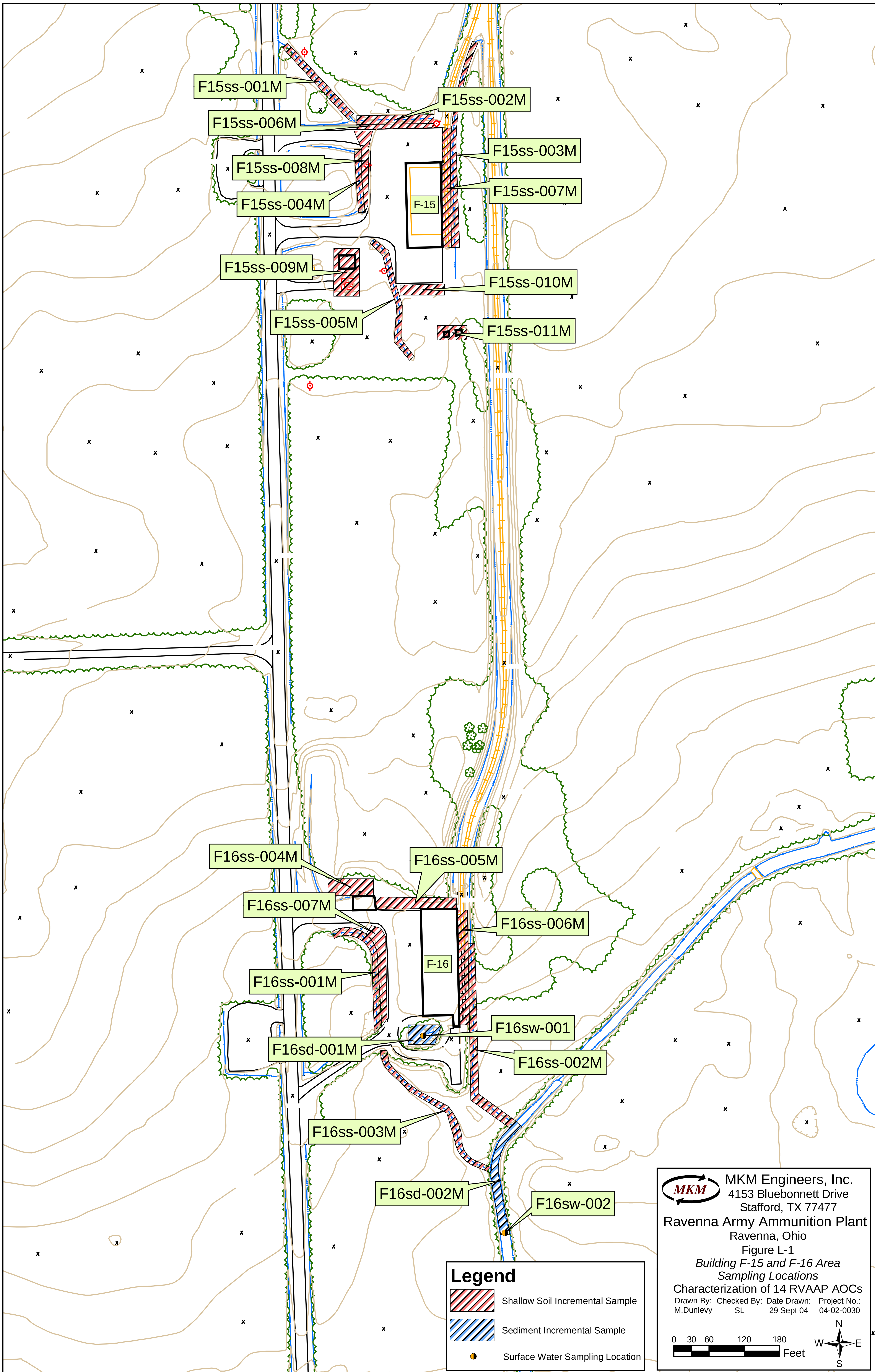
The results of the assessment and evaluation plus knowledge about the processes conducted at these two buildings were used to select sampling locations, determine sample media, identify the analyses and determine the number of samples to be collected for this characterization activity. The sampling requirements, as specified in USACE's 11 May 2004 Scope of Work, are summarized in Section 1.3.

1.3 Summary of Characterization Activities

Six MI surface soil and five MI dry ditch (surface soil) samples will be collected from Building F-15. Four MI surface soil, three MI dry ditch (surface soil), two MI sediment and two surface water wet ditch samples will be collected from Building F-16. The rationale for the sample locations are summarized in the following table.

Buildings F15/F16 Characterization Activities		
Type of Sample	**No. of Samples**	**Rationale**
MI Surface Soils (F-15)	6	Outside buildings along walkways and berms
Surface Soil/Dry Ditch MI (F-15)	5	Surface drainage ditches running from buildings
MI Surface Soils (F-16)	4	Outside buildings along walkways and berms
Surface Soil/Dry Ditch MI (F-16)	3	Surface drainage ditches running from buildings
MI Wet Ditch Sediment (F-16)	2	Drainage ditches and runoff collection areas/sumps
Surface Water (F-16)	2	Drainage ditches and runoff collection areas/sumps

A list of the sampling and analytical requirements for Buildings F-15 and F-16 can be found in Table 1-12 and Table 1-13 of the QAPP Addendum. Figure L-1 shows the soil, sediment and surface water sampling locations.


F15ss-001M
F15ss-002M
F15ss-006M
F15ss-003M
F15ss-008M
F15ss-007M
F15ss-004M
F-15
F15ss-009M
F15ss-010M
F15ss-005M
F15ss-011M
F16ss-004M
F16ss-005M
F16ss-007M
F16ss-006M
F-16
F16ss-001M
F16sw-001
F16sd-001M
F16ss-002M
F16ss-003M
F16sd-002M
F16sw-002
Legend
Shallow Soil Incremental Sample
Sediment Incremental Sample
Surface Water Sampling Location
MKM
MKM Engineers, Inc.
4153 Bluebonnett Drive
Stafford, TX 77477
Ravenna Army Ammunition Plant
Ravenna, Ohio
Figure L-1
Building F-15 and F-16 Area
Sampling Locations
Characterization of 14 RVAAP AOCs
Drawn By: M.Dunlevy
Checked By: SL
Date Drawn: 29 Sept 04
Project No.: 04-02-0030
0 30 60 120 180
Feet
N
W
E
S

APPENDIX M

ANCHOR TEST AREA (RVAAP-48)

APPENDIX M
ANCHOR TEST AREA (RVAAP-48)

1.1 Description

Anchor Test Area is located on the west side of Wilcox-Wayland Road, south of Newton Falls Road and north of South Service Road. Although little is known about the historical function of the Anchor Test Area, it is suspected that the Anchor Test Area was used to test explosively-charged anchors. A 1961 drawing shows the `proposed site' for the Anchor Test Area, so the area was not active until after the early 1960's. A design figure showing the type of anchor that may have been used at the AOC is the only information found in the RVAAP historical files regarding "anchors" or "anchor testing".

Currently the AOC is heavily overgrown and consists of two distinct dirt mounds and a nearby sandpit. It is suspected that the anchor tests were performed within the 12 ft x 36 ft sandpit and the dirt mounds functioned as blast walls. Metal debris is visible in the area and one of the dirt mounds has a cement culvert.

1.2 Previous Investigations

The following assessment and evaluation have included the Anchor Test Area:

- 1978 USATHAMA Installation Risk Assessment.
- 1998 USACHPPM relative risk evaluation for newly-added RVAAP sites.

Information from the assessment and evaluation were used to select sampling locations, determine sampling media, determine numbers of samples and identify analyses for this characterization activity. The sampling activities, as specified in USACE's 11 May 2004 SOW, are summarized in Section 1.3.

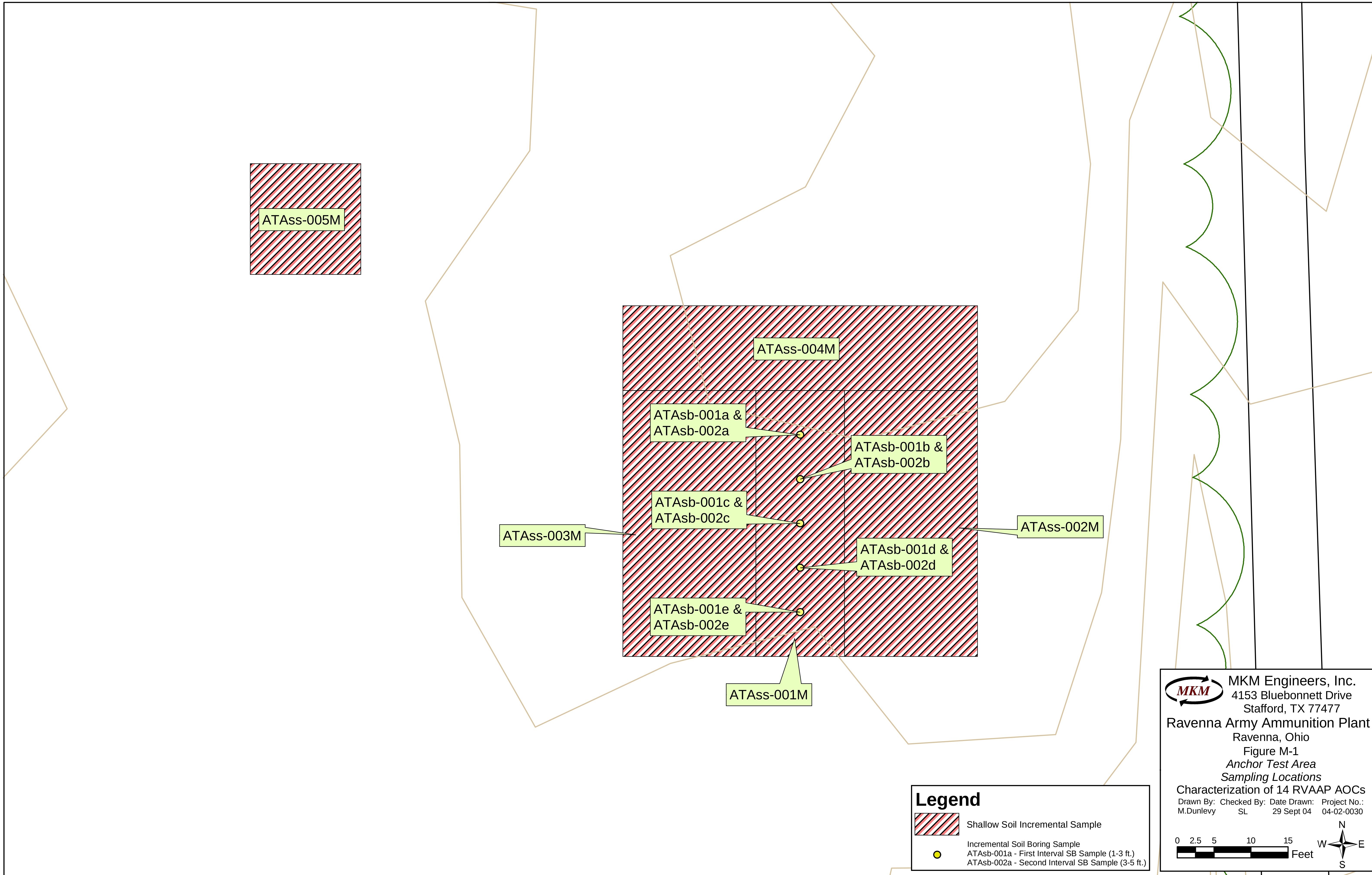
1.3 Summary of Characterization Activities

Five MI surface soil, one MI sub-surface soil (1 to 3 ft), and one MI sub-surface soil (3 to 5 ft) will be collected at Anchor Test Area. The rationale for the sample locations are summarized in the following table.

Anchor Test Area Characterization Activities

Type of Sample	No. of Samples	Rationale
MI Surface Soils	5	Berms and blast walls surrounding sand test pit
MI Sub-Surface Soils (1-3 ft)	1	Sand pit (1 to 3 ft interval)
MI Sub-Surface Soils (3-5 ft)	1	Sand pit (3 to 5 ft interval)

A list of the sampling and analytical requirements for the Anchor Test Area is in Table 1-14 of the QAPP Addendum. Figure M-1 shows the soil sampling locations.


ATAss-005M
ATAss-004M
ATAsb-001a &
ATAsb-002a
ATAsb-001b &
ATAsb-002b
ATAsb-001c &
ATAsb-002c
ATAss-003M
ATAss-002M
ATAsb-001d &
ATAsb-002d
ATAsb-001e &
ATAsb-002e
ATAss-001M
Legend
Shallow Soil Incremental Sample
Incremental Soil Boring Sample
ATAsb-001a - First Interval SB Sample (1-3 ft.)
ATAsb-002a - Second Interval SB Sample (3-5 ft.)
MKM
MKM Engineers, Inc.
4153 Bluebonnett Drive
Stafford, TX 77477
Ravenna Army Ammunition Plant
Ravenna, Ohio
Figure M-1
Anchor Test Area
Sampling Locations
Characterization of 14 RVAAP AOCs
Drawn By: M.Dunlevy
Checked By: SL
Date Drawn: 29 Sept 04
Project No.: 04-02-0030
0 2.5 5 10 15
Feet
N
W
E
S

APPENDIX N

ATLAS SCRAP YARD (RVAAP-50)

APPENDIX N
ATLAS SCRAP YARD (RVAAP-50)

1.1 Description

Atlas Scrap Yard is located southwest of the intersection of Newton Falls Road and Paris-Windham Road. The Atlas Scrap Yard was a construction camp built in 1940 to house workers and their families during the construction of the plant. After World War II, the facilities were demolished. Since that time, Atlas Scrap Yard has served as a storage area for non-explosive scrap materials. Currently, the area is covered by thick grass and is littered with miscellaneous non-explosive scraps. Remnants of an unimproved road can be seen.

The site is located in an area which has a very low topographic relief. Based upon surface topography the site appears to form a portion of a surface drainage divide with an east-west orientation. Bedrock topographic surface and monitor well groundwater elevations from Load Line 12 and Load Line 4 remedial investigations indicate that the groundwater gradient may be bi-directional to the north or south.

1.2 Previous Investigations

Atlas Scrap Yard was included in the USACHPPM's 1998 relative risk evaluation that was conducted for RVAAP AOCs that were identified as AOCs after CHPPM's first evaluation was completed in 1996. The results of that evaluation and knowledge about potential source area locations were used to select sampling locations, determine sampling media, identify analyses and determine numbers of samples to be collected as part of this characterization activity. The sampling activities, as specified in USACE's 11 May 2004 Scope of Work, are summarized in Section 1.3.

1.3 Summary of Characterization Activities

Eighteen MI surface soil, fifteen MI dry ditch (surface soil), sixteen sewer sediment and sixteen sewer surface water samples will be collected. Eight test trenches will be excavated to determine depth to first groundwater and to collect lithologic data. Bedrock topographic maps at this AOC and this AOCs proximity to Load Lin 12 indicate that bedrock is not anticipated to be encountered. Ten groundwater monitoring wells will be installed to an anticipated depth of 30 ft bgs. During drilling activities, geotechnical samples will be collected by advancing Shelby tubes. Currently, approximately three geotechnical samples will be collected from this AOC; however field observations will determine the exact number of geotechnical samples collected. The specific location (i.e. specific borehole) of the geotechnical sample will be determined in the field. After the monitoring wells have been installed and developed, a groundwater sample will be collected from each of the newly-installed groundwater monitoring wells. The rationale for the sample locations, test trench locations and placement of groundwater monitoring wells are summarized in the following table.

Atlas Scrap Yard Characterization Activities		
Type of Sample	**No. Samples /Locations**	**Rationale**
MI Surface Soils	18	Scrap storage areas and operational building locations. Two samples near suspected locations of two buried USTs associated with two former service stations
Surface Soil/Dry Ditch MI	15	Drainage ditches that carried site storm water and runoff
Sewer Sediment	16	Sanitary sewer system for the construction camp
Sewer Surface Water	16	Sanitary sewer system for the construction camp
Test Trenches	8	Near monitoring well locations
(Groundwater) MW-1	1	Possible upgradient
(Groundwater) MW-2	1	Possible upgradient and triangulation monitoring well
(Groundwater) MW-3	1	Stockpile area
(Groundwater) MW-4	1	Downgradient of Service Station No. 1
(Groundwater) MW-5	1	East of operations area and ammo box storage area
(Groundwater) MW-6	1	West of operations area
(Groundwater) MW-7	1	Possible downgradient of Service Station No. 2, paint shop and repair shop
(Groundwater) MW-8	1	Service Station No. 2
(Groundwater) MW-9	1	Possible upgradient and triangulation area
(Groundwater) MW-10	1	North of Service Station No. 2
Geotechnical	≈ 3	Locations to be determined in the field

A list of the sampling and analytical requirements for the Atlas Scrap Yard can be found in Table 1-15 of the QAPP Addendum. Figure N-1 shows the groundwater monitoring well locations. Figure N-2 shows the soil, sediment and surface water sampling locations. Figure N-3 shows the test trench locations.

1.4 Geophysical Survey Plan

This Geophysical Survey Plan outlines the procedures to be employed to complete the geophysical surveys at the two former fueling stations located at the Atlas Scrap Yard. These two locations are shown in Figure N-2. The geophysical sampling team will establish a local survey grid. The data collected will be processed and presented in map form. Any geophysical anomalies found indicating the presence of an underground storage tank (UST) will be listed on the map and flagged within the survey grid. In early August 2004, a visual/schonstedt sweep of the two former fueling station sites was conducted; the results indicate that there is a high scrap metal, reinforced concrete and slag population in the proposed survey areas. The EM instruments will be calibrated to a higher level of background noise in an attempt to maximize the search for targets at depth (possible USTs). Also the field data will be processed with the appropriate software filters to remove as much background noise as possible.

1.4.1 Personnel Qualifications

Geophysical activities will be managed by a qualified geophysicist. Field activities, such as establishing grids, data collection, and reacquisition, will be supervised by a person well-trained in geophysical operations and certified by MKM's geophysicist.

1.4.2 Site Preparation

The activities associated with site preparation include surface clearance, land surveying and site assessment.

1.4.2.1 Surface Clearance

UXO-qualified personnel will use the Schonstedt GA-52Cx to assist in conducting visual surveys for surface ordnance prior to personnel entering any area potentially containing UXO. Before driving stakes or conducting any intrusive activity, the vicinity where the USTs may be located will be searched with a Schonstedt GA-52Cx to ensure that those locations are free of ferrous metal.

1.4.2.2 Land Surveying

Before investigation begins, the surface geometry will be analyzed and a local grid will be established. Stakes will mark the grid corners. All stakes will be assigned coordinates based on GPS. If tree cover will not allow an accurate positional reading, the stake locations will be measured using a tape.

1.4.2.3 Site Assessment

An initial site visit and assessment was made by the site geophysicist. Service Station 1 was cleared of most brush; however, many trees still remain. This will decrease the accuracy of the data and create data collection problems. Additionally, both sites are covered with a significant amount of surface scrap metal which creates interferences for the geophysical instruments. Adequate results from the geophysical investigation may not be possible, but every attempt will be made to increase the data quality in the field.

1.4.3 Geophysical Investigation Survey

This section describes the instruments that will be used, summarizes the geophysical survey steps and QC procedures for the survey, and details how the data will be processed.

1.4.3.1 Geophysical Instruments

Two different geophysical instruments will be used for this survey, a Geonics EM-61 MK2 and EM-31 MK2.

Geonics EM-61: The Geonics EM-61 MK2 will be the first instrument used. The EM-61 MK2 generates an electromagnetic pulse that triggers eddy currents in the subsurface. A secondary magnetic field is produced from the decaying eddy currents. The receiving coils within the EM-61 measure this secondary field and record the readings.

Geonics EM-31: If surface metal prevents the use of the EM-61, a follow on attempt using the Geonics EM-31 Frequency Domain Conductivity Meter will be completed. The EM-31 generates a time-varying magnetic field by generating an alternating current through the transmitter coils. Again, the receiving coils record the secondary magnetic field.

1.4.3.2 Geophysical Survey Procedures

The EM-61 MK2 survey will be performed with a 5 foot line spacing traversing the grid. The EM-61 samples at a rate of once every 0.6 feet. This data density will be adequate to identify any fuel USTs, if the background noise permits. To ensure straight lines, tapes will be placed across the grid edge lines and the operator will maintain a straight walking path toward the next point. When the operator reaches the edge line, he will move up 5 feet, turn around, and walk back to the first grid line. This will be repeated until the entire grid is surveyed.

Likewise, the EM-31 will follow the same survey parameters. However, it will be necessary to manually collect a data point at a regular spacing along the survey line by pressing the collection button found on the EM-31. To ensure good spatial density, a tape will be placed across the sampling grid and data will be collected every 5.0 feet.

1.4.3.3 Quality Control and Geophysical Instrument Checks

QC tests will be performed in order to ensure all geophysical and navigational equipment are functioning properly. Pass/Fail criteria will be utilized when analyzing test results. Equipment not functioning properly will be repaired or replaced prior to commencement of data collection. The project objectives are known and were factored into the design of the study. Any such proposed changes will be made in consultation with the project team.

1.4.3.3.1 Equipment/Electronics Warm-up

To minimize sensor drift due to thermal stabilization, geophysical equipment will be allowed to run for five minutes before being operated. Data readings will be monitored until they stabilize.

1.4.3.3.2 Personnel Tests

Personnel tests will be conducted to ensure that survey personnel have removed all potential interference sources from their clothing. Common interference sources are ballpoint pens in the operator's pocket, steel-toed boots, or large metallic belt buckles, which can produce data anomalies similar to MEC targets.

Instrument operators and personnel who will be in close proximity to geophysical sensors during survey operations will move around the stationary, operating instrument to scan for any effects of remaining metal on their person. The acceptance criterion of the EM61 MK2 is ± 2mV.

1.4.3.3.3 Cable Shake Test

This test will identify shorting cables and broken pin-outs on connectors. During the cable shake test, the instrument will be run in static mode and all cables will be shaken while the operator monitors the instrument's response. If a short is found, the cable will be marked and replaced.

1.4.3.3.4 Null Instrument

The EM61 MK2 will be placed in a nullified state prior to performing static tests, instrument response tests or data collection. The EM61 MK2 utilizes software to nullify, or zero, all channels simultaneously. It is essential the instrument be fully warmed up prior to nulling, and that this procedure is performed in an area free of metal.

1.4.3.3.5 Static (Background) and Instrument Response Test

The static and instrument response test will be performed in an area that is free of metal and sufficiently far from power lines, transmitters, or other sources of electromagnetic noise. The test location will be clearly marked with survey stakes, because it will be re-used throughout the duration of this geophysical survey. The static (background) response will be used to ensure that stable readings are collected by all geophysical instrumentation. The instrument response will be used to determine the repeatability of the instruments to a standard test item. The test item will consist of a standard 2-inch diameter steel trailer ball.

Prior to performing this test the instrument will be sufficiently warmed-up and nullified. The instrument will be placed at its normal operating height and static background readings will be collected for a minimum of three minutes. The test item will be placed below the sensors and data will be collected for one minute. The test item will then be removed and data will be collected for an additional minute. The operator will review the readings to confirm their stability prior to continuing with the geophysical survey.

The acceptance criteria for the static background test is +/- 2.5 mV. The acceptance criteria for the static spike test is +/-20 percent of the standard item response, after correcting for background conditions.

1.4.3.3.6 Repeatability of Data

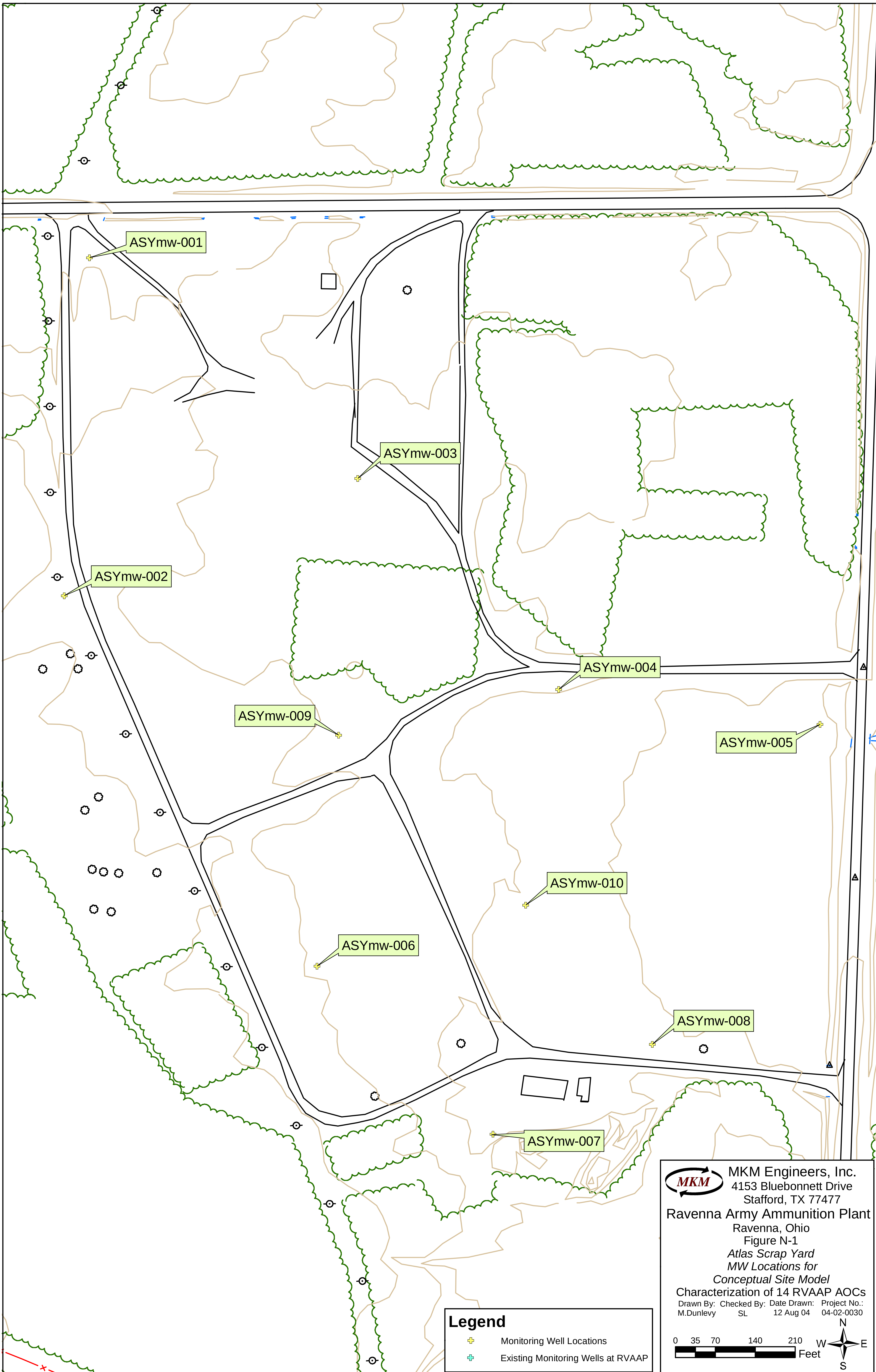
To determine positional and geophysical data repeatability, one line per grid will be repeated before and after the survey. The test standard placed will be placed at approximately the halfway point of the repeat line in an area lacking anomalous responses. The repeat line will be located at least ten feet outside the grid and parallel to the direction of travel. When viewed in profile and compared to original data, repeat data provides a means to evaluate the ability of the instrument to respond consistently, and evaluates the positional accuracy of the data. Errors in positional repeatability outside acceptable tolerances (positional accuracy ± 20 cm) indicate a problem in the method of navigation or navigational equipment operation. Errors outside acceptable tolerances for the amplitude repeatability response (repeatability of response amplitudes ± 20 percent) indicate a problem in the detector system or in the ability of the operator to perform an adequate survey.

1.4.4 Data Processing

Raw geophysical data will be uploaded daily to processing computers and copied to storage media for backup purposes. Once copied to the processing computers, the data will be imported to Geosoft's Oasis Montaj mapping software. This software package will be used to process, analyze, and present the findings of the geophysical surveys. The processing and analysis will apply standard corrections to the data (i.e. drift and lag correction) and produce color contour maps for the purposes of data interpretation. Data interpretation will attempt to identify anomalous responses potentially representing a UST.

1.4.5 Geophysical Investigation Report

A geophysical investigation report will be submitted that describes in detail the investigation, analysis, and recommendations. The report will include copies of the finals maps, geophysical data, and a discussion of the anomalies that most likely represent an underground storage tank. If no conclusions can be reached, the report will describe the failures of the survey and the reason for the failures.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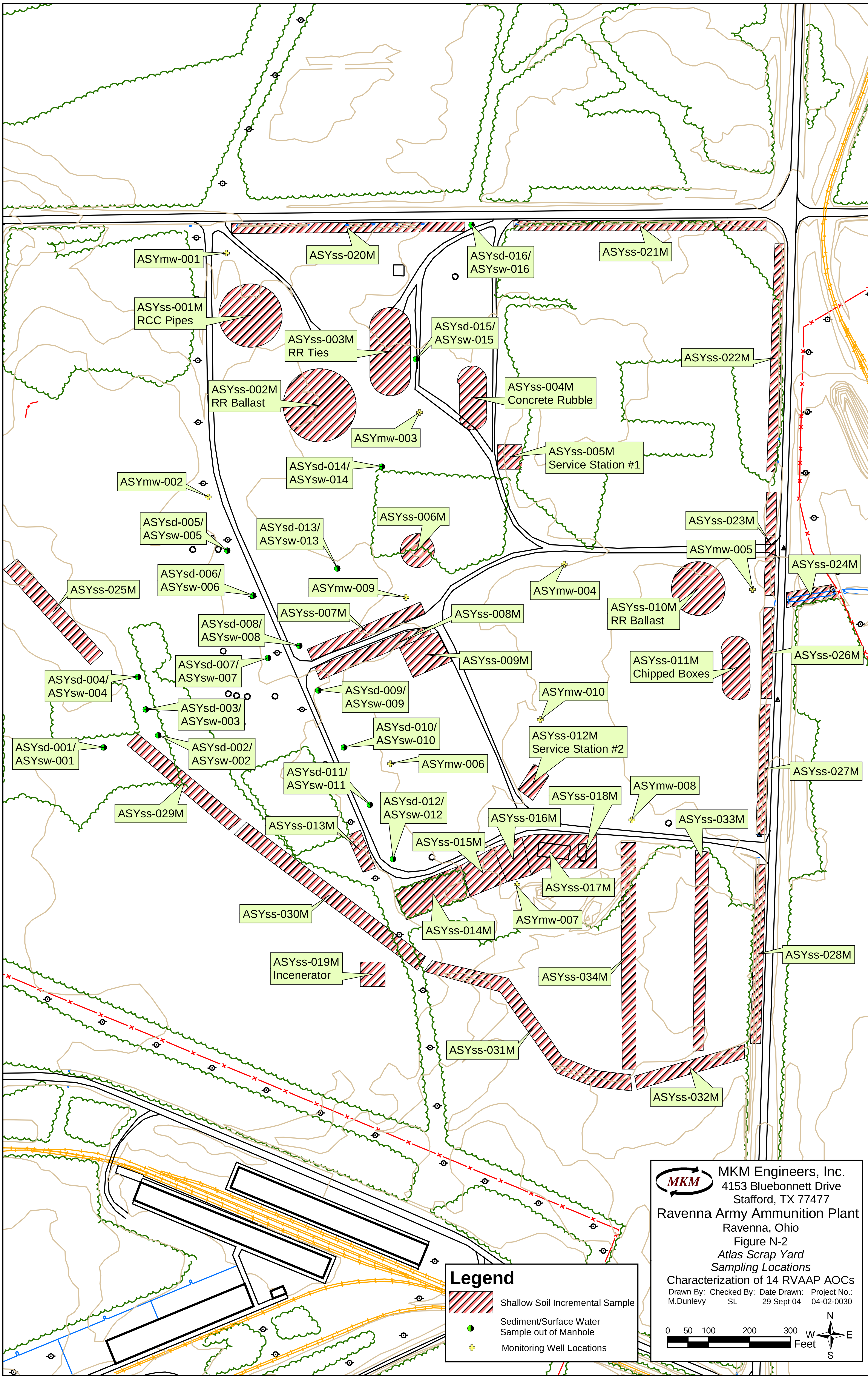
ASYmw-004
ASYmw-005
ASYmw-006
ASYmw-007
ASYmw-008
ASYmw-009
ASYmw-010
Legend
Monitoring Well Locations
Existing Monitoring Wells at RVAAP
MKM
MKM Engineers, Inc.
4153 Bluebonnett Drive
Stafford, TX 77477
Ravenna Army Ammunition Plant
Ravenna, Ohio
Figure N-1
Atlas Scrap Yard
MW Locations for
Conceptual Site Model
Characterization of 14 RVAAP AOCs
Drawn By: M.Dunlevy
Checked By: SL
Date Drawn: 12 Aug 04
Project No.: 04-02-0030
0 35 70 140 210
Feet
N
W
E
S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ASYss-020M
ASYsd-016/
ASYsw-016
ASYss-021M
ASYss-001M
RCC Pipes
ASYss-003M
RR Ties
ASYsd-015/
ASYsw-015
ASYss-022M
ASYss-002M
RR Ballast
ASYss-004M
Concrete Rubble
ASYmw-003
ASYss-005M
Service Station #1
ASYsd-014/
ASYsw-014
ASYmw-002
ASYss-023M
ASYsd-005/
ASYsw-005
ASYsd-013/
ASYsw-013
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ASYmw-005
ASYss-024M
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ASYmw-009
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RR Ballast
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ASYsd-009/
ASYsw-009
ASYmw-010
ASYsd-003/
ASYsw-003
ASYsd-010/
ASYsw-010
ASYss-012M
Service Station #2
ASYsd-001/
ASYsw-001
ASYsd-002/
ASYsw-002
ASYmw-006
ASYss-027M
ASYsd-011/
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ASYmw-008
ASYss-018M
ASYsd-012/
ASYsw-012
ASYss-029M
ASYss-016M
ASYss-033M
ASYss-013M
ASYss-015M
ASYss-017M
ASYss-030M
ASYmw-007
ASYss-014M
ASYss-019M
Incenerator
ASYss-028M
ASYss-034M
ASYss-031M
ASYss-032M
Legend
Shallow Soil Incremental Sample
Sediment/Surface Water
Sample out of Manhole
Monitoring Well Locations
MKM
MKM Engineers, Inc.
4153 Bluebonnett Drive
Stafford, TX 77477
Ravenna Army Ammunition Plant
Ravenna, Ohio
Figure N-2
Atlas Scrap Yard
Sampling Locations
Characterization of 14 RVAAP AOCs
Drawn By: M.Dunlevy
Checked By: SL
Date Drawn: 29 Sept 04
Project No.: 04-02-0030
0 50 100 200 300
Feet
N
W
E
S

ASYmw-001
ASYtr-006
ASYtr-002
ASYtr-007
ASYgr-002
ASYmw-003
ASYtr-001
ASYmw-002
ASYtr-004
ASYmw-009
ASYmw-004
ASYmw-005
ASYtr-003
ASYmw-010
ASYmw-006
ASYgr-001
ASYmw-008
ASYtr-008
ASYtr-005
ASYmw-007
Legend
Geophysical Grid Locations
Trench Location
Monitoring Well Locations
MKM
MKM Engineers, Inc.
4153 Bluebonnett Drive
Stafford, TX 77477
Ravenna Army Ammunition Plant
Ravenna, Ohio
Figure N-3
Atlas Scrap Yard
Geophysical Grids and Trench Locations
Characterization of 14 RVAAP AOCs
Drawn By: M.Dunlevy
Checked By: SL
Date Drawn: 29 Sept 04
Project No.: 04-02-0030
0 40 80 160 240
Feet
N
W E
S

FIGURES

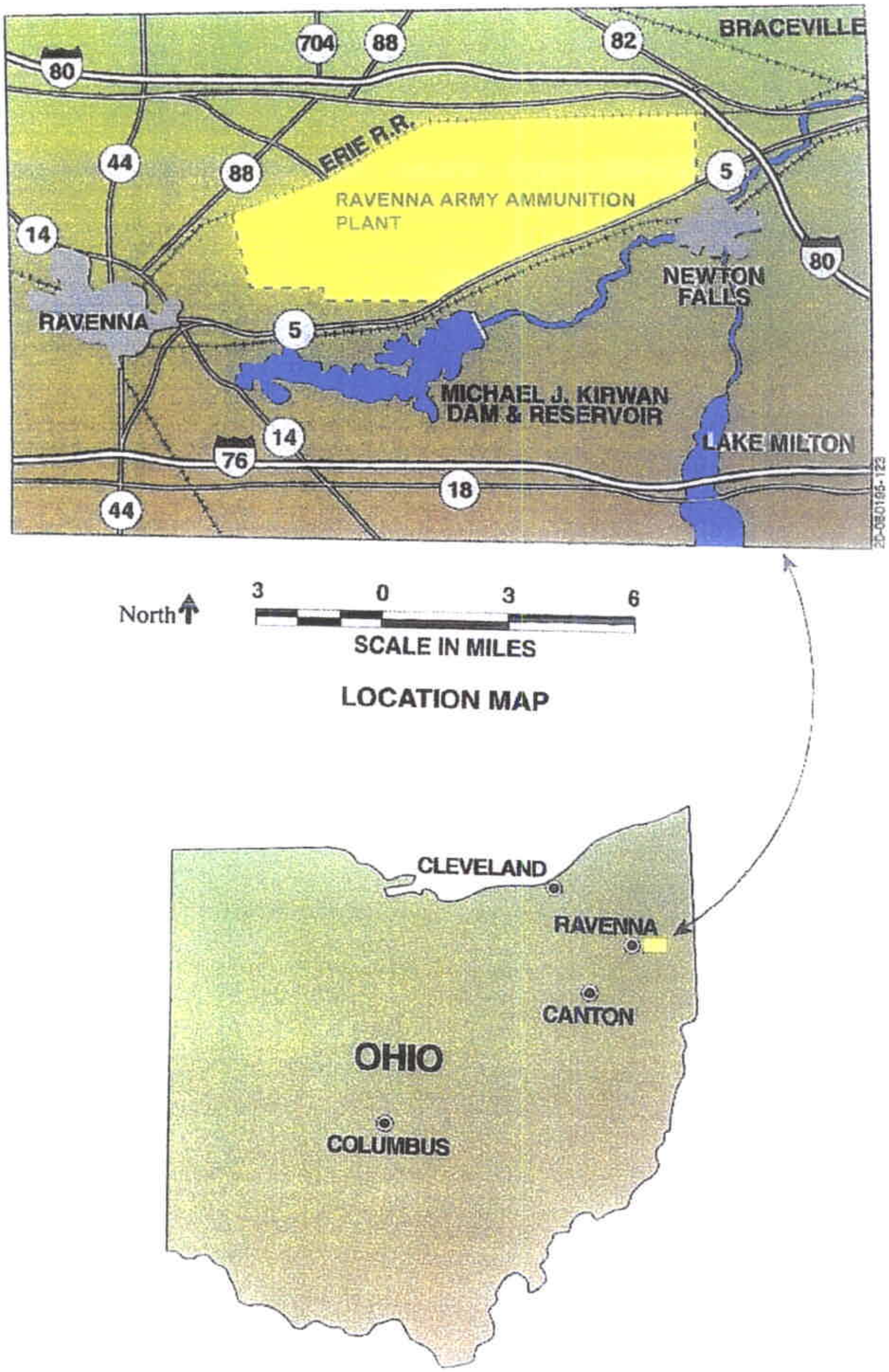
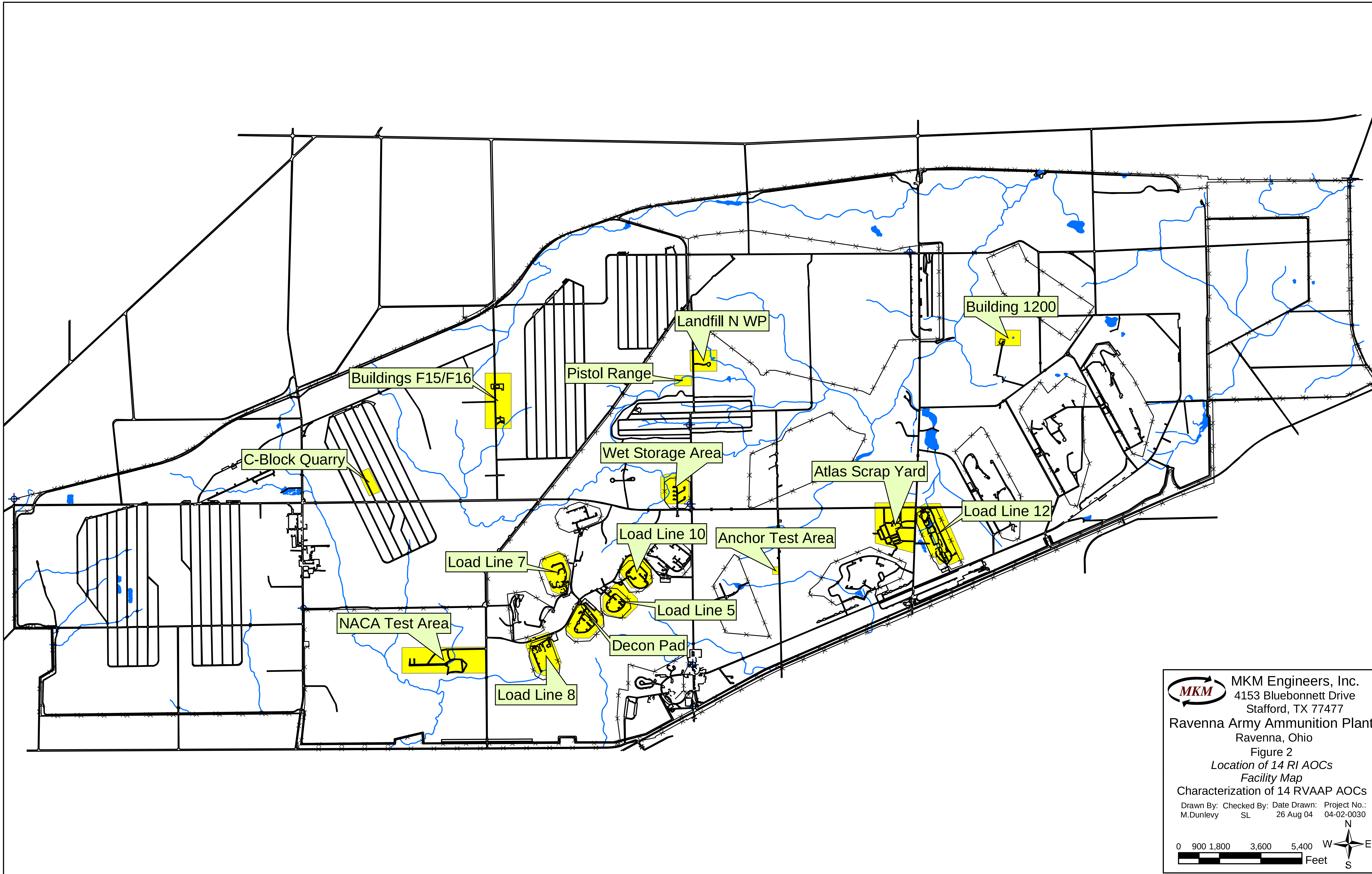


Figure 1. Ravenna Army Ammunition Plant Location Map


Building 1200
Landfill N WP
Pistol Range
Buildings F15/F16
C-Block Quarry
Wet Storage Area
Atlas Scrap Yard
Load Line 12
Load Line 10
Anchor Test Area
Load Line 7
Load Line 5
NACA Test Area
Decon Pad
Load Line 8
MKM
MKM Engineers, Inc.
4153 Bluebonnett Drive
Stafford, TX 77477
Ravenna Army Ammunition Plant
Ravenna, Ohio
Figure 2
Location of 14 RI AOCs
Facility Map
Characterization of 14 RVAAP AOCs
Drawn By: M.Dunlevy
Checked By: SL
Date Drawn: 26 Aug 04
Project No.: 04-02-0030
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Feet
N
W
E
S

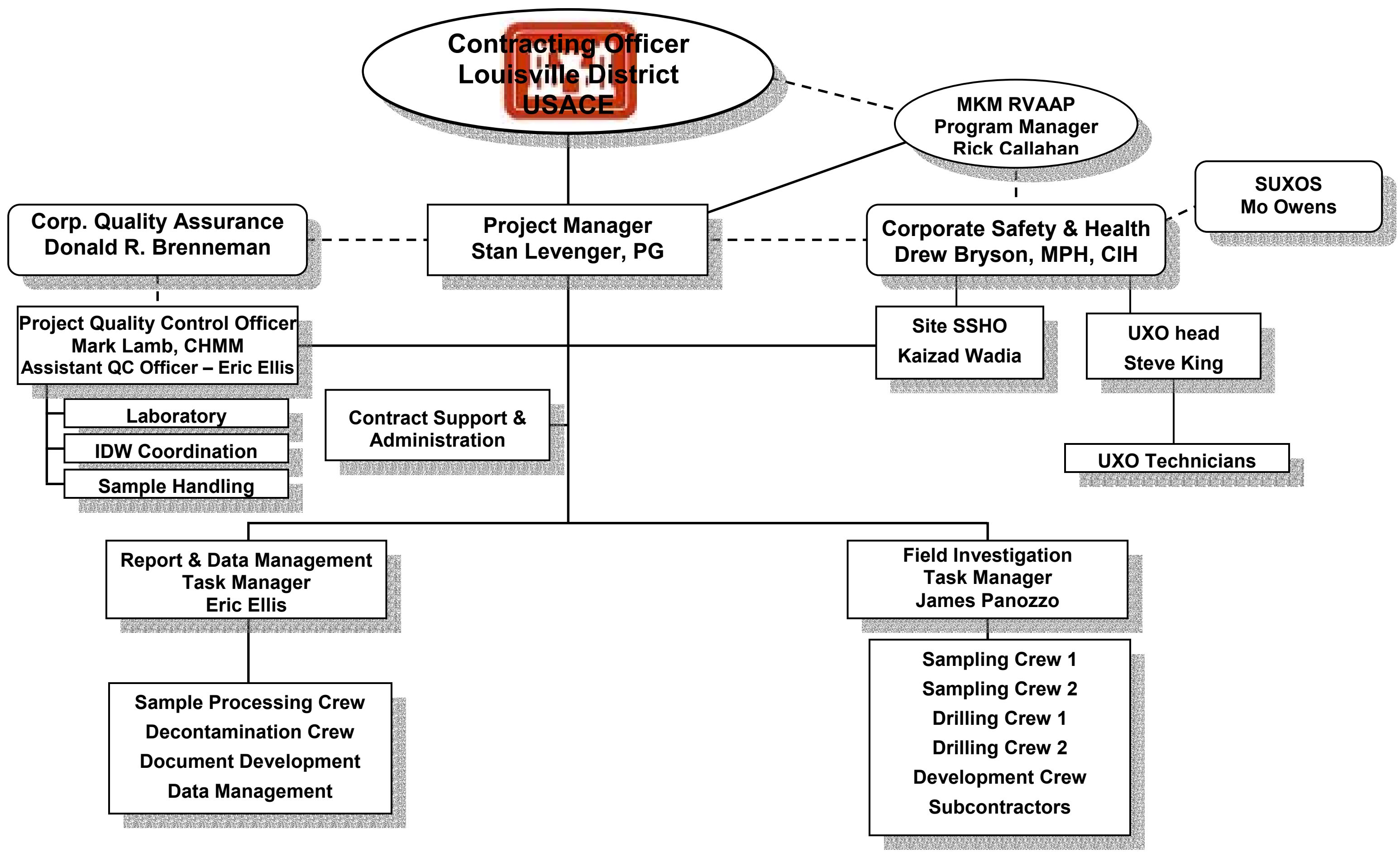
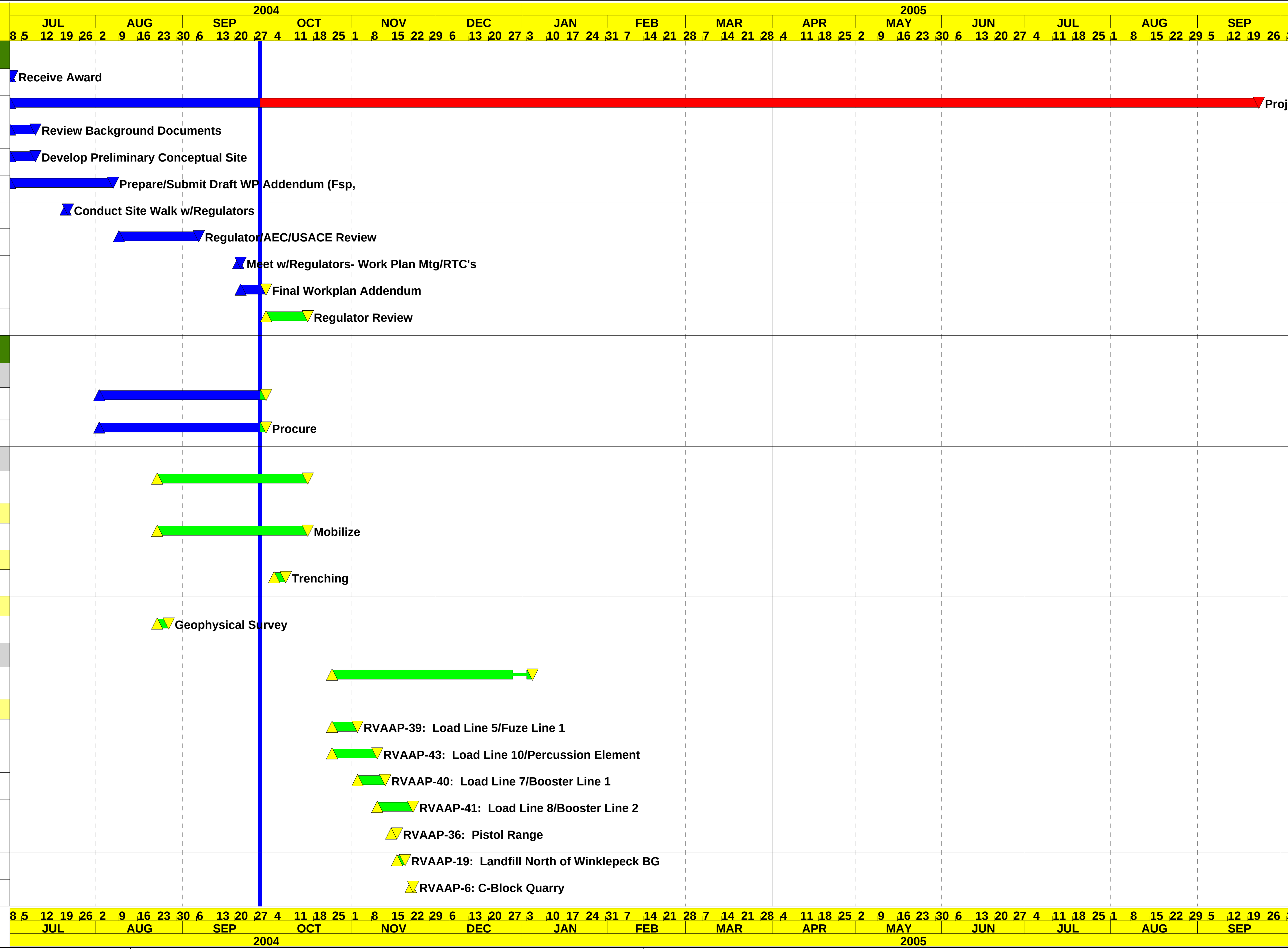


Figure 3.
Organizational Chart

Figure 4
Characterization of RVAPP 14 AOC's
Project Schedule

Activity ID	Activity Description	Orig Dur	Rem Dur	Early Start	Early Finish
PROJECT PLANNING/OVERSIGHT					
V1 10	Receive Award	1	0	01JUL04A	01JUL04A
V1 20	Project Management/Oversight	321	257	01JUL04A	22SEP05
V1 30	Review Background Documents	7	0	01JUL04A	09JUL04A
V1 40	Develop Preliminary Conceptual Site	7	0	01JUL04A	09JUL04A
V1 60	Prepare/Submit Draft WP Addendum	27	0	01JUL04A	06AUG04A
V1 50	Conduct Site Walk w/Regulators	1	0	21JUL04A	21JUL04A
V1 70	Regulator/AEC/USACE Review	21	0	09AUG04A	06SEP04A
V1 80	Meet w/Regulators- Work Plan	1	1	21SEP04	21SEP04
V1 90	Final Workplan Addendum	7	7	22SEP04	30SEP04
V1 100	Regulator Review	11	11	01OCT04	15OCT04
FIELD INVESTIGATION					
Procurement					
Subtotal		21	2	02AUG04A	30SEP04
V1 110	Procure	21	2	02AUG04A	30SEP04
Pre-Sampling Activities					
Subtotal		40	40	23AUG04	15OCT04
Mobilize (PreSmpl Swp, Clr/Grub, Eqp on Site)					
V1 120	Mobilize	40	40	23AUG04	15OCT04
Trenches					
V1 130	Trenching	4	4	04OCT04	07OCT04
Geophysical Survey					
V1 140	Geophysical Survey	4	4	23AUG04	26AUG04
Field Activities					
Subtotal		52	52	25OCT04	04JAN05
Collect/Process Soil, Sediment, SW					
V1 150	RVAAP-39: Load Line 5/Fuze Line 1	7	7	25OCT04	02NOV04
V1 160	RVAAP-43: Load Line 10/Percussion	12	12	25OCT04	09NOV04
V1 170	RVAAP-40: Load Line 7/Booster Line	8	8	03NOV04	12NOV04
V1 180	RVAAP-41: Load Line 8/Booster Line	9	9	10NOV04	22NOV04
V1 190	RVAAP-36: Pistol Range	2	2	15NOV04	16NOV04
V1 200	RVAAP-19: Landfill North of	3	3	17NOV04	19NOV04
V1 210	RVAAP-6: C-Block Quarry	1	1	22NOV04	22NOV04



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Finish Date	07NOV05
Data Date	29SEP04
Run Date	07OCT04 13:49

Run Date 07OCT04 13:49

RIRI

Sheet 1 of 3

MKM Engineers, Inc.

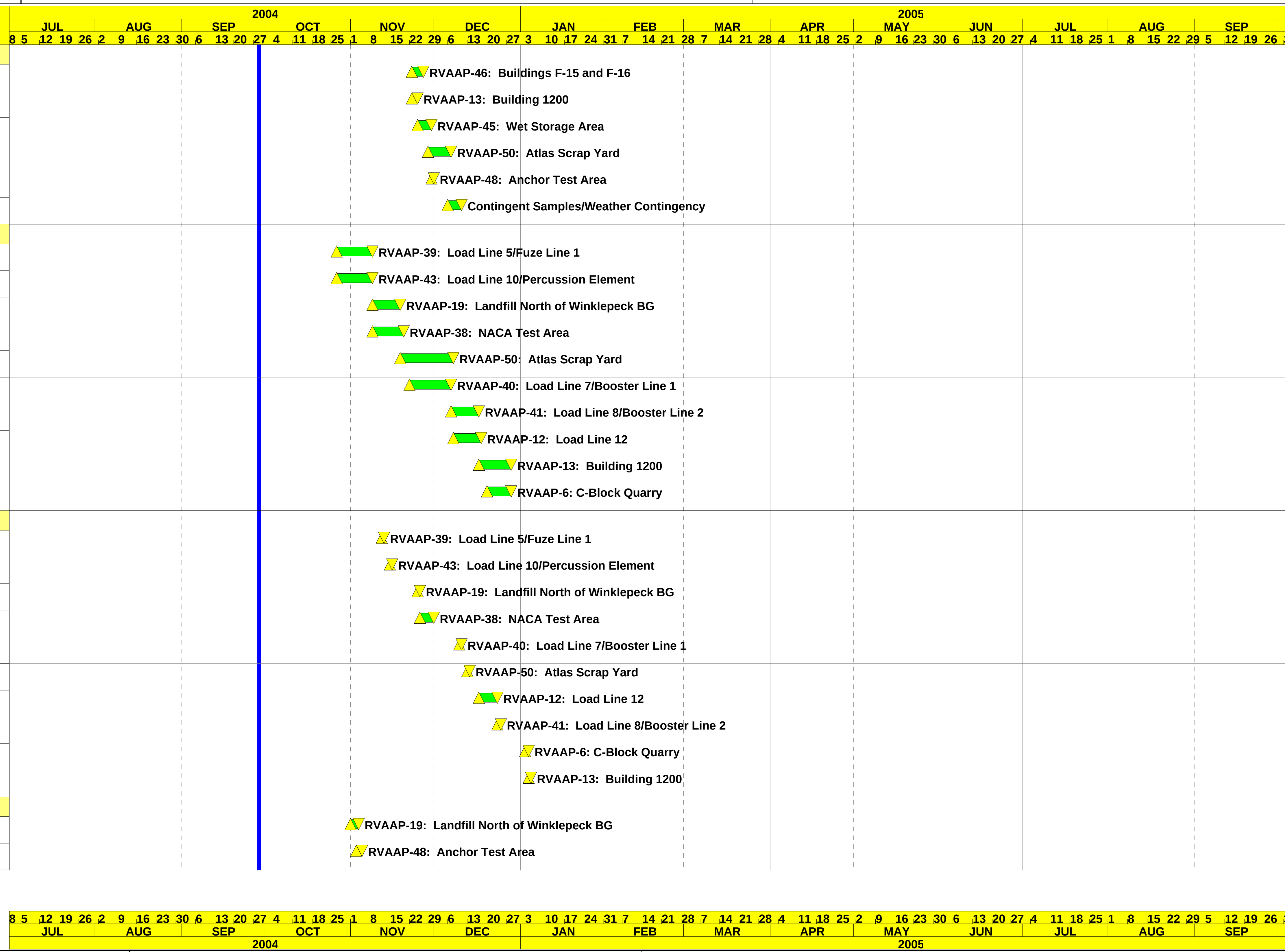
Characterization of RVAPP 14AOC's

Classic Schedule Layout

Date	Revision	Checked	Approved

Figure 4
Characterization of RVAPP 14 AOC's
Project Schedule

Activity ID		Activity Description	Orig Dur	Rem Dur	Early Start	Early Finish
Collect/Process Soil, Sediment, SW						
V1	220	RVAAP-46: Buildings F-15 and F-16	4	4	23NOV04	26NOV04
V1	230	RVAAP-13: Building 1200	2	2	23NOV04	24NOV04
V1	240	RVAAP-45: Wet Storage Area	3	3	25NOV04	29NOV04
V1	250	RVAAP-50: Atlas Scrap Yard	6	6	29NOV04	06DEC04
V1	260	RVAAP-48: Anchor Test Area	1	1	30NOV04	30NOV04
V1	270	Contingent Samples/Weather	5	5	06DEC04	10DEC04
Drilling (Well Installation, Development, Compl)						
V1	280	RVAAP-39: Load Line 5/Fuze Line 1	9	9	27OCT04	08NOV04
V1	290	RVAAP-43: Load Line 10/Percussion	9	9	27OCT04	08NOV04
V1	300	RVAAP-19: Landfill North of	8	8	09NOV04	18NOV04
V1	310	RVAAP-38: NACA Test Area	9	9	09NOV04	19NOV04
V1	320	RVAAP-50: Atlas Scrap Yard	13	13	19NOV04	07DEC04
V1	330	RVAAP-40: Load Line 7/Booster Line	11	11	22NOV04	06DEC04
V1	340	RVAAP-41: Load Line 8/Booster Line	8	8	07DEC04	16DEC04
V1	350	RVAAP-12: Load Line 12	8	8	08DEC04	17DEC04
V1	360	RVAAP-13: Building 1200	8	8	17DEC04	28DEC04
V1	370	RVAAP-6: C-Block Quarry	7	7	20DEC04	28DEC04
Groundwater Sampling						
V1	390	RVAAP-39: Load Line 5/Fuze Line 1	1	1	12NOV04	12NOV04
V1	400	RVAAP-43: Load Line 10/Percussion	1	1	15NOV04	15NOV04
V1	460	RVAAP-19: Landfill North of	1	1	25NOV04	25NOV04
V1	410	RVAAP-38: NACA Test Area	3	3	26NOV04	30NOV04
V1	420	RVAAP-40: Load Line 7/Booster Line	1	1	10DEC04	10DEC04
V1	470	RVAAP-50: Atlas Scrap Yard	1	1	13DEC04	13DEC04
V1	380	RVAAP-12: Load Line 12	5	5	17DEC04	23DEC04
V1	430	RVAAP-41: Load Line 8/Booster Line	1	1	24DEC04	24DEC04
V1	440	RVAAP-6: C-Block Quarry	1	1	03JAN05	03JAN05
V1	450	RVAAP-13: Building 1200	1	1	04JAN05	04JAN05
Geoprobe						
V1	490	RVAAP-19: Landfill North of	3	3	01NOV04	03NOV04
V1	480	RVAAP-48: Anchor Test Area	2	2	03NOV04	04NOV04



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Finish Date	07NOV05
Data Date	29SEP04
Run Date	07OCT04 13:49

Run Date 07OCT04 13:49

RIRI

Sheet 2 of 3

MKM Engineers, Inc.

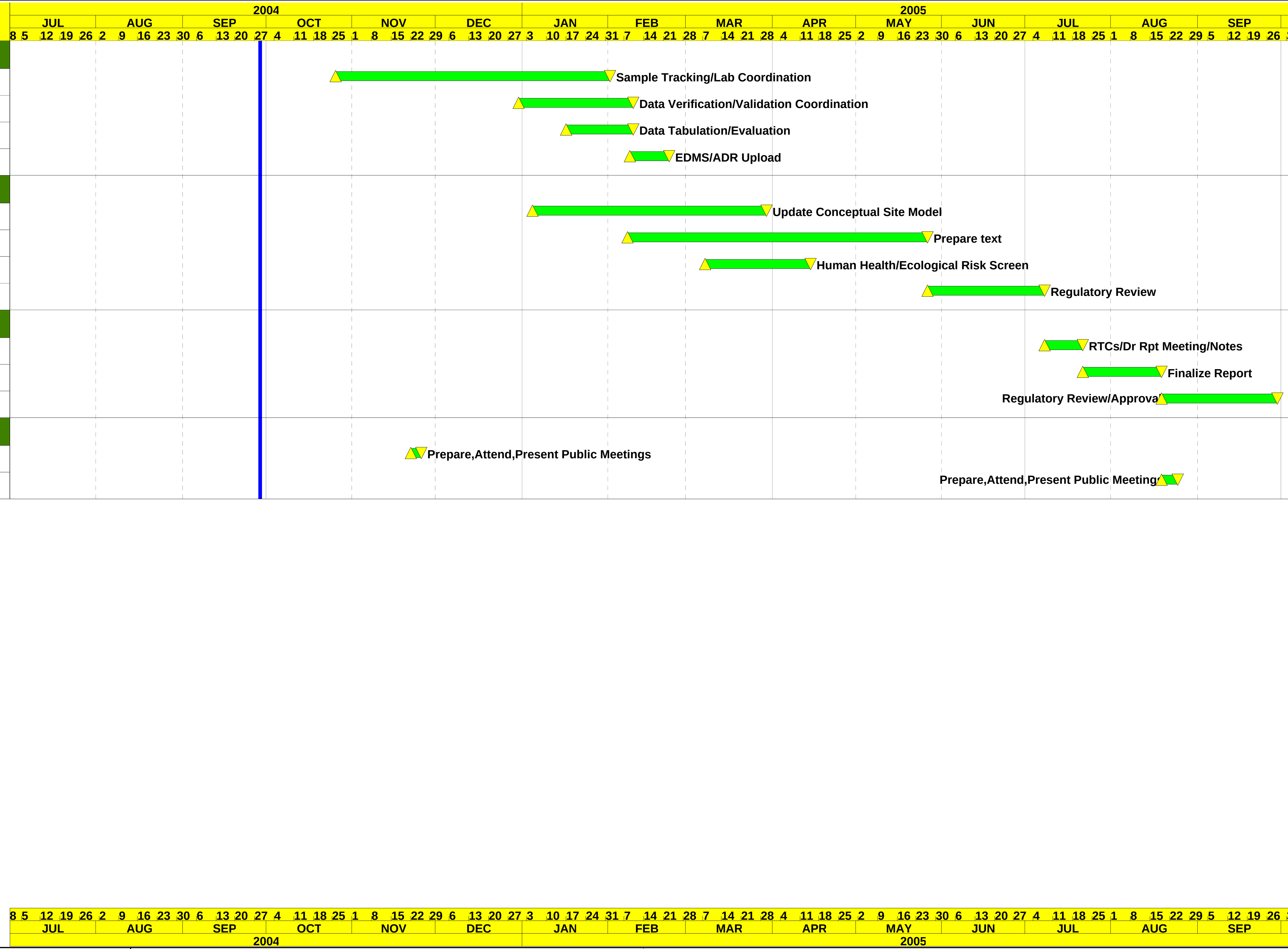
Characterization of RVAPP 14AOC's

Classic Schedule Layout

Date	Revision	Checked	Approved

Figure 4
Characterization of RVAPP 14 AOC's
Project Schedule

Activity ID		Activity Description	Orig Dur	Rem Dur	Early Start	Early Finish
ANALYTICAL INVESTIGATION						
V1	500	Sample Tracking/Lab Coordination	71	71	26OCT04	01FEB05
V1	510	Data Verification/Validation	29	29	31DEC04	09FEB05
V1	520	Data Tabulation/Evaluation	18	18	17JAN05	09FEB05
V1	530	EDMS/ADR Upload	10	10	09FEB05	22FEB05
DRAFT RI REPORT						
V1	540	Update Conceptual Site Model	60	60	05JAN05	29MAR05
V1	560	Prepare text	78	78	08FEB05	26MAY05
V1	550	Human Health/Ecological Risk Screen	28	28	08MAR05	14APR05
V1	570	Regulatory Review	30	30	27MAY05	07JUL05
FINAL REPORT						
V1	580	RTCs/Dr Rpt Meeting/Notes	10	10	08JUL05	21JUL05
V1	590	Finalize Report	20	20	22JUL05	18AUG05
V1	600	Regulatory Review/Approval	30	30	19AUG05	29SEP05
PUBLIC MEETINGS						
V1	610	Prepare,Attend,Present Public	4	4	22NOV04	25NOV04
V1	620	Prepare,Attend,Present Public	4	4	19AUG05	24AUG05



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Finish Date	07NOV05		
Data Date	29SEP04		
Run Date	07OCT04 13:49		

RIRI

Sheet 3 of 3

MKM Engineers, Inc.

Characterization of RVAPP 14AOC's

Classic Schedule Layout

Date	Revision	Checked	Approved

ATTACHMENT 1

ATTACHMENT 1

Munitions and Explosives of Concern (MEC) Avoidance Plan

Munitions and Explosives of Concern Avoidance Plan

MKM

Munitions and Explosives of Concern Avoidance Plan

For The RVAAP 14 AOC Site Characterization

Prepared By:

MKM Engineers, Inc.
8451 State Route 5
Building 1038
Ravenna, Ohio 44266

August 5, 2004

TABLE OF CONTENTS

PREFACE

The objective of this Ordnance Avoidance Plan is to discuss the Munitions and Explosives of Concern (MEC) avoidance services which MKM Engineers, Inc. (MKM) will perform at the Ravenna Army Ammunition Plant (RVAAP) located in Ravenna, Ohio. The MEC avoidance tasks outlined in this plan are required, and will be implemented, due to the potential for site personnel and equipment to encounter hazardous MEC during the performance of environmental sampling tasks to be conducted by MKM.

The MEC avoidance tasks will be performed in accordance with all applicable Federal, state and local regulations, and any work or safety plans that have been implemented by MKM. This document will be used by MKM personnel solely for the conduct of the MEC avoidance activities, and is not intended to address any other safety or health issues related to site-specific hazards or procedures. As such, this document will be used as a supplement to the Work Plans, and shall not, unless specifically stated and required by this document, supersede or change the existing MKM plans. For all non-MEC site activities and requirements, MKM personnel will adhere to and comply with the provisions of the Work Plans.

GENERAL

MKM Engineers, Inc. (MKM) will provide a Unexploded Ordnance (UXO) avoidance team (minimum Tech II) to provide on-site MEC avoidance support during intrusive sampling or work activities at the RVAAP 14 AOCs located at the Ravenna Army Ammunition Plant (RVAAP). This plan will be applied to all MEC avoidance operations conducted by MKM personnel, MKM subcontractors and site visitors. For those hazards and operations not covered by this plan, MKM personnel will follow the provisions of the MKM Work Plans.

DEFINITIONS

Military Munitions

Military munitions means all ammunition products and components produced for or used by the armed forces for national defense and security, including ammunition products or components under the control of the Department of Defense, the Coast Guard, the Department of Energy, and the National Guard. The term includes confined gases, liquid, and solid propellants, explosives, pyrotechnics, chemical and riot control agents, smokes, and incendiaries, including bulk explosives and chemical warfare agents, chemical munitions, rockets, guided and ballistic missiles, bombs, warheads, mortar rounds, artillery ammunitions, small arms ammunition, grenades, mines, torpedoes, depth charges, cluster munitions and dispensers, demolitions charges, and devices and components thereof.

The term does not include wholly inert items, improvised explosive devices, and nuclear weapons, nuclear devices, and nuclear components, other than non-nuclear components of nuclear devices that are managed under the nuclear weapons program of the Department of Energy after all required sanitation operations under the Atomic Energy Act of 1954 (42 U.S.C. 2011 et seq.) have been completed (10 U.S.C. 101(e)(4).

Munitions and Explosives of Concern (MEC)

This term, which distinguishes specific categories of military munitions that may pose unique explosives safety risks, means:

(A) Unexploded Ordnance (UXO), as defined in 10 U.S.C. 2710(e)(9);
(B) Discarded military munitions (DMM), as defined in 10 U.S.C. 2710(e)(2);
(C) Munitions constituents (MC) present in high enough concentrations (i.e. TNT greater than 10% in soil) to pose an explosive hazard.

Unexploded Ordnance (UXO)

Military munitions that:

(A) Have been primed, fused, armed, or otherwise prepared for action;
(B) Have been fired, dropped, launched, projected, or placed in such a manner as to constitute a hazard to operations, installations, personnel, or material; and
(C) Remain unexploded whether by malfunction, design, or any other cause (10 U.S.C. 101(e)(5)).

Discarded Military Munitions (DMM)

Military munitions that have been abandoned without proper disposal or removed from storage in a military magazine or other storage area for the purpose of disposal. The term does not include UXO, military munitions, that are being held for future use or planned disposal, or military munitions that have been properly disposed of consistent with applicable environmental laws and regulations (10 U.S.C. 2710(e)(2)).

Munitions Constituents (MC)

Any materials originating from UXO, DMM, or other military munitions, including explosive and nonexplosive materials, and emission, degradation, or breakdown elements of such ordnance or munitions (10 U.S.C. 2710(e)(4)). MC includes both chemically reactive materials (explosives) and traditionally non-explosive materials (i.e. shell casings and fragmentation). Munitions constituents are further defined into:

(A) Materials Potentially Presenting an Explosive Hazard (MPPEH) and
(B) Munitions debris.

<u>Materials Potentially Presenting an Explosive Hazard (MPPEH)</u>

Material potentially containing explosives or munitions (including containers, packing material, munitions debris, and range related debris), or materials potentially contaminated with a high enough concentration of explosives such that the material presents an explosives hazard (i.e. equipment, holding tanks, piping and drainage systems).

<u>Munitions Debris</u>

Remnants of munitions remaining after munitions use, demilitarization, or disposal.

Explosive Ordnance Disposal (EOD) Personnel

Active duty military EOD personnel who have received documented training in the military and perform EOD functions.

UXO Personnel

UXO personnel are former military EOD personnel who are employed by a civilian contractor.

REFERENCES

MKM personnel shall employ and refer to the following documents when conducting OE avoidance operations.

- US Army Corps of Engineers (USACE), Engineering Pamphlet (EP) 75-1-2, Unexploded Ordnance (UXO) Support During Hazardous, Toxic, And Radioactive Waste (HTRW) And Construction Activities, 20 November 2000.

- USACE EP 385-1-95a, Basic Safety Concepts and Considerations for Ordnance and Explosives (OE) Activities, 29 June 2001.

MEC TEAM COMPOSITION AND QUALIFICATIONS

MEC Team shall consist of two members during MEC avoidance activities involving the need to clear work and sampling areas. For intrusive sampling or work activities, only one MEC technician will be required to provide down-hole magnetometer support.

GENERAL QUALIFICATIONS

MKM will utilize one UXO Supervisor as a team leader and other qualified personnel for the performance of the assigned tasks. UXO-qualified technicians will be used to escort non-UXO personnel and to conduct MEC avoidance services involving magnetometer surveys and if needed, the investigation of anomalies. UXO-qualified technicians to be used on this project will have the training and experience required by the U.S. Army Engineering and Support Center, Huntsville, (CEHNC) the USACE Mandatory Center of Expertise (MCX) for MEC. Additionally all MKM personnel will have met the occupational Safety and Health Administration (OSHA) training and medical surveillance requirements as outlined in the 29 CFR Part 1910.120.

RESPONSIBILITIES OF MKM SITE PERSONNEL

UXO Supervisor

The SUXOS will have the direct responsibility for, and will be the technical lead for, all MEC operations conducted on-site. As such the SUXOS will ensure the proper performance of all MKM on-site operations, and will manage the MKM on-site personnel, and resources. Due to the small size of each MKM field team, the SUXOS will also act as the UXO Site Officer, and will have the following responsibilities:

1. Providing the MEC portions of the initial, pre-operational and daily tailgate safety briefings;

2. Ensuring that all site operations are conducted IAW this document, the SSHP, and all other relevant safety and health regulations and standards;

3. Consulting with the MKM Certified Industrial Hygienist (CIH) for questions or concerns regarding occupational safety and health;

4. Ensuring that all geophysical surveying and magnetometer instruments are calibrated, field checked, and operated IAW the manufacturer's instructions or established procedures, to include the recording of data relative to equipment calibration, repair or replacement.

UXO Specialist

The UXO Specialist for this project meet all the training and experience requirements for a UXO Technician II as outlined in EP-385-1-95a. The UXO Specialist will be responsible for safely conducting site operations as directed by the UXO Supervisor. The UXO Specialist will comply with this plan and the Work Plans, and will immediately report to the UXO Supervisor any known, or potentially, hazardous condition observed.

GENERAL PROJECT DESCRIPTION

MKM will conduct MEC avoidance at the RVAAP 14 AOCs. Due to the potential for encountering MEC, MKM has been tasked with the following responsibilities:

1. Providing MEC recognition and avoidance training for non-UXO qualified personnel.

2. Providing escort to MKM personnel, subcontractors and equipment during the conduct of intrusive sampling activities.

3. Determining the location of anomaly-free locations for soil boring.

MEC FIELD INVESTIGATION EQUIPMENT

To conduct the MEC avoidance services, an UXO-qualified technician will utilize a Schonstedt magnetometer (or equivalent) to conduct sweeps of work areas and conduct down-hole surveys to detect ferrous anomalies. A response check of the Schonstedts will be conducted daily, prior to use, to ensure that the instruments are operating properly. Only properly trained MKM UXO-qualified technicians will handle and operate these instruments.

UXO SAFETY PRECAUTIONS AND PROCEDURES

GENERAL SAFETY MEASURES

Operations at the RVAAP 14 AOCs with the potential for encountering MEC shall be conducted only by appropriately trained, MKM UXO-qualified technicians. Non-UXO qualified personnel will be allowed to operate in a MEC area only when escorted and directly observable by a UXO-qualified technician. For the purpose of this avoidance plan, a MEC area shall be defined as an area which has not been cleared and demarcated by UXO-qualified technician and where the potential exists for encountering MEC. Once an area has been cleared and demarcated as being anomaly-free, non-UXO personnel may walk and transport equipment within the demarcated area without direct supervision of the UXO personnel. However, intrusive activities by non-UXO personnel will be directly supervised by an UXO technician. The general MEC safety measures listed below will be strictly adhered to during the conduct of MEC operations at the RVAAP 14 AOCs.

1. Using the procedures in this avoidance plan, work areas for all sampling sites will be surveyed by MKM personnel prior to non-UXO qualified personnel accessing the area.

2. Using the procedures in this avoidance plan, MKM personnel will conduct down-hole surveying of sampling sites prior to drilling or augering activities, after the initial one foot sample is taken and then at two-foot intervals as necessary. It is anticipated that there will only need to be one down-hole check per sampling location since the sampling depth should end at three feet.

3. Before driving stakes or marker posts into the ground a magnetometer check of the point of ground penetration will be performed.

4. Until such time as an area is cleared of MEC hazards, and positively demarcated by MKM personnel, non-UXO qualified personnel will not enter or perform activities in a potential MEC area unless escorted or supervised by UXO-qualified personnel.

5. Non-UXO qualified personnel will not touch or disturb any object that is potentially MEC related, and will immediately notify the nearest UXO-qualified technician of the presence of the object.

6. Sub-surface magnetometer survey equipment will be calibrated and operated in accordance with the manufacturer's requirements and procedures.

MEC AVOIDANCE PROCEDURES

MEC Avoidance for Sampling and Work Areas

Prior to personnel conducting sampling operations, UXO personnel will conduct a visual and magnetometer survey of the access lanes to the sampling locations and the work areas adjacent to each location. The access lanes shall be surveyed to a minimum width of five feet (or twice the width of the widest piece of equipment to be used at the sampling site, as determined by the UXO Supervisor). The surveyed work areas around the sampling sites, will if need be widened if more area is needed for equipment and personnel staging and use. Each access lane and work area will be surveyed using the Schonstedt which will allow for MEC avoidance to an approximate depth of two feet. The procedures listed below will be followed during access lane or work area clearances.

1. Surveyed access lanes and work areas shall be clearly marked with wooden stakes, pin flags, surveyors tape, caution tape or other positive means.

2. The primary objective of each surface survey will be to identify an access lane that accesses the work area as directly as possible without encountering subsurface anomalies, and to identify sampling locations that are also free of anomalies.

3. If a surface anomaly is found and identified as being known or potential MEC, the UXO-qualified technician will flag the anomaly and will re-direct the access lane or relocate the sampling site in such a manner as to enable identification of an anomaly free area. The presence of the MEC item will be recorded and reported to the MKM Project Manager.

4. If a subsurface anomaly is located, the UXO-qualified technician will assume it to be MEC. The anomaly will be flagged and the access lane or drilling/sampling point will be re-located/directed.

5. If an access lane or work area must be significantly re-directed, the UXO-qualified technician will consult with the Project Manager and Field Task Manager to ensure the re-directed access lane or work area will still meet the needs and requirements of the project mission.

Clearance of Sampling Sites

MKM UXO-qualified personnel will conduct a clearance of each soil boring site through the use of surface and down-hole magnetometry. To ensure that the soil around and under each intrusive site is free of potential MEC, MKM personnel will use the procedures listed below. During the actual sampling, only one UXO-qualified technician will be required to escort the non-UXO personnel and clear the sampling locations.

1. Prior to initiating the intrusive activity, a surface check of the location will be conducted using the Schonstedt to ensure that the surface and first two feet is free of ferrous anomalies.

2. If a positive reading occurs the location will be flagged, and the sampling point shall be relocated to another area that is free of ferrous anomalies.

3. After establishment of an approved sampling point, and having previously cleared the surrounding work area, the soil will be drilled by sampling technicians to a depth of 1 foot.

4. Once the sample has been taken from the zero to one-foot depth, the UXO-qualified technician will insert the Schonstedt into the hole and check if any ferrous anomalies exist under the hole.

5. If no ferrous anomalies are indicated, the Schonstedt will be removed and the sample from the one to three foot depth will be taken.

6. If a subsurface ferrous object is detected, the sampling location will be abandoned and a new sampling location will be selected by the sampling technicians and the above procedures will be followed for the new location.

7. In the event that the UXO-qualified technician experience difficulties in locating an anomaly-free drilling/boring location, UXO personnel will consult with the Project Manager.

ATTACHMENT 2

GUIDANCE FOR MULTI-INCREMENTAL SAMPLING

1 Purposes & Basic Requirements of Taking Multi-Incremental Samples

a The purpose of collecting, preparing, and analyzing a multi-incremental sample is to provide a repeatable and accurate measure of the average concentrations of constituents of interest within a sample area. Specific data quality objectives (DQOs) will be required for each project that will determine the types and numbers of samples required.

b Sufficient amount of sample material must be collected from the sample area to account for compositional heterogeneity and additionally, a sufficient number of sub samples utilizing a stratified random methodology must be taken to account for distributional heterogeneity.

c Typical uses of accurate, average values are as,
- exposure point concentrations within human health or ecological risk assessments,
- delineation of nature and extent of contamination,
- characterization sampling of a potential waste material, and
- closure sampling of a remediated area to provide legally defensible, scientifically based evidence that satisfactory remediation has been accomplished.

d The likelihood of determining small scale hot spots of contamination by conventional discrete sampling is extremely low, unrepeatable, and legally indefensible. Multi-incremental sampling, alternatively, provides a much greater probability of determining representative, repeatable, and legally defensible contamination within a reasonably sized area,see Reference 8.

2 Determination of Multi-Incremental Sample Areas

The determination of appropriate sample areas depends on many factors including, the ultimate use of the average value, the constituent's toxicity and mobility, physical/chemical characteristics of a given site, and the reasonably anticipated future land use. For instance, in the ecological realm, if a fish population study is to be conducted over a specified reach of a creek or river, then the appropriate multi-incremental sample area is the entire same specified reach of that creek or river. If a vegetation analysis is to be made at a burning pad at a burning grounds, then the appropriate sample area is the pad area.

In the human health realm, if the future land use is known, then the appropriate sample area is the smallest exposure area associated with that land use. For instance, if a given site is to be industrial, then the appropriate sample area would be the smallest exposure area associated with industrial usage. If an unrestricted land use, residential, is used, then the smallest exposure area is ¼ acre, and thus sample areas would be no larger than ¼ acre.

In many instances, the physical/chemical/operational characteristics at the site will direct appropriate sample areas. For instance, see Attachment 1, the areas about 20' wide immediately adjacent to the melt pour buildings at the RVAAP at Load Lines 1,2, and 3 are several feet lower in elevation than those areas beyond 20 feet from the buildings. During operation of the melt pour buildings, the floors of the melt pour buildings were routinely rinsed and the subsequent water washed out the doors on all four sides of the buildings. Appropriate sample areas would be the lower elevation areas immediately adjacent to the buildings on each of the four sides, and additional sample areas on the higher elevation areas on all four sides of the buildings.

The determination of multi-incremental sample areas would generally be done on a site by site basis for any given investigation in coordination with risk assessment guidelines and risk assessor recommendations. Similar site by site selection is required when discrete biased sampling is performed, so there is nothing new or additional in determining appropriate multi-incremental sample areas.

3 Determination of Sub-Sample Locations within a Multi-Incremental Sample Area

Obviously, the best and surest measure of determining the average value within a sample area would be to collect portions over the entire sample area. But because that is cost prohibitive in most cases, sampling of only portions within the sample area must be done. As in many other disciplines where heterogeneity is a major concern, sub-sample locations should be selected on a stratified-random basis. The stratification assures coverage over the entire sample area and the randomness provides repeatability and accuracy. Varying degrees of sophistication may be utilized to achieve stratified random sampling locations, as subdividing a sample area into say 30 sub-sample areas and then using a random number generator to select a location within the 30 sub-sample areas. This method requires minor surveying, but the major disadvantage is that sometimes the random locations are not accessible, as for instance if a large tree is present at the specified location. **Alternatively, the sub-sample locations may be located by a "drunken-sailor" approach wherein a sample locator merely wanders over the entire sample area throwing out**

sampling location stakes randomly as he/she walks over the entire sample area.

Generally about 30 sub-samples should be taken within a given sample area. If replicates yield a variability that is too great, then the number of sub-samples would have to be increased, possibly as high as 100 and potentially more sample mass would be required.

4 Collection of a Multi-Incremental Sample

Because of the use of multi-incremental sampling in other disciplines, tools already exist to collect sub samples of environmental media, as soil and sediment. Reference to the Forest Suppliers, Inc Catalog 54, pages 223 - 229 and the AMS 2003 Soil and Groundwater 2003 Catalog, pages 20 - 39 shows many types of tools are already available that can be used to easily collect the necessary sub-samples. Generally, the samplers should be stainless steel if metals analyses are to be made and a small volume should be collected to facilitate subsequent sample processing. For sediment sampling recently performed something as simple as a plastic scope was utilized. Recent examples of sampling tools utilized have included:

RVAAP Facility-Wide Surface Water Sediment Study,

- Eckman dredges for sediment in the large ponds with soft mud, silt or sand bottoms (not appropriate for gravel, rock bottoms, or detritus),
- Plastic scoops for silt, sand, clay creek sediment along the rock bottom creeks,
- A 7/8″-diameter step probe for small pond sediment sampling

It is envisioned that the surface soil and dry sediment, and probably pond multi-incremental sampling for the Characterization of 14 RVAAP AOCs will be performed with a 7/8″-diameter step probe.

If feasible, disposable tools may be utilized; otherwise decontamination can be made of tools between sample areas, but obviously not during collection of the sub-samples within a sample area. Selection of sampling tools and equipment will also be dependent upon the DQOs and will be identified in the Project Specific Sampling Plan Addendum.

As in all field sampling, sufficient prefield work should be done to select an array of possible tools. Then selection and use of the tools should be customized to the actual field conditions. For instance, one type of surface soil sampler may be more effective with sandy soils than with clayey soils.

The sub-samples collected from a sample area should be all placed in a container, as a large baggie or bowl, large enough to transport them back to the sample processing location.

Because of volatilization issues, multi-incremental sampling cannot be utilized for collection of samples for VOC analysis unless collected samples are stored in a solution of methanol.

Additionally, if SVOCs are of concern, further consideration of the use of plastic sampling materials should be done prior to sampling.

5 Processing of a Multi-Incremental Sample

The overall goal of the field collection is to collect sufficient material over the sample area to account for both compositional and distributional heterogeneity. In all probability much more sample material will be collected in the field than will be tested in the laboratory. If facilities are available in the field, field sample processing can be done prior to shipment of a sample to the laboratory. If no facilities are available in the field, the total collected field sample can be forwarded to the laboratory where sample processing can be performed. Sample processing must be done of the field collected sample to again provide a representative, but smaller sample of appropriate quantity for laboratory analyses.

The type of material collected will determine the type of processing required. For the thoroughly saturated clayey sediments (muck) collected from the ponds in the RVAAP Surface Water/ Sediment Study, the entire saturated sample was laid out and 30 small spoon samples taken randomly across the mix to fill each of the analytical sample jars.

For less saturated materials, the total sample of a sample area should initially be air dried overnight. Subsequently, the entire air-dried multi-incremental sample should be sieved according to the needs of the DQOs, but for soil the most typical size is a #10 sieve. Any materials larger than #10 discarded should be discarded. The remaining air-dried, sieved material should then be ground to better homogenize the sample. At the Lexington Blue Grass Study and at the Joliet Army Reserve Study, a MC200 Miracle Mill was utilized for grinding. Successful grinding was accomplished at the GPL Laboratory utilizing a Hamilton Beach Custom Grind coffee grinder. As before, the ground material should be laid out and 30 small spoon samples were taken randomly across the mix to fill each of the analytical sample jars.

The sample processing provides a much more representative, uniform, repeatable set of jar samples that analytical labs can analyze.

It is envisioned that all surface soil, dry sediment, and wet sediment multi-incremental samples for the Characterization of 14 RVAAP AOCs will be air-dryed, then passed through #4 and #10 sieves, ground, and

then incrementally placed into sample jars. Floor sweep samples will just be incrementally placed into sample jars.

6 Quality Control/Assurance

A Field

To measure repeatability of field collection techniques, two separate field samples can be collected using the same field collection techniques from any given sample areas to measure their repeatability. **Collection of duplicative samples should be done as a minimum for each type of environmental media and on a pre-selected basis of 1 in 20 where there are more than 15 samples of a given media.** The results of these duplicative samples can then be used to measure repeatability. If such samples are indeed very repeatable, their accuracy can be inferred. If the variability of the replicates is too great, either the number of increments or the mass must be increased (and in some cases both).

B Laboratory

The current practice of preparing duplicates or splits from a single discrete sample is extremely flawed because of no sample processing prior to sending the jar samples to the laboratory. The measures specified for sample processing in 5 above will provide samples to the laboratories that are much more similar than the current practice. With more uniform samples received from the field, the comparison of analytical results from different labs and QC samples from the same laboratory will be much more valid. Significantly improved agreement between original, QC, and QA samples has been observed at both the RVAAP Facility-Wide Surface Water/Sediment Project and the Joliet Army Reserve Project, Attachments B and C, respectively.

Attachments

1 Melt Pour Building Sample Area Determination
2 RVAAP Facility-Wide Surface Water/Sediment Study
3 Joliet, IL Army Reserve Center Study

References

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QAPP ADDENDUM

Quality Assurance Project Plan (QAPP) Addendum

Characterization of the 14 Areas of Concern (AOCs) at the Ravenna Army Ammunition Plant

Ravenna, Ohio

October 2004

Prepared for

US Army Corps of Engineers – Louisville District
600 Dr. Martin Luther King Jr. Place
Louisville, Kentucky 40202
GSA Contract No. GS-10F-0542N

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APPENDICIES

ABBREVIATIONS

COC	Chain of Custody
CX	Center of Excellence
DQO	Data Quality Objective
EPA	U.S. Environmental Protection Agency
HTRW	Hazardous, Toxic, and Radioactive Waste
LCL	Lower Control Limits
LCS	Laboratory Control Sample
LQM	Laboratory Quality Manual
MS	Matrix Spike
MSD	Matrix Spike Duplicate
PCB	Polychlorinated Biphenyl
QA	Quality Assurance
QC	Quality Control
QAPP	Quality Assurance Project Plan
RI	Remedial Investigation
RL	Reporting Limits
RVAAP	Ravenna Army Ammunition Plant
SAP	Sampling and Analysis Plan
SOP	Standard Operating Procedure
TAL	Target Analyte List
TCL	Target Compound List
UCL	Upper Control Limits
USACE	U.S. Army Corps of Engineers
WP	Work Plan

INTRODUCTION

This Quality Assurance Project Plan (QAPP) addendum addresses supplemental project-specific information in relation to the Revised 2001 Facility Wide QAPP for the Ravenna Army Ammunition Plant (RVAAP), Ravenna, Ohio. Each QAPP section is presented documenting adherence to the Facility Wide QAPP or stipulating project-specific addendum requirements.

1.0 PROJECT DESCRIPTION

1.1 SITE HISTORY/BACKGROUND INFORMATION

This information is presented in Section 1.2 of the Sampling and Analysis (SAP) Addendum for the Characterization of 14 RVAAP AOCs.

1.2 PAST DATA COLLECTION ACTIVITY/CURRENT STATUS

This information is presented in Sections 1.1 through 1.4 of the SAP Addendum for the Characterization of 14 RVAAP AOCs.

1.3 PROJECT OBJECTIVES AND SCOPE

This information is presented in Section 3.0 of the SAP Addendum for the Characterization of 14 RVAAP AOCs.

1.4 SAMPLE NETWORK DESIGN AND RATIONALE

This information is presented in Section 4.0 of the SAP Addendum for the Characterization of 14 RVAAP AOCs.

1.5 PARAMETERS TO BE TESTED AND FREQUENCY

Sample matrix types, analytical parameters, and analytical methods are discussed in Section 4.0 of the SAP Addendum for the Characterization of 14 RVAAP AOCs. These analyses are summarized in Tables 1-1 through 1-16 of this QAPP addendum, in conjunction with anticipated sample numbers, quality assurance (QA) sample frequencies, field quality control (QC) sample frequencies and the 10% USACE QA Split sample frequencies. All QA split samples will be submitted to a USACE specified Laboratory (USACE funded) for analysis.

1.6 PROJECT SCHEDULE

The project schedule for this AOC characterization is discussed in Section 4.0 of the SAP Addendum for the Characterization of 14 RVAAP AOCs.

TABLE 1-1
SAMPLE ANALYSIS SPREADSHEET
CHARACTERIZATION OF 14 RVAAP AOCs - *C-BLOCK QUARRY*

SAMPLE PREFIX	SAMPLE ID		VOC	SVOC	Explosives	Propellants	TAL Metals	Chrome +6	Pesticides	PCB	Cyanides	Nitrate	TOC	Geo-Tech Analysis	Grain Size	FIELD QA/QC SAMPLES					
CBL			8260B	8270C	8330	3532/8330	6010/7000	7196A	8081A	8082B	9010A/9012A	EPA 353.2	EPA 415.1	(Various)	ASTM D422	Multi-Incremental QA	Duplicate Sample	Equipment Blank	Trip Blank	MS/MSD	USACE Split
MULTI-INCREMENTAL SOILS																					
Surface Soils	SS-001M	0001			1		1	1													
	SS-002M	0001			1		1	1													
	SS-003M	0001			1		1	1									1			1	1
	SS-004M	0001			1		1	1													
	SS-005M	0001	1	1	1	1	1	1	1	1											
	SS-006M	0001			1		1	1													
			1	1	6	1	6	6	1	1	0	0	0	0	0	0	1	0	0	1	1
GROUNDWATER	MW-001	0001	1	1	1	1	1	1	1	1				1	1						
	MW-002	0001	1	1	1	1	1	1	1	1				1	1		1		1		1
	MW-003	0001	1	1	1	1	1	1	1	1											
	MW-004	0001	1	1	1	1	1	1	1	1											
			4	4	4	4	4	4	4	4	0	0	0	2	2	0	1	0	1	0	0
SURFACE WATER	SW-001	0001	1	1	1	1	1	1	1	1											
Spring	SW-002	0001	1	1	1	1	1	1	1	1									1		
	SW-003	0001	1	1	1	1	1	1	1	1							1				1
			3	3	3	3	3	3	3	3	0	0	0	0	0	0	1	0	1	0	1
SEDIMENT	SD-001	0001			1		1	1					1		1						
Spring	SD-002	0001	1	1	1	1	1	1	1	1			1		1		1				1
	SD-003	0001			1		1	1					1		1						
			1	1	3	1	3	3	1	1	0	0	3	0	3	0	1	0	0	0	0
DECON WATER	DECON1	0001	1	1	1	1	1														
			1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
DISPOSAL WASTE	WD1	0001	1	1	1		1		1	1	1										
			1	1	1	0	1	0	1	1	1	0	0	0	0	0	0	0	0	0	0

Notes:

Geo-tech analysis consists of Moisture Content (ASTM D2216), Atterburg Limits (ASTM D4318), UCS (ASTM D2487), pH (EPA 150.1) & Specific Gravity (ASTM D854)

Grainsize and TOC are taken at "all major drainageway" sediments

All shelby tubes taken during MW installatinons will have full geo-tech and grainsize analyses

TABLE 1-2
SAMPLE ANALYSIS SPREADSHEET
CHARACTERIZATION OF 14 RVAAP AOCs - *LOAD LINE 12*

SAMPLE PREFIX			VOC	SVOC	Explosives	Propellants	TAL Metals	Chrome +6	Pesticides	PCB	Cyanides	Nitrate	TOC	Geo-Tech Analysis	Grain Size	FIELD QA/QC SAMPLES					
L12	SAMPLE ID		8260B	8270C	8330	3532/8330	6010/7000	7196A	8081A	8082B	9010A/9012A	EPA 353.2	EPA 415.1	(Various)	ASTM D422	Multi-Incremental QA	Duplicate Sample	Equipment Blank	Trip Blank	MS/MSD	USACE Split
GROUNDWATER	MW-242	0001	1	1	1	1	1		1	1		1		1	1						
Newly Installed Wells	MW-243	0001	1	1	1	1	1		1	1		1									
	MW-244	0001	1	1	1	1	1		1	1		1									
	MW-245	0001	1	1	1	1	1		1	1		1					1	1	1	1	1
	MW-246	0001	1	1	1	1	1		1	1		1									
			5	5	5	5	5	0	5	5	0	5	0	1	1	0	1	1	1	1	1
GROUNDWATER	L12MW-088	0001	1	1	1	1	1		1	1		1									
Existing Wells	L12MW-107	0001	1	1	1	1	1		1	1		1									
	L12MW-113	0001	1	1	1	1	1		1	1		1									
	L12MW-128	0001	1	1	1	1	1		1	1		1									
	L12MW-153	0001	1	1	1	1	1		1	1		1									
	L12MW-154	0001	1	1	1	1	1		1	1		1									
	L12MW-182	0001	1	1	1	1	1		1	1		1					1		1		1
	L12MW-183	0001	1	1	1	1	1		1	1		1									
	L12MW-184	0001	1	1	1	1	1		1	1		1									
	L12MW-185	0001	1	1	1	1	1		1	1		1									
	L12MW-186	0001	1	1	1	1	1		1	1		1									
	L12MW-187	0001	1	1	1	1	1		1	1		1									
	L12MW-188	0001	1	1	1	1	1		1	1		1									
	L12MW-189	0001	1	1	1	1	1		1	1		1									
			14	14	14	14	14	0	14	14	0	14	0	0	0	0	1	0	0	0	1
DECON WATER	DECON1	0001	1	1	1	1	1														
			1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
DISPOSAL WASTE	WD1	0001	1	1	1		1		1	1	1										
			1	1	1	0	1	0	1	1	1	0	0	0	0	0	0	0	0	0	0

Notes:
Geo-tech analysis consists of Moisture Content (ASTM D2216), Atterburg Limits (ASTM D4318), UCS (ASTM D2487), pH (EPA 150.1) & Specific Gravity (ASTM D854)
Grainsize and TOC are taken at "all major drainageway" sediments
All shelby tubes taken during MW installatinons will have full geo-tech and grainsize analyses

TABLE 1-3
SAMPLE ANALYSIS SPREADSHEET
CHARACTERIZATION OF 14 RVAAP AOCs - *BUILDING 1200*

SAMPLE PREFIX B12	SAMPLE ID		VOC 8260B	SVOC 8270C	Explosives 8330	Propellants 3532/8330	TAL Metals 6010/7000	Chrome +6 7196A	Pesticides 8081A	PCB 8082B	Cyanides 9010A/9012A	Nitrate EPA 353.2	TOC EPA 415.1	Geo-Tech Analysis (Various)	Grain Size ASTM D422	FIELD QA/QC SAMPLES: Multi-Incremental QA	Duplicate Sample	Equipment Blank	Trip Blank	MS/MSD	USACE Split
MULTI-INCREMENTAL SOILS																					
Surface Soils	SS-013M	0001			1		1														
	SS-014M	0001			1		1														
	SS-015M	0001			1		1										1			1	1
	SS-016M	0001			1		1														
	SS-017M	0001			1		1														
	SS-018M	0001	1	1	1	1	1		1	1									1		
Dry-Ditch Soils	SS-019M	0001			1		1														
	SS-020M	0001			1		1														
	SS-021M	0001			1		1														
	SS-022M	0001			1		1														
			1	1	10	1	10	0	1	1	0	0	0	0	0	0	1	0	1	1	0
GROUNDWATER	MW-010	0001	1	1	1	1	1		1	1				1	1						
	MW-011	0001	1	1	1	1	1		1	1				1	1						
	MW-012	0001	1	1	1	1	1		1	1				1	1		1		1		1
Background Well	BKGMW-010	0001	1	1	1	1	1		1	1				1	1						
			4	4	4	4	4	0	4	4	0	0	0	4	4	0	1	0	1	0	0
SURFACE WATER	SW-001	0001	1	1	1	1	1		1	1							1				1
Pond/Wet Ditch/Spring	SW-002	0001	1	1	1	1	1		1	1											
			2	2	2	2	2	0	2	2	0	0	0	0	0	0	1	0	0	0	0
SEDIMENT	SD-023M	0001			1		1						1		1		1				1
Pond/Wet Ditch/Spring	SD-024M	0001	1	1	1	1	1		1	1			1		1						
			1	1	2	1	2	0	1	1	0	0	2	0	2	0	1	0	0	0	0
DECON WATER	DECON1	0001	1	1	1	1	1														
			1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
DISPOSAL WASTE	WD1	0001	1	1	1		1		1	1	1										
			1	1	1	0	1	0	1	1	1	0	0	0	0	0	0	0	0	0	0

Notes:
Geo-tech analysis consists of Moisture Content (ASTM D2216), Atterburg Limits (ASTM D4318), UCS (ASTM D2487), pH (EPA 150.1) & Specific Gravity (ASTM D854)
Grainsize and TOC are taken at "all major drainageway" sediments
All shelby tubes taken during MW installatinons will have full geo-tech and grainsize analyses

TABLE 1-4
SAMPLE ANALYSIS SPREADSHEET
CHARACTERIZATION OF 14 RVAAP AOCs - *LANDFILL NORTH OF WBG*

SAMPLE PREFIX			VOC	SVOC	Explosives	Propellants	TAL Metals	Chrome +6	Pesticides	PCB	Cyanides	Nitrate	TOC	Geo-Tech Analysis	Grain Size	FIELD QA/QC SAMPLES: Multi-Incremental QA	Duplicate Sample	Equipment Blank	Trip Blank	MS/MSD	USACE Split
LNW	SAMPLE ID		8260B	8270C	8330	3532/8330	6010/7000	7196A	8081A	8082B	9010A/9012A	EPA 353.2	EPA 415.1	(Various)	ASTM D422						
MULTI-INCREMENTAL SOILS																					
Surface Soils	SS-028M	0001		1	1		1														
	SS-029M	0001		1	1		1														
	SS-030M	0001		1	1		1										1			1	1
	SS-031M	0001		1	1		1									1					
	SS-032M	0001		1	1		1														
	SS-033M	0001		1	1		1														
	SS-034M	0001	1	1	1	1	1		1	1											
	SS-035M	0001		1	1		1														
	SS-036M	0001		1	1		1														
Creek Bank	SS-037M	0001		1	1		1										1				1
	SS-038M	0001		1	1		1														
	SS-039M	0001	1	1	1	1	1		1	1											
Tracer Burn Furnace	SS-040M	0001		1	1		1														
	SS-041M	0001		1	1		1														
			2	14	14	2	14	0	2	2	0	0	0	0	0	1	2	0	0	1	2
GEO-PROBE																					
25' - Outside LF	SB-053	0001		1	1		1														
	SB-054	0001		1	1		1														
	SB-055	0001		1	1		1														
	SB-056	0001		1	1		1										1				1
	SB-057	0001		1	1		1														
	SB-058	0001		1	1		1														
	SB-059	0001		1	1		1														
	SB-060	0001		1	1		1														
	SB-061	0001		1	1		1														
	SB-062	0001		1	1		1														
	SB-063	0001		1	1		1														
	SB-064	0001		1	1		1										1				1
	SB-065	0001		1	1		1														
	SB-066	0001		1	1		1														
	SB-067	0001		1	1		1														
	SB-068	0001		1	1		1														
	SB-069	0001		1	1		1														
	SB-070	0001		1	1		1														
			0	18	18	0	18	0	0	0	0	0	0	0	0	0	1	0	0	0	0
GROUNDWATER	MW-024	0001	1	1	1	1	1		1	1				1	1						
	MW-025	0001	1	1	1	1	1		1	1				1	1						
	MW-026	0001	1	1	1	1	1		1	1				1	1		1		1	1	1
	MW-027	0001	1	1	1	1	1		1	1				1	1						
			4	4	4	4	4	0	4	4	0	0	0	4	4	0	1	0	1	1	1
SURFACE WATER	SW-047	0001	1	1	1	1	1		1	1											
Pond/Wet Ditch/Spring	SW-048	0001	1	1	1	1	1		1	1											
	SW-049	0001	1	1	1	1	1		1	1							1				1
	SW-050	0001	1	1	1	1	1		1	1											
	SW-051	0001	1	1	1	1	1		1	1											
			5	5	5	5	5	0	5	5	0	0	0	0	0	0	1	0	0	0	0
SEDIMENT	SD-042M	0001		1	1		1						1		1						
Pond/Wet Ditch/Spring	SD-043M	0001	1	1	1	1	1		1	1			1		1			1			
	SD-044M	0001		1	1		1						1		1		1				1
	SD-045M	0001		1	1		1						1		1						
			1	4	4	1	4	0	1	1	0	0	4	0	4	0	1	1	0	0	1
DECON WATER	DECON1	0001	1	1	1	1	1														
			1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
DISPOSAL WASTE	WD1	0001	1	1	1		1		1	1	1										
			1	1	1	0	1	0	1	1	1	0	0	0	0	0	0	0	0	0	0

Notes:
Geo-tech analysis consists of Moisture Content (ASTM D2216), Atterburg Limits (ASTM D4318), UCS (ASTM D2487), pH (EPA 150.1) & Specific Gravity (ASTM D854)
Grainsize and TOC are taken at "all major drainageway" sediments
All shelby tubes taken during MW installatinons will have full geo-tech and grainsize analyses

TABLE 1-5
SAMPLE ANALYSIS SPREADSHEET
CHARACTERIZATION OF 14 RVAAP AOCs - *PISTOL RANGE*

SAMPLE PREFIX			VOC	SVOC	Explosives	Propellants	TAL Metals	Chrome +6	Pesticides	PCB	Cyanides	Nitrate	TOC	Geo-Tech Analysis	Grain Size	FIELD QA/QC SAMPLES					
PIR	SAMPLE ID		8260B	8270C	8330	3532/8330	6010/7000	7196A	8081A	8082B	9010A/9012A	EPA 353.2	EPA 415.1	(Various)	ASTM D422	Multi-Incremental QA	Duplicate Sample	Equipment Blank	Trip Blank	MS/MSD	USACE Split
MULTI-INCREMENTAL SOILS																					
Surface Soils	SS-001M	0001			1		1														
	SS-002M	0001			1		1														
	SS-003M	0001	1	1	1	1	1		1	1											
	SS-004M	0001			1		1														
	SS-005M	0001			1		1										1				1
	SS-006M	0001			1		1														
			1	1	6	1	6	0	1	1	0	0	0	0	0	0	1	0	0	0	1
SURFACE WATER	SW-001	0001	1	1	1	1	1		1	1									1		
Pond/Wet Ditch/Spring																					
			1	1	1	1	1	0	1	1	0	0	0	0	0	0	0	0	1	0	0
SEDIMENT	SD-001M	0001	1	1	1	1	1		1	1			1		1		1				1
Pond/Wet Ditch/Spring	SD-002M	0001			1		1						1		1					1	
			1	1	2	1	2	0	1	1	0	0	2	0	2	0	1	0	0	1	0
DISPOSAL WASTE	WD1	0001	1	1	1		1		1	1	1										
			1	1	1	0	1	0	1	1	1	0	0	0	0	0	0	0	0	0	0

Notes:

Geo-tech analysis consists of Moisture Content (ASTM D2216), Atterburg Limits (ASTM D4318), UCS (ASTM D2487), pH (EPA 150.1) & Specific Gravity (ASTM D854)

Grainsize and TOC are taken at "all major drainageway" sediments

All shelby tubes taken during MW installatinons will have full geo-tech and grainsize analyses

TABLE 1-6
SAMPLE ANALYSIS SPREADSHEET
CHARACTERIZATION OF 14 RVAAP AOCs - NACA TEST AREA

SAMPLE PREFIX			VOC	SVOC	Explosives	Propellants	TAL Metals	Chrome +6	Pesticides	PCB	Cyanides	Nitrate	TOC	Geo-Tech	Grain	FIELD QA/QC SAMPLES					
NTA	SAMPLE ID													Analysis	Size	Multi-Incremental QA	Duplicate Sample	Equipment Blank	Trip Blank	MS/MSD	USACE Split
			8260B	8270C	8330	3532/8330	6010/7000	7196A	8081A	8082B	9010A/9012A	EPA 353.2	EPA 415.1	(Various)	ASTM D422						
GROUNDWATER	MW-107	0001	1	1	1	1	1		1	1				1	1						
	MW-108	0001	1	1	1	1	1		1	1				1	1						
	MW-109	0001	1	1	1	1	1		1	1				1	1						
	MW-110	0001	1	1	1	1	1		1	1				1	1						
	MW-111	0001	1	1	1	1	1		1	1							1		1	1	1
	MW-112	0001	1	1	1	1	1		1	1											
	MW-113	0001	1	1	1	1	1		1	1											
	MW-114	0001	1	1	1	1	1		1	1											
	MW-115	0001	1	1	1	1	1		1	1							1				1
	MW-116	0001	1	1	1	1	1		1	1											
	MW-117	0001	1	1	1	1	1		1	1											
	MW-118	0001	1	1	1	1	1		1	1											
			12	12	12	12	12	0	12	12	0	0	0	4	4	0	2	0	1	1	2
DECON WATER	DECON1	0001	1	1	1	1	1														
			1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
DISPOSAL WASTE	WD1	0001	1	1	1		1		1	1	1										
			1	1	1	0	1	0	1	1	1	0	0	0	0	0	0	0	0	0	0

Notes:

Geo-tech analysis consists of Moisture Content (ASTM D2216), Atterburg Limits (ASTM D4318), UCS (ASTM D2487), pH (EPA 150.1) & Specific Gravity (ASTM D854)

Grainsize and TOC are taken at "all major drainageway" sediments

All shelby tubes taken during MW installatinons will have full geo-tech and grainsize analyses

TABLE 1-7
SAMPLE ANALYSIS SPREADSHEET
CHARACTERIZATION OF 14 RVAAP AOCs -*LOAD LINE 5*

SAMPLE PREFIX			VOC	SVOC	Explosives	Propellants	TAL Metals	Chrome +6	Pesticides	PCB	Cyanides	Nitrate	TOC	Geo-Tech	Grain	FIELD QA/QC SAMPLES					
LL5	SAMPLE ID		8260B	8270C	8330	3532/8330	6010/7000	7196A	8081A	8082B	9010A/9012A	EPA 353.2	EPA 415.1	Analysis (Various)	Size ASTM D422	Multi-Incremental QA	Duplicate Sample	Equipment Blank	Trip Blank	MS/MSD	USACE Split
MULTI-INCREMENTAL SOILS																					
Surface Soils	SS-001M	0001			1		1					1									
	SS-002M	0001			1		1					1					1				1
	SS-003M	0001			1		1					1									
	SS-004M	0001			1		1					1									
	SS-005M	0001	1	1	1	1	1		1	1		1						1	1		
	SS-006M	0001			1		1					1									
	SS-007M	0001			1		1					1									
	SS-008M	0001			1		1					1									
	SS-009M	0001			1		1					1									
	SS-010M	0001			1		1					1					1				1
	SS-011M	0001			1		1					1									
	SS-012M	0001	1	1	1	1	1		1	1		1									
	SS-013M	0001			1		1					1									
	SS-014M	0001			1		1					1									
	SS-015M	0001			1		1					1									
	SS-016M	0001			1		1					1				1					
	SS-017M	0001			1		1					1									
Dry-Ditch Soils	SS-018M	0001			1		1					1									
	SS-019M	0001	1	1	1	1	1		1	1		1									
	SS-020M	0001			1		1					1					1				1
	SS-021M	0001			1		1					1									
	SS-022M	0001			1		1					1								1	
	SS-023M	0001			1		1					1									
	SS-024M	0001			1		1					1									
	SS-025M	0001			1		1					1									
	SS-026M	0001			1		1					1				1					
	SS-027M	0001			1		1					1									
	SS-028M	0001			1		1					1									
	SS-029M	0001			1		1					1									
DISCRETE SOILS	SS-030	0001	1														1				1
			4	3	29	3	29	0	3	3	0	28	0	0	0	2	4	1	1	1	4
GROUNDWATER	MW-001	0001	1	1	1		1		1	1		1		1	1						
	MW-002	0001	1	1	1		1		1	1		1		1	1						
	MW-003	0001	1	1	1	1	1		1	1		1		1	1		1	1	1	1	1
	MW-004	0001	1	1	1		1		1	1		1		1	1						
	MW-005	0001	1	1	1		1		1	1		1									
	MW-006	0001	1	1	1		1		1	1		1									
			6	6	6	1	6	0	6	6	0	6	0	4	4	0	1	1	1	1	1
SURFACE WATER	SW-001	0001	1	1	1		1		1	1		1									
Sanitary Sewers	SW-002	0001	1	1	1		1		1	1		1									
	SW-003	0001	1	1	1		1		1	1		1									
	SW-004	0001	1	1	1		1		1	1		1									
	SW-005	0001	1	1	1	1	1		1	1		1									
	SW-006	0001	1	1	1		1		1	1		1					1		1		1
	SW-007	0001	1	1	1		1		1	1		1									
	SW-008	0001	1	1	1		1		1	1		1									
	SW-009	0001	1	1	1		1		1	1		1									
	SW-010	0001	1	1	1		1		1	1		1									
Basements	SW-011	0001	1	1	1		1		1	1		1					1				1
	SW-012	0001	1	1	1	1	1		1	1		1									
Sumps/Basins	SW-013	0001	1	1	1		1		1	1		1									
			13	13	13	2	13	0	13	13	0	13	0	0	0	0	2	0	1	0	2

TABLE 1-7
SAMPLE ANALYSIS SPREADSHEET
CHARACTERIZATION OF 14 RVAAP AOCs -*LOAD LINE 5*

SAMPLE PREFIX			VOC	SVOC	Explosives	Propellants	TAL Metals	Chrome +6	Pesticides	PCB	Cyanides	Nitrate	TOC	Geo-Tech Analysis	Grain Size	FIELD QA/QC SAMPLES					
LL5	SAMPLE ID		8260B	8270C	8330	3532/8330	6010/7000	7196A	8081A	8082B	9010A/9012A	EPA 353.2	EPA 415.1	(Various)	ASTM D422	Multi-Incremental QA	Duplicate Sample	Equipment Blank	Trip Blank	MS/MSD	USACE Split
SEDIMENT	SD-001	0001			1		1					1									
Sanitary Sewers	SD-002	0001			1		1					1								1	
	SD-003	0001			1		1					1					1				1
	SD-004	0001	1	1	1	1	1		1	1		1									
	SD-005	0001			1		1					1									
	SD-006	0001			1		1					1									
	SD-007	0001			1		1					1					1				1
	SD-008	0001			1		1					1									
	SD-009	0001			1		1					1									
	SD-010	0001			1		1					1									
Sumps/Basins	SD-013	0001			1		1					1									
			1	1	11	1	11	0	1	1	0	11	0	0	0	0	2	0	0	1	2
DECON WATER	DECON1	0001	1	1	1	1	1														
			1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
DISPOSAL WASTE	WD1	0001	1	1	1		1		1	1	1										
			1	1	1	0	1	0	1	1	1	0	0	0	0	0	0	0	0	0	0

Notes:
Discrete Sample is taken for VOCs only from Bldg 1F15 doorway
Geo-tech analysis consists of Moisture Content (ASTM D2216), Atterburg Limits (ASTM D4318), UCS (ASTM D2487), pH (EPA 150.1) & Specific Gravity (ASTM D854)
Grainsize and TOC are taken at "all major drainageway" sediments
All shelby tubes taken during MW installatinons will have full geo-tech and grainsize analyses

TABLE 1-8
SAMPLE ANALYSIS SPREADSHEET
CHARACTERIZATION OF 14 RVAAP AOCs -*LOAD LINE 7*

SAMPLE PREFIX			VOC	SVOC	Explosives	Propellants	TAL Metals	Chrome +6	Pesticides	PCB	Cyanides	Nitrate	TOC	Geo-Tech Analysis	Grain Size	FIELD QA/QC SAMPLES					
LL7	SAMPLE ID		8260B	8270C	8330	3532/8330	6010/7000	7196A	8081A	8082B	9010A/9012A	EPA 353.2	EPA 415.1	(Various)	ASTM D422	Multi-Incremental QA	Duplicate Sample	Equipment Blank	Trip Blank	MS/MSD	USACE Split
MULTI-INCREMENTAL SOILS																					
Surface Soils	SS-001M	0001			1	1	1					1									
	SS-002M	0001			1		1					1									
	SS-003M	0001			1	1	1					1					1				1
	SS-004M	0001			1		1					1									
	SS-005M	0001	1	1	1	1	1		1	1		1									
	SS-006M	0001			1		1					1									
	SS-007M	0001			1	1	1					1									
	SS-008M	0001			1		1					1									
	SS-009M	0001			1	1	1					1									
	SS-010M	0001			1		1					1									
	SS-011M	0001			1	1	1					1									
	SS-012M	0001			1		1					1									
	SS-013M	0001	1	1	1	1	1		1	1		1					1	1		1	1
	SS-014M	0001			1		1					1									
	SS-015M	0001			1	1	1					1									
	SS-016M	0001			1		1					1									
	SS-017M	0001			1	1	1					1									
	SS-018M	0001			1		1					1				1					
	SS-019M	0001			1	1	1					1									
	SS-020M	0001			1		1					1									
	SS-021M	0001			1	1	1					1									
	SS-022M	0001			1		1					1									
	SS-023M	0001	1	1	1	1	1		1	1		1									
	SS-024M	0001			1		1					1					1				1
	SS-025M	0001			1	1	1					1									
	SS-026M	0001			1		1					1									
Dry-Ditch Soils	SS-027M	0001			1		1					1									
	SS-028M	0001			1	1	1					1									
	SS-029M	0001			1		1					1									
	SS-030M	0001			1	1	1					1									
	SS-031M	0001			1		1					1									
	SS-032M	0001	1	1	1	1	1		1	1		1									
	SS-033M	0001			1		1					1					1				1
	SS-034M	0001			1	1	1					1									
	SS-035M	0001			1		1					1									
	SS-036M	0001			1	1	1					1				1				1	
	SS-037M	0001			1		1					1									
	SS-038M	0001			1	1	1					1									
	SS-039M	0001			1		1					1									
	SS-040M	0001			1	1	1					1									
DISCRETE SOILS	SS-041	0001	1																		
			5	4	40	20	40	0	4	4	0	40	0	0	0	2	4	1	0	2	0
GROUNDWATER	MW-001	0001	1	1	1	1	1		1	1		1		1	1						
	MW-002	0001	1	1	1	1	1		1	1		1		1	1						
	MW-003	0001	1	1	1	1	1		1	1		1		1	1		1	1	1		1
	MW-004	0001	1	1	1	1	1		1	1		1		1	1						
	MW-005	0001	1	1	1	1	1		1	1		1									
	MW-006	0001	1	1	1	1	1		1	1		1									
			6	6	6	6	6	0	6	6	0	6	0	4	4	0	1	1	1	0	0

TABLE 1-8
SAMPLE ANALYSIS SPREADSHEET
CHARACTERIZATION OF 14 RVAAP AOCs -*LOAD LINE 7*

SAMPLE PREFIX			VOC	SVOC	Explosives	Propellants	TAL Metals	Chrome +6	Pesticides	PCB	Cyanides	Nitrate	TOC	Geo-Tech	Grain	FIELD QA/QC SAMPLES					
														Analysis	Size	Multi-	Duplicate	Equipment Blank	Trip Blank	MS/MSD	USACE Split
LL7	SAMPLE ID		8260B	8270C	8330	3532/8330	6010/7000	7196A	8081A	8082B	9010A/9012A	EPA 353.2	EPA 415.1	(Various)	ASTM D422	Incremental QA	Sample				
SURFACE WATER	SW-001	0001	1	1	1	1	1		1	1		1									
Sanitary Sewers	SW-002	0001	1	1	1	1	1		1	1		1									
	SW-003	0001	1	1	1	1	1		1	1		1									
	SW-004	0001	1	1	1	1	1		1	1		1					1	1	1	1	1
	SW-005	0001	1	1	1	1	1		1	1		1									
	SW-006	0001	1	1	1	1	1		1	1		1									
	SW-007	0001	1	1	1	1	1		1	1		1									
	SW-008	0001	1	1	1	1	1		1	1		1					1				1
	SW-009	0001	1	1	1	1	1		1	1		1									
	SW-010	0001	1	1	1	1	1		1	1		1									
Sumps/Basins	SW-011	0001	1	1	1	1	1		1	1		1									
			11	11	11	11	11	0	11	11	0	11	0	0	0	0	2	1	1	1	0
SEDIMENT	SD-001	0001			1	1	1					1									
Sanitary Sewers	SD-002	0001			1	1	1					1									
	SD-003	0001			1	1	1					1									
	SD-004	0001	1	1	1	1	1		1	1		1									
	SD-005	0001			1	1	1					1									
	SD-006	0001			1	1	1					1					1				1
	SD-007	0001			1		1					1								1	
	SD-008	0001			1	1	1					1									
	SD-009	0001			1		1					1									
	SD-010	0001			1	1	1					1									
Sumps/Basins	SD-011	0001	1	1	1	1	1		1	1		1									
	SD-012	0001			1	1	1					1					1				1
			2	2	12	10	12	0	2	2	0	12	0	0	0	0	2	0	0	1	0
DECON WATER	DECON1	0001	1	1	1	1	1														
			1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
DISPOSAL WASTE	WD1	0001	1	1	1		1		1	1	1										
			1	1	1	0	1	0	1	1	1	0	0	0	0	0	0	0	0	0	0

Notes:

Discrete Sample is taken for VOCs only from Bldg 1B22 doorway

Geo-tech analysis consists of Moisture Content (ASTM D2216), Atterburg Limits (ASTM D4318), UCS (ASTM D2487), pH (EPA 150.1) & Specific Gravity (ASTM D854)

Grainsize and TOC are taken at "all major drainageway" sediments

All shelby tubes taken during MW installatinons will have full geo-tech and grainsize analyses

TABLE 1-9
SAMPLE ANALYSIS SPREADSHEET
CHARACTERIZATION OF 14 RVAAP AOCs -*LOAD LINE 8*

SAMPLE PREFIX				VOC	SVOC	Explosives	Propellants	TAL Metals	Chrome +6	Pesticides	PCB	Cyanides	Nitrate	TOC	Geo-Tech	Grain	FIELD QA/QC SAMPLES					
LL8	SAMPLE ID														Analysis	Size	Multi-Incremental QA	Duplicate Sample	Equipment Blank	Trip Blank	MS/MSD	USACE Split
				8260B	8270C	8330	3532/8330	6010/7000	7196A	8081A	8082B	9010A/9012A	EPA 353.2	EPA 415.1	(Various)	ASTM D422						
MULTI-INCREMENTAL SOILS						1																
Surface Soils	SS-001M		0001			1		1														
	SS-002M		0001			1		1														
	SS-003M		0001			1		1														
	SS-004M		0001			1		1														
	SS-005M		0001	1	1	1	1	1		1	1							1	1			1
	SS-006M		0001			1		1														
	SS-007M		0001			1		1														
	SS-008M		0001			1		1														
	SS-009M		0001			1		1														
	SS-010M		0001			1		1										1			1	1
	SS-011M		0001			1		1														
	SS-012M		0001			1		1														
	SS-013M		0001			1		1									1					
	SS-014M		0001			1		1														
	SS-015M		0001	1	1	1	1	1		1	1											
	SS-016M		0001			1		1														
Dry-Ditch Soils	SS-017M		0001			1		1														
	SS-018M		0001			1		1														
DISCRETE SOILS	SS-019		0001	1																		
				3	2	18	2	18	0	2	2	0	0	0	0	0	1	2	1	0	1	2
GROUNDWATER	MW-001		0001	1	1	1		1		1	1		1		1	1						
	MW-002		0001	1	1	1		1		1	1		1		1	1						
	MW-003		0001	1	1	1	1	1		1	1		1		1	1						
	MW-004		0001	1	1	1		1		1	1		1		1	1		1	1	1	1	1
	MW-005		0001	1	1	1		1		1	1		1									
	MW-006		0001	1	1	1		1		1	1		1									
				6	6	6	1	6	0	6	6	0	6	0	4	4	0	1	1	1	1	1
SURFACE WATER	SW-001		0001	1	1	1		1		1	1		1									
Sanitary Sewers	SW-002		0001	1	1	1		1		1	1		1									
	SW-003		0001	1	1	1		1		1	1		1					1				1
	SW-004		0001	1	1	1		1		1	1		1									
	SW-005		0001	1	1	1	1	1		1	1		1									
	SW-006		0001	1	1	1		1		1	1		1									
	SW-007		0001	1	1	1		1		1	1		1									
	SW-008		0001	1	1	1		1		1	1		1									
	SW-009		0001	1	1	1		1		1	1		1									
	SW-010		0001	1	1	1		1		1	1		1									
	SW-011		0001	1	1	1		1		1	1		1									
Pond/Wet Ditch/Spring	SW-012		0001	1	1	1		1		1	1		1									
	SW-013		0001	1	1	1		1		1	1		1					1		1		1
	SW-014		0001	1	1	1	1	1		1	1		1									
	SW-015		0001	1	1	1		1		1	1		1									
	SW-016		0001	1	1	1		1		1	1		1									
	SW-017		0001	1	1	1		1		1	1		1									
Basements	SW-018		0001	1	1	1		1		1	1		1									
	SW-019		0001	1	1	1		1		1	1		1									
				19	19	19	2	19	0	19	19	0	19	0	0	0	0	2	0	1	0	2

TABLE 1-9
SAMPLE ANALYSIS SPREADSHEET
CHARACTERIZATION OF 14 RVAAP AOCs -*LOAD LINE 8*

SAMPLE PREFIX			VOC	SVOC	Explosives	Propellants	TAL Metals	Chrome +6	Pesticides	PCB	Cyanides	Nitrate	TOC	Geo-Tech Analysis	Grain Size	FIELD QA/QC SAMPLES					
LL8	SAMPLE ID		8260B	8270C	8330	3532/8330	6010/7000	7196A	8081A	8082B	9010A/9012A	EPA 353.2	EPA 415.1	(Various)	ASTM D422	Multi-Incremental QA	Duplicate Sample	Equipment Blank	Trip Blank	MS/MSD	USACE Split
SEDIMENT	SD-001	0001			1		1														
Sanitary Sewers	SD-002	0001			1		1														
	SD-003	0001			1		1														
	SD-004	0001			1		1										1				1
	SD-005	0001			1		1														
	SD-006	0001			1		1														
	SD-007	0001			1		1														
	SD-008	0001			1		1														
	SD-009	0001			1		1														
	SD-010	0001			1		1														
	SD-011	0001			1		1														
Pond/Wet Ditch/Spring	SD-001M	0001	1	1	1	1	1		1	1			1		1						
	SD-002M	0001			1		1						1		1		1			1	1
	SD-003M	0001			1		1						1		1						
	SD-004M	0001	1	1	1	1	1		1	1			1		1						
	SD-005M	0001			1		1						1		1						
	SD-006M	0001			1		1						1		1						
			2	2	17	2	17	0	2	2	0	0	6	0	6	0	2	0	0	1	0
DECON WATER	DECON1	0001	1	1	1	1	1														
			1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
DISPOSAL WASTE	WD1	0001	1	1	1		1		1	1	1										
			1	1	1	0	1	0	1	1	1	0	0	0	0	0	0	0	0	0	0

Notes:

Discrete Sample is taken for VOCs only from Bldg 2B22 doorway

Geo-tech analysis consists of Moisture Content (ASTM D2216), Atterburg Limits (ASTM D4318), UCS (ASTM D2487), pH (EPA 150.1) & Specific Gravity (ASTM D854)

Grainsize and TOC are taken at "all major drainageway" sediments

All shelby tubes taken during MW installatinons will have full geo-tech and grainsize analyses

TABLE 1-10
SAMPLE ANALYSIS SPREADSHEET
CHARACTERIZATION OF 14 RVAAP AOCs -*LOAD LINE 10*

SAMPLE PREFIX	SAMPLE ID		VOC	SVOC	Explosives	Propellants	TAL Metals	Chrome +6	Pesticides	PCB	Cyanides	Nitrate	TOC	Geo-Tech Analysis	Grain Size	FIELD QA/QC SAMPLES: Multi-Incremental QA	Duplicate Sample	Equipment Blank	Trip Blank	MS/MSD	USACE Split
L10			8260B	8270C	8330	3532/8330	6010/7000	7196A	8081A	8082B	9010A/9012A	EPA 353.2	EPA 415.1	(Various)	ASTM D422						
MULTI-INCREMENTAL SOILS																					
Surface Soils	SS-001M	0001			1		1				1										
	SS-002M	0001			1		1				1										
	SS-003M	0001			1		1				1										
	SS-004M	0001			1		1				1										
	SS-005M	0001			1		1				1						1				1
	SS-006M	0001			1		1				1										
	SS-007M	0001			1		1				1										
	SS-008M	0001			1		1				1										
	SS-009M	0001			1		1				1										
	SS-010M	0001	1	1	1	1	1		1	1	1									1	
	SS-011M	0001			1		1				1										
	SS-012M	0001			1		1				1										
	SS-013M	0001			1		1				1					1					
	SS-014M	0001			1		1				1										
	SS-015M	0001			1		1				1										
	SS-016M	0001			1		1				1										
	SS-017M	0001			1		1				1						1				1
	SS-018M	0001			1		1				1										
	SS-019M	0001			1		1				1										
	SS-020M	0001			1		1				1										
	SS-021M	0001	1	1	1	1	1		1	1	1										
	SS-022M	0001			1		1				1										
	SS-023M	0001			1		1				1										
Dry-Ditch Soils	SS-024M	0001			1		1				1										
	SS-025M	0001			1		1				1										
	SS-026M	0001			1		1				1										
	SS-027M	0001	1	1	1	1	1		1	1	1						1	1			1
	SS-028M	0001			1		1				1										
	SS-029M	0001			1		1				1										
	SS-030M	0001			1		1				1					1				1	
	SS-031M	0001			1		1				1										
	SS-032M	0001			1		1				1										
	SS-033M	0001	1	1	1	1	1		1	1	1										
	SS-034M	0001			1		1				1										
	SS-035M	0001			1		1				1										
	SS-036M	0001			1		1				1										
DISCRETE SOILS	SS-037	0001	1														1				1
	SS-038	0001	1																		
	SS-039	0001	1																		
			7	4	36	4	36	0	4	4	36	0	0	0	0	2	4	1	0	2	4
GROUNDWATER	MW-001	0001	1	1	1		1		1	1	1			1	1						
	MW-002	0001	1	1	1		1		1	1	1			1	1						
	MW-003	0001	1	1	1	1	1		1	1	1			1	1					1	
	MW-004	0001	1	1	1		1		1	1	1			1	1						
	MW-005	0001	1	1	1		1		1	1	1						1	1	1		1
	MW-006	0001	1	1	1		1		1	1	1										
			6	6	6	1	6	0	6	6	6	0	0	4	4	0	1	1	1	1	1

TABLE 1-10
SAMPLE ANALYSIS SPREADSHEET
CHARACTERIZATION OF 14 RVAAP AOCs -*LOAD LINE 10*

SAMPLE PREFIX			VOC	SVOC	Explosives	Propellants	TAL Metals	Chrome +6	Pesticides	PCB	Cyanides	Nitrate	TOC	Geo-Tech Analysis	Grain Size	FIELD QA/QC SAMPLES					
L10	SAMPLE ID		8260B	8270C	8330	3532/8330	6010/7000	7196A	8081A	8082B	9010A/9012A	EPA 353.2	EPA 415.1	(Various)	ASTM D422	Multi-Incremental QA	Duplicate Sample	Equipment Blank	Trip Blank	MS/MSD	USACE Split
SURFACE WATER	SW-001	0001	1	1	1		1		1	1	1										
Sanitary Sewers	SW-002	0001	1	1	1		1		1	1	1						1				1
	SW-003	0001	1	1	1		1		1	1	1										
	SW-004	0001	1	1	1		1		1	1	1										
	SW-005	0001	1	1	1	1	1		1	1	1									1	
	SW-006	0001	1	1	1		1		1	1	1										
	SW-007	0001	1	1	1		1		1	1	1										
	SW-008	0001	1	1	1		1		1	1	1						1				1
	SW-009	0001	1	1	1		1		1	1	1										
	SW-010	0001	1	1	1		1		1	1	1										
Sumps/Basins	SW-011	0001	1	1	1		1		1	1	1										
	SW-012	0001	1	1	1		1		1	1	1										
	SW-013	0001	1	1	1		1		1	1	1										
	SW-014	0001	1	1	1		1		1	1	1										
	SW-015	0001	1	1	1		1		1	1	1										
	SW-016	0001	1	1	1	1	1		1	1	1								1		
	SW-017	0001	1	1	1		1		1	1	1										
	SW-018	0001	1	1	1		1		1	1	1										
	SW-019	0001	1	1	1		1		1	1	1						1				1
	SW-020	0001	1	1	1		1		1	1	1										
	SW-021	0001	1	1	1		1		1	1	1										
	SW-022	0001	1	1	1		1		1	1	1										
	SW-023	0001	1	1	1		1		1	1	1										
	SW-024		1	1	1		1		1	1	1										
Basement	SW-025	0001	1	1	1		1		1	1	1										
			25	25	25	2	25	0	25	25	25	0	0	0	0	0	3	0	1	1	3
SEDIMENT	SD-001	0001			1		1				1										
Sanitary Sewers	SD-002	0001			1		1				1						1				1
	SD-003	0001			1		1				1										
	SD-004	0001			1		1				1										
	SD-005	0001			1		1				1										
	SD-006	0001			1		1				1										
	SD-007	0001			1		1				1										
	SD-008	0001	1	1	1	1	1		1	1	1										
	SD-009	0001			1		1				1						1				1
	SD-010	0001			1		1				1										
Sumps/Basins	SD-011	0001			1		1				1										
	SD-012	0001			1		1				1									1	
	SD-013	0001			1		1				1										
	SD-014	0001			1		1				1										
	SD-015	0001			1		1				1										
	SD-016	0001	1	1	1	1	1		1	1	1										
	SD-017	0001			1		1				1										
	SD-018	0001			1		1				1										
	SD-019	0001			1		1				1						1				1
	SD-020	0001			1		1				1										
	SD-021	0001	1	1	1	1	1		1	1	1										
	SD-022	0001			1		1				1										
	SD-023	0001			1		1				1										
	SD-024	0001			1		1				1										
Wet Ditch (MI)	SD-025M	0001			1		1				1		1		1						
			3	3	25	3	25	0	3	3	25	0	1	0	1	0	3	0	0	1	3
DECON WATER	DECON1	0001	1	1	1	1	1														
			1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
DISPOSAL WASTE	WD1	0001	1	1	1		1		1	1	1										
			1	1	1	0	1	0	1	1	1	0	0	0	0	0	0	0	0	0	0

Notes:
Discrete Sample is taken for VOCs only from Bldgs PE2, PE17 & PE20 and doorway
Geo-tech analysis consists of Moisture Content (ASTM D2216), Atterburg Limits (ASTM D4318), UCS (ASTM D2487), pH (EPA 150.1) & Specific Gravity (ASTM D854)
Grainsize and TOC are taken at "all major drainageway" sediments
All shelby tubes taken during MW installatinons will have full geo-tech and grainsize analyses

TABLE 1-11
SAMPLE ANALYSIS SPREADSHEET
CHARACTERIZATION OF 14 RVAAP AOCs - *WET STORAGE AREA*

SAMPLE PREFIX				VOC	SVOC	Explosives	Propellants	TAL Metals	Chrome +6	Pesticides	PCB	Cyanides	Nitrate	TOC	Geo-Tech Analysis	Grain Size	FIELD QA/QC SAMPLES					
WSA	SAMPLE ID			8260B	8270C	8330	3532/8330	6010/7000	7196A	8081A	8082B	9010A/9012A	EPA 353.2	EPA 415.1	(Various)	ASTM D422	Multi-Incremental QA	Duplicate Sample	Equipment Blank	Trip Blank	MS/MSD	USACE Split
MULTI-INCREMENTAL SOILS																						
Surface Soils	SS-001M		0001			1		1														
	SS-002M		0001			1		1														
	SS-003M		0001			1		1														
	SS-004M		0001	1	1	1	1	1		1	1											
	SS-005M		0001			1		1										1				1
	SS-006M		0001			1		1														
Dry-Ditch Soils	SS-007M		0001			1		1														
	SS-008M		0001			1		1														
	SS-009M		0001			1		1														
	SS-010M		0001			1		1														
	SS-011M		0001	1	1	1	1	1		1	1									1		
	SS-012M		0001			1		1														
	SS-013M		0001			1		1														
	SS-014M		0001			1		1										1			1	1
	SS-015M		0001			1		1														
	SS-016M		0001			1		1									1					
	SS-017M		0001			1		1														
	SS-018M		0001			1		1														
	SS-019M		0001			1		1														
				2	2	19	2	19	0	2	2	0	0	0	0	0	1	2	0	1	1	2
DISPOSAL WASTE	WD1		0001	1	1	1		1		1	1	1										
				1	1	1	0	1	0	1	1	1	0	0	0	0	0	0	0	0	0	0

Notes:
Geo-tech analysis consists of Moisture Content (ASTM D2216), Atterburg Limits (ASTM D4318), UCS (ASTM D2487), pH (EPA 150.1) & Specific Gravity (ASTM D854)
Grainsize and TOC are taken at "all major drainageway" sediments
All shelby tubes taken during MW installatinons will have full geo-tech and grainsize analyses

TABLE 1-12
SAMPLE ANALYSIS SPREADSHEET
CHARACTERIZATION OF 14 RVAAP AOCs - *BUILDING F-15*

SAMPLE PREFIX				VOC	SVOC	Explosives	Propellants	TAL Metals	Chrome +6	Pesticides	PCB	Cyanides	Nitrate	TOC	Geo-Tech Analysis	Grain Size	FIELD QA/QC SAMPLES					
F15	SAMPLE ID			8260B	8270C	8330	3532/8330	6010/7000	7196A	8081A	8082B	9010A/9012A	EPA 353.2	EPA 415.1	(Various)	ASTM D422	Multi-Incremental QA	Duplicate Sample	Equipment Blank	Trip Blank	MS/MSD	USACE Split
MULTI-INCREMENTAL SOILS																						
Surface Soils	SS-001M		0001			1		1														
	SS-002M		0001			1		1										1				1
	SS-003M		0001			1		1														
	SS-004M		0001			1		1													1	
	SS-005M		0001			1		1														
	SS-006M		0001	1	1	1	1	1		1	1											
Dry-Ditch Soils	SS-007M		0001			1		1														
	SS-008M		0001			1		1														
	SS-009M		0001			1		1										1				1
	SS-010M		0001			1		1														
	SS-011M		0001			1		1														
				1	1	11	1	11	0	1	1	0	0	0	0	0	0	2	0	0	1	0
DISPOSAL WASTE	WD1		0001	1	1	1		1		1	1	1										
				1	1	1	0	1	0	1	1	1	0	0	0	0	0	0	0	0	0	0

Notes:
Geo-tech analysis consists of Moisture Content (ASTM D2216), Atterburg Limits (ASTM D4318), UCS (ASTM D2487), pH (EPA 150.1) & Specific Gravity (ASTM D854)
Grainsize and TOC are taken at "all major drainageway" sediments
All shelby tubes taken during MW installatinons will have full geo-tech and grainsize analyses

TABLE 1-13
SAMPLE ANALYSIS SPREADSHEET
CHARACTERIZATION OF 14 RVAAP AOCs - *BUILDING F-16*

SAMPLE PREFIX	SAMPLE ID		VOC	SVOC	Explosives	Propellants	TAL Metals	Chrome +6	Pesticides	PCB	Cyanides	Nitrate	TOC	Geo-Tech	Grain	FIELD QA/QC SAMPLES					
F16														Analysis	Size	Multi-Incremental QA	Duplicate Sample	Equipment Blank	Trip Blank	MS/MSD	USACE Split
			8260B	8270C	8330	3532/8330	6010/7000	7196A	8081A	8082B	9010A/9012A	EPA 353.2	EPA 415.1	(Various)	ASTM D422						
MULTI-INCREMENTAL SOILS																					
Surface Soils	SS-001M	0001			1		1														
	SS-002M	0001			1		1														
	SS-003M	0001			1		1														
	SS-004M	0001			1		1														
Dry-Ditch Soils	SS-005M	0001	1	1	1	1	1		1	1											
	SS-006M	0001			1		1										1				1
	SS-007M	0001			1		1														
			1	1	7	1	7	0	1	1	0	0	0	0	0	0	1	0	0	0	0
SURFACE WATER	SW-001	0001	1	1	1	1	1		1	1							1		1		1
Pond/Wet Ditch/Spring	SW-002	0001	1	1	1	1	1		1	1											
			2	2	2	2	2	0	2	2	0	0	0	0	0	0	1	0	1	0	0
SEDIMENT	SD-001M	0001			1		1						1		1		1				1
Pond/Wet Ditch/Spring	SD-002M	0001			1		1						1		1						
			0	0	2	0	2	0	0	0	0	0	2	0	2	0	1	0	0	0	0
DISPOSAL WASTE	WD1	0001	1	1	1		1		1	1	1										
			1	1	1	0	1	0	1	1	1	0	0	0	0	0	0	0	0	0	0

Notes:

Geo-tech analysis consists of Moisture Content (ASTM D2216), Atterburg Limits (ASTM D4318), UCS (ASTM D2487), pH (EPA 150.1) & Specific Gravity (ASTM D854)

Grainsize and TOC are taken at "all major drainageway" sediments

All shelby tubes taken during MW installatinons will have full geo-tech and grainsize analyses

TABLE 1-14
SAMPLE ANALYSIS SPREADSHEET
CHARACTERIZATION OF 14 RVAAP AOCs - *ANCHOR TEST AREA*

SAMPLE PREFIX			VOC	SVOC	Explosives	Propellants	TAL Metals	Chrome +6	Pesticides	PCB	Cyanides	Nitrate	TOC	Geo-Tech Analysis	Grain Size	FIELD QA/QC SAMPLES					
ATA	SAMPLE ID		8260B	8270C	8330	3532/8330	6010/7000	7196A	8081A	8082B	9010A/9012A	EPA 353.2	EPA 415.1	(Various)	ASTM D422	Multi-Incremental QA	Duplicate Sample	Equipment Blank	Trip Blank	MS/MSD	USACE Split
MULTI-INCREMENTAL SOILS																					
Surface Soils	SS-001M	0001			1		1										1			1	1
	SS-002M	0001			1		1														
	SS-003M	0001	1	1	1	1	1		1	1									1		
	SS-004M	0001			1		1														
	SS-005M	0001			1		1														
			1	1	5	1	5	0	1	1	0	0	0	0	0	0	1	0	1	1	1
MI SUB-SURFACE SOILS																					
1-3 ft interval	SB-001	0001			1		1														
3-5 ft interval	SB-002	0001			1		1														
			0	0	2	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	
DISPOSAL WASTE	WD1	0001	1	1	1		1		1	1	1										
			1	1	1	0	1	0	1	1	1	0	0	0	0	0	0	0	0	0	0

Notes:

MI Sub-surface samples will be taken in sand pit (5 aliquots will compose each surface and subsurface soil sample)

Geo-tech analysis consists of Moisture Content (ASTM D2216), Atterburg Limits (ASTM D4318), UCS (ASTM D2487), pH (EPA 150.1) & Specific Gravity (ASTM D854)

Grainsize and TOC are taken at "all major drainageway" sediments

All shelby tubes taken during MW installatinons will have full geo-tech and grainsize analyses

TABLE 1-15
SAMPLE ANALYSIS SPREADSHEET
CHARACTERIZATION OF 14 RVAAP AOCs -*ATLAS SCRAP YARD*

SAMPLE PREFIX ASY	SAMPLE ID		VOC 8260B	SVOC 8270C	Explosives 8330	Propellants 3532/8330	TAL Metals 6010/7000	Chrome +6 7196A	Pesticides 8081A	PCB 8082B	Cyanides 9010A/9012A	Nitrate EPA 353.2	TOC EPA 415.1	Geo-Tech Analysis (Various)	Grain Size ASTM D422	FIELD QA/QC SAMPLES: Multi-Incremental QA	Duplicate Sample	Equipment Blank	Trip Blank	MS/MSD	USACE Split
MULTI-INCREMENTAL SOILS																					
RCC Pipes	SS-001M	0001			1		1														
Railroad Ballast	SS-002M	0001			1		1														
Railroad Ties	SS-003M	0001			1		1														
Concrete Rubble	SS-004M	0001	1	1	1	1	1		1	1											
Service Station #1	SS-005M	0001	1		1		1	1													
Surface Soils	SS-006M	0001			1		1														
	SS-007M	0001			1		1										1			1	1
	SS-008M	0001			1		1														
	SS-009M	0001			1		1														
Railroad Ballast	SS-010M	0001			1		1														
Chipped Ammo Boxes	SS-011M	0001			1		1														
Service Station #2	SS-012M	0001	1		1		1	1								1					
Tar Cleaning Tank	SS-013M	0001	1		1		1														
Surface Soils	SS-014M	0001			1		1														
	SS-015M	0001	1	1	1	1	1		1	1									1		
	SS-016M	0001			1		1														
	SS-017M	0001			1		1										1				1
	SS-018M	0001			1		1														
Incinerator	SS-019M	0001			1		1														
Dry-Ditch Soils	SS-020M	0001			1		1														
	SS-021M	0001			1		1										1				1
	SS-022M	0001			1		1									1					
	SS-023M	0001			1		1														
	SS-024M	0001			1		1														
	SS-025M	0001			1		1														
	SS-026M	0001			1		1														
	SS-027M	0001			1		1														
	SS-028M	0001	1	1	1	1	1		1	1							1	1			1
	SS-029M	0001			1		1														
	SS-030M	0001			1		1														
	SS-031M	0001			1		1														
	SS-032M	0001			1		1														
	SS-033M	0001			1		1														
			6	3	33	3	33	2	3	3	0	0	0	0	0	2	4	1	1	1	4
GROUNDWATER	MW-001	0001	1	1	1	1	1	1	1	1				1	1						
	MW-002	0001	1	1	1	1	1	1	1	1				1	1						
	MW-003	0001	1	1	1	1	1	1	1	1				1	1		1	1	1	1	1
	MW-004	0001	1	1	1	1	1	1	1	1				1	1						
	MW-005	0001	1	1	1	1	1	1	1	1											
	MW-006	0001	1	1	1	1	1	1	1	1											
	MW-007	0001	1	1	1	1	1	1	1	1											
	MW-008	0001	1	1	1	1	1	1	1	1											
	MW-009	0001	1	1	1	1	1	1	1	1											
	MW-010	0001	1	1	1	1	1	1	1	1											
			10	10	10	10	10	10	10	10	0	0	0	4	4	0	1	1	1	1	1

TABLE 1-15
SAMPLE ANALYSIS SPREADSHEET
CHARACTERIZATION OF 14 RVAAP AOCs -*ATLAS SCRAP YARD*

SAMPLE PREFIX	SAMPLE ID		VOC	SVOC	Explosives	Propellants	TAL Metals	Chrome +6	Pesticides	PCB	Cyanides	Nitrate	TOC	Geo-Tech Analysis	Grain Size	FIELD QA/QC SAMPLES					
ASY			8260B	8270C	8330	3532/8330	6010/7000	7196A	8081A	8082B	9010A/9012A	EPA 353.2	EPA 415.1	(Various)	ASTM D422	Multi-Incremental QA	Duplicate Sample	Equipment Blank	Trip Blank	MS/MSD	USACE Split
SURFACE WATER	SW-001	0001	1	1	1	1	1		1	1											
Sanitary Sewers	SW-002	0001	1	1	1	1	1		1	1											
	SW-003	0001	1	1	1	1	1		1	1											
	SW-004	0001	1	1	1	1	1		1	1											
	SW-005	0001	1	1	1	1	1		1	1											
	SW-006	0001	1	1	1	1	1		1	1											
	SW-007	0001	1	1	1	1	1		1	1							1		1		1
	SW-008	0001	1	1	1	1	1		1	1											
	SW-009	0001	1	1	1	1	1		1	1											
	SW-010	0001	1	1	1	1	1		1	1											
	SW-011	0001	1	1	1	1	1		1	1											
	SW-012	0001	1	1	1	1	1		1	1							1				1
	SW-013	0001	1	1	1	1	1		1	1											
	SW-014	0001	1	1	1	1	1		1	1											
	SW-015	0001	1	1	1	1	1		1	1											
	SW-016	0001	1	1	1	1	1		1	1											
			16	16	16	16	16	0	16	16	0	0	0	0	0	0	2	0	1	0	
SEDIMENT	SD-001	0001			1		1														
Sanitary Sewers	SD-002	0001			1		1										1				1
	SD-003	0001			1		1														
	SD-004	0001	1	1	1	1	1		1	1											
	SD-005	0001			1		1														
	SD-006	0001			1		1														
	SD-007	0001			1		1													1	
	SD-008	0001			1		1														
	SD-009	0001			1		1														
	SD-010	0001	1	1	1	1	1		1	1											
	SD-011	0001			1		1														
	SD-012	0001			1		1										1				1
	SD-013	0001			1		1														
	SD-014	0001			1		1														
	SD-015	0001			1		1														
	SD-016	0001			1		1														
			2	2	16	2	16	0	2	2	0	0	0	0	0	0	2	0	0	1	
DECON WATER	DECON1	0001	1	1	1	1	1														
			1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
DISPOSAL WASTE	WD1	0001	1	1	1		1		1	1	1										
			1	1	1	0	1	0	1	1	1	0	0	0	0	0	0	0	0	0	0

Notes:
Geo-tech analysis consists of Moisture Content (ASTM D2216), Atterburg Limits (ASTM D4318), UCS (ASTM D2487), pH (EPA 150.1) & Specific Gravity (ASTM D854)
Grainsize and TOC are taken at "all major drainageway" sediments
All shelby tubes taken during MW installatinons will have full geo-tech and grainsize analyses
PCPs need to be added to SVOC sample for Ammuntion Box pile

TABLE 1-16
SAMPLE ANALYSIS SPREADSHEET
CHARACTERIZATION OF 14 RVAAP AOCs - *CONTINGENCY SAMPLES*

SAMPLE PREFIX	SAMPLE ID			VOC 8260B	SVOC 8270C	Explosives 8330	Propellants 3532/8330	TAL Metals 6010/7000	Chrome +6 7196A	Pesticides 8081A	PCB 8082B	Cyanides 9010A/9012A	Nitrate EPA 353.2	TOC EPA 415.1	Geo-Tech Analysis (Various)	Grain Size ASTM D422	FIELD QA/QC SAMPLES Multi-Incremental QA	Duplicate Sample	Equipment Blank	Trip Blank	MS/MSD	USACE Split
CONTINGENCY SOILS																						
Surface Soils	SS-001M		0001		1	1		1														
	SS-002M		0001			1		1														
	SS-003M		0001			1		1														
	SS-004M		0001			1		1														
	SS-005M		0001	1	1	1	1	1		1	1											
	SS-006M		0001			1		1														
	SS-007M		0001			1		1										1				1
	SS-008M		0001			1		1														
	SS-009M		0001			1		1														
	SS-010M		0001	1	1	1	1	1		1	1											
Dry Ditches	SS-011M		0001			1		1														
	SS-012M		0001			1		1														
	SS-013M		0001			1		1										1				1
	SS-014M		0001			1		1														
	SS-015M		0001			1		1														
Sumps/Basins	SS-016M		0001			1		1														
	SS-017M		0001			1		1														
Pond/Wet Ditch/Spring	SS-018M		0001			1		1														
	SS-019M		0001			1		1														
				2	3	19	2	19	0	2	2	0	0	0	0	0	0	0	0	0	0	0
CONTINGENCY WATER																						
Sumps/Basins	SW-001		0001	1	1	1	1	1		1	1											
	SW-002		0001	1	1	1	1	1		1	1									1		
Pond/Wet Ditch/Spring	SW-003		0001	1	1	1	1	1		1	1											
	SW-004		0001	1	1	1	1	1		1	1											
				4	4	4	4	4	0	4	4	0	0	0	0	0	0	0	0	0	0	0
DECON WATER BLANK																						
	DW001		0001	1	1	1	1	1	1	1	1	1	1									
	DW002		0001	1	1	1	1	1	1	1	1	1	1									
				2	2	2	2	2	0	2	2	2	0	0	0	0	0	0	0	0	0	0

* Sample IDs can be changed prior to contingency sample use to reflect site/location specifics and media being sampled

2.0 PROJECT ORGANIZATION AND RESPONSIBILITY

The functional project organization and responsibilities are described in Section 2.0 of the Revised 2001 Facility-Wide Sampling and Analysis Plan (FW SAP) and Characterization of 14 RVAAP AOCs SAP Addendum. Analytical support for this work has been assigned to Severn Trent Laboratories, Inc. All of the analysis will be performed by Severn Trent's Chicago, Illinois laboratory with the exception of the propellant analysis (nitrocellulose & nitroguanidine). Severn Trent Laboratories, Inc. at their West Sacramento California facility will analyze the propellants. The QA lab, which will receive splits of 10% of the environmental samples, is PDC Laboratories in Peoria, IL. The U.S. Army Corp of Engineers (USACE) Hazardous, Toxic, and Radioactive Waste (HTRW) Center of Excellence (CX), Omaha, Nebraska has certified these laboratories. Severn Trent Chicago's, Severn Trent Laboratories, Inc./Sacramento Services' and PDC Laboratories Quality Manuals (LQM) are available for review upon request. The laboratories' organizational structure, roles, and responsibilities are identified in their LQM and facility-specific appendices. The project manager for both STL Laboratories will be Nancy McDonald and the project manager for PDC Laboratories will be Kurt Stepping. Eric Ellis will serve as MKM's primary liaison with both laboratories. Addresses and telephone numbers for the laboratories' facilities are as follows:

Analytical Facilities

Severn Trent Laboratories, Inc./Chicago – general analytical, explosive and nitroglycerin analytical services:
2417 Bond Street, University Park
Chicago, IL 60466
Tel: (708) 534-5200
Fax: (708) 534-5211

Severn Trent Laboratories, Inc./Sacramento – Propellants (nitrocellulose & nitroguanidine):
Sacramento, CA
880 Riverside Parkway
West Sacramento, CA 95605
Tel: (916) 373-5600
Fax: (916) 372-1059.

PDC Laboratories, Inc. – all analytical services for the 10% QA Split samples
2231 West Altorfer Drive
Peoria, IL 61615-1886
Tel: (309) 692-9688
Fax: (309) 692-9689

3.0 QUALITY ASSURANCE OBJECTIVES FOR MEASUREMENT

3.1 DATA QUALITY OBJECTIVES

Analytical Data Quality Objectives (DQO) summaries for this investigation will provide the information required in Tables 3-1 and 3-2 in the FW QAPP. All QC parameters will adhere to the requirements stated in the specific U.S. Environmental Protection Agency (EPA) SW-846 methods for each chemical listed. SW-846 Method references found in the FW QAPP have been revised to the Update III Methods (i.e., 8260A is now 8260B, 8270B is now 8270C, etc.). Laboratories are required to comply with all methods as written; recommendations are considered requirements.

3.2 LEVEL OF QUALITY CONTROL EFFORT

QC efforts will follow Section 3.2 of the FW QAPP. Field QC measurements will include field source water blanks, trip blanks, field duplicates, and equipment rinseate blanks. Laboratory QC measurements will include method blanks, laboratory control samples (LCS), laboratory duplicates, and matrix spike/matrix spike duplicate (MS/MSD) samples, as dictated by the individual methods.

3.3 ACCURACY, PRECISION, AND SENSITIVITY OF ANALYSIS

Accuracy, precision, and sensitivity goals identified in Section 3.3 and Table 3-1 and 3-2 of the FW QAPP and Table 3-1 of this document will be utilized for this investigation.

3.4 COMPLETENESS, REPRESENTATIVENESS, AND COMPARABILITY

Completeness, representativeness, and comparability goals identified in Section 3.4 and Tables 3-1 and 3-2 of the FW QAPP will be utilized for this investigation.

Table 3-1
RVAAP 14 AOC Characterization
Analytical Methods Parameters and Projects Quantitation Levels

	Analytical Methods		Project Quantitation[a]	
Parameters	**Water**	**Soil/Sediment**	**Water**	**Soil/Sediment**
Volatile Organic Compounds	SW-846-5030/8260B	SW-846-5030/8260B	(µg/L)	(µg/kg)
Chloromethane			1	5
Bromomethane			1	5
Vinyl chloride			1	5
Chloroethane			1	5
Methylene chloride			1	5
Acetone			10	20
Carbon disulfide			1	5
1,1-Dichloroethene			1	5
1,1-Dichloroethane			1	5
1,2-Dichloroethene (total)			1	5
Chloroform			1	5
1,2-Dibromomethane			1	5
1,2-Dichloroethane			1	5
2-Butanone			10	20
1,1,1-Trichloroethane			1	5
Carbon tetrachloride			1	5
Bromodichloromethane			1	5
1,2-Dichloropropane			1	5
1,3-*cis*-Dichloropropene			1	5
Trichloroethene			1	5
Dibromochloromethane			1	5
1,1,2-Trichloroethane			1	5
Benzene			1	5
1,3-*trans*-Dichloropropene			1	5
Tribromomethane			1	5
4-Methyl-2-pentanone			10	20
2-Hexanone			10	20
Tetrachloroethane			1	5
Toluene			1	5
1,1,2,2-Tetrachloroethane			1	5
Chlorobenzene			1	5
Ethylbenzene			1	5
Styrene			1	5
Xylenes (total)			2	10

	Analytical Methods		Project Quantitation[a]	
Parameters	**Water**	**Soil/Sediment**	**Water**	**Soil/Sediment**
Semivolatile Organic Compounds	SW-846-3520/8270C	SW-846-3550/8270C	(µg/L)	(µg/kg)[c]
Phenol			10	330
bis(2-Chloroethyl) ether			10	330
2-Chlorophenol			10	330
1,3-Dichlorobenzene			10	330
1,4-Dichlorobenzene			10	330
1,2-Dichlorobenzene			10	330
2-Methylphenol			10	330
2,2'-Oxybis (1-chloropropane)			10	330
4-Methylphenol			10	330
N-nitroso-di-n-dipropylamine			10	330
Hexachloroethane			10	330
Nitrobenzene			10	330
Isophorone			10	330
2-Nitrophenol			10	330
2,4-Dimethylphenol			10	330
bis (2-Chloroethoxy) methane			10	330
2,4-Dichlorophenol			10	330
1,2,4-Trichlorobenzene			10	330
Naphthalene			10	50
4-Chloroaniline			10	330
Hexachlorobutadiene			10	330
4-Chloro-3-methylphenol			10	330
2-Methylnaphthalene			10	330
Hexachlorocyclopentadiene			10	330
2,4,6-Trichlorophenol			10	330
2,4,5-Trichlorophenol			25	800
2-Chloronaphthalene			10	330
2-Nirtoaniline			25	800
Dimethylphthalate			10	330
Acenaphthylene			10	50
2,6 Dinitrotoluene			10	330
3-Nitroaniline			25	800
Acenaphthene			10	50
2,4-Dinitrophenol			25	800
4-Nitrophenol			25	800
Dibenzofuran			10	330
2,4-Dinitrotoluene			10	330
Diethylphthalate			10	330
4-Chlorophenyl-phenyl ether			10	330
Fluorene			10	50
4-Nitroaniline			25	800
4,6-Dinitro-2-methylphenol			25	800
N-nitrosodiphenylamine			10	330

	Analytical Methods		Project Quantitation[a]	
Parameters	**Water**	**Soil/Sediment**	**Water**	**Soil/Sediment**
Semivolatile Organic Compounds (continued)	SW-846-3520/8270C	SW-846-3550/8270C	(µg/L)	(µg/kg)[c]
4-Bromophenyl-phenylether			10	330
Hexachlorobenzene			10	330
Pentachlorophenol			25	800
Phenanthrene			10	50
Anthracene			10	50
Carbazole			10	50
di-N-butylphthalate			10	330
Fluoranthene			10	50
Pyrene			10	50
Butylbenzylphthalate			10	330
3,3'-Dichlorobenzidine			10	330
Benzo(a)anthracene			10	50
Chrysene			10	50
bis(2-Ethylhexyl)phthalate			10	330
di-N-octylphthalate			10	330
Benzo(*b*)fluoranthene			10	50
Benzo(*k*)fluoranthene			10	50
Benzo(*a*)pyrene			10	50
Indenol(*1,2,3-cd*)pyrene			10	50
Dibenzo(*a,h*)anthracene			10	50
Benzo(*g,h,I*)perylene			10	50
Pesticides/PCBs	SW-846-8081[b]/8082	SW-846-8081[b]/8082	(µg/L)	(µg/kg)[c]
alpha-BHC			0.05	1.7
beta-BHC			0.05	1.7
delta-BHC			0.05	1.7
gamma-BHC (Lindane)			0.05	1.7
Heptachlor			0.05	1.7
Aldrin			0.05	1.7
Heptachlor epoxide			0.05	1.7
Endosulfan I			0.05	1.7
Dieldrin			0.05	1.7
4,4-DDE			0.05	1.7
Endrin			0.05	1.7
Endosulfan II			0.05	1.7
4,4-DDD			0.05	1.7
Endosulfan sulfate			0.05	1.7
4,4-DDT			0.05	1.7
Methoxychlor			0.1	17
Endrin ketone			0.05	1.7
Endrin aldehyde			0.05	1.7
alpha-Chlorodane			0.05	1.7
gamma-Chlorodane			0.05	1.7

	Analytical Methods		Project Quantitation[a]	
Parameters	**Water**	**Soil/Sediment**	**Water**	**Soil/Sediment**
Pesticides/PCBs (Continued)	SW-846-8081[b]/8082	SW-846-8081[b]/8082	(µg/L)	(µg/kg)[c]
Toxaphene			2.0	33
Arochlor-1016			0.5	33
Arochlor-1221			0.5	33
Arochlor-1232			0.5	33
Arochlor-1242			0.5	33
Arochlor-1248			0.5	33
Arochlor-1254			0.5	33
Arochlor-1260			0.5	33
Explosive Compounds	SW-846-8330	SW-846-8330	(µg/L)	(µg/kg)[c]
HMX [Octahydro-1,3,5,7-				
tetranitro-1,3,5,7-tetrazocinel]			0.5	1
RDX (cyclonite) [Hexahydro-				
1,3,5-trinitro-1,3,5-triazine]			0.5	1
1,3,5,-Trinitrobenzine			0.2	0.25
1,3-Dinitrobenzene			0.2	0.25
Tetryl			0.2	0.25
Nitrobenzene			0.2	0.25
2,4,6-Trinitroltoluene			0.2	0.25
2,4-Dinitrotoluene			0.2	0.25
2,6-Dinitrotoluene			0.2	0.25
o-Nitrotoluene			0.2	0.25
m-Nitrotoluene			0.2	0.25
p-Nitrotoluene			0.2	0.25
Propellant Compounds	SW-846-8330 Modified	SW-846-8330 Modified	(µg/L)	(µg/kg)[c]
Nitroglycerin			3	3
Nitroquanidine			3	3
	EPA 353.2	EPA 353.2		
Nitrocellulose	Modified	Modified	500	5
Metals (Target Analyte List)	SW-846-3010A/6010B, 6020, or 7000 Series	SW-846-3010A/6010B, 6020, or 7000 Series	(µg/L)	(mg/kg)[ce]
Aluminum			72.6	7.2
Antimony			5	1
Arsenic			5	0.5
Barium			10	1
Beryllium			0.051	0.132
Cadmium			1	0.25
Calcium			100	10
Chromium			5	1.0
Cobalt			5	0.5
Copper			4.8	3

	Analytical Methods		Project Quantitation[a]	
Parameters	**Water**	**Soil/Sediment**	**Water**	**Soil/Sediment**
Metals (Target Analyte List) (Continued)	SW-846-3010A/6010B, 6020, or 7000 Series	SW-846-3010A/6010B, 6020, or 7000 Series	(µg/L)	(µg/kg)[e]
Iron			125	10
Lead			3	0.3
Magnesium			100	10
Manganese			10	1
Mercury (CVAA)	SW-846-7470A	SW-846-7471A	0.2	0.1
Nickel			10	1
Potassium			330	50
Selenium			5	0.5
Silver			5	1.0
Sodium			1500	260.10
Thallium			2	0.2
Vanadium			10	1
Zinc			30	2
Hexavalent Chromium	SW-846-7196A	SW-846-7196A	--	--
Cyanide	SW-846-9010B	SW-846-9014	0.01	0.5
Anions				
Nitrate/Nitrite	EPA 352.2 or 352.3	--	0.1	--

a These are expected quantitation limits based on reagent-grade water or a purified solid matrix. Actual quantitation limits may be higher depending upon the nature of the sample matrix. The limit reported on final laboratory reports will take into account the actual sample volume or weight, percent solids (where applicable), and the dilution factor, if any. The quantitation limits for additional analytes to this list may vary, depending upon the results of laboratory studies

b Values determined between the laboratory method detection levels and the project quantitation levels will be reported as estimated ('J').

c Soils and sediment analysis will be reported on a dry-weight basis.

d Modification of the SW-846 preparation and analysis procedures may be required to achieve these quantitation levels.

e Estimated detection limits for metals in soil are based on a 2-gram sample diluted to 200 milliliters.

f See Appendix A to this QAPP for detailed laboratory limits/variances specific to this project.

CVAA = Cold vapor atomic absorption.

4.0 SAMPLING PROCEDURES

Sampling procedures are discussed in Section 4.0 of the FW SAP and SAP Addendum for the Characterization of 14 RVAAP AOCs. Tables 4-1 and 4-2 summarize sample container, preservation, and holding time requirements for the water and soil matrices for this investigation. The number of containers is based on the number of samples listed on Table 3 of the 11 May 2004 SOW.

Table 4-1
RVAAP 14 AOC Characterization
EPA SW-846 Container Requirements for Soil and Sediment Samples

Analyte Group	Approx. No. of Bottles incl. Field QC	Container	Minimum Sample Size	Preservative	Holding Time
Volatile Organic Compounds	71	2 – 2 oz. glass jar bottles with Teflon® - lined caps (no headspace)	5 grams	Cool, 4º C +/-2	14 days
Semi-volatile Organic Compounds	112	1 – 16 oz. glass jar with Teflon® - lined cap (no headspace)	30 grams	Cool, 4º C +/-2	14 days (extraction) 40 days (analysis)
Pesticides/PCBs	69	Glass jar with Teflon® - lined cap (include in SVOC container)	30 grams	Cool, 4º C +/-2	14 days (extraction) 40 days (analysis)
Explosives/ Nitroglycerine	466	1 – 4 oz. glass jar with Teflon® - lined cap	5 grams	Cool, 4º C +/-2	14 days (extraction) 40 days (analysis)
Propellants (Nitroquanidine & Nitrocellulose)	89	1 – 4 oz. glass jar with Teflon® - lined cap	5 grams	Cool, 4º C +/-2	14 days (extraction) 40 days (analysis)
Metals	466	Glass jar with Teflon® - lined cap (include in SVOC container)	10 grams	Cool, 4º C +/-2	180 days (Hg 28 days)
Cyanide	74	1 – 4 oz. glass jar with Teflon® - lined cap	5 grams	Cool, 4º C +/-2	14 days
Nitrate	121	Glass jar with Teflon® - lined cap (include in Cyanide container)	20 grams	Cool, 4º C +/-2	2 days (extraction) 28 days (analysis)
Hexavalent Chromium	20	Glass jar with Teflon® - lined cap (include in Cyanide container)	5 grams	Cool, 4º C +/-2	28 days

QC = Quality Control

Table 4-2
RVAAP 14 AOC Characterization
EPA SW-846 Container Requirements for All Groundwater, Surface Water And All Rinseate Samples

Analyte Group	Approx. No. of Bottles incl. Field QC	Container	Minimum Sample Size	Preservative	Holding Time
Volatile Organic Compounds	253	3 – 40mL glass vials with Teflon® - lined septum (no headspace)	80 mL	Cool, 4º C +/-2 HCL to pH < 2	14 days
Semi-volatile Organic Compounds	229	2 - 1L amber glass bottles with Teflon® - lined lids	1000 mL	Cool, 4º C +/-2	7 days (extraction) 40 days (analysis)
Pesticides/PCBs	229	2 – 1L amber glass bottles with Teflon® - lined lids	1000 mL	Cool, 4º C +/-2	7 days (extraction) 40 days (analysis)
Explosives/ Nitroglycerine	229	2 – 1L amber glass bottles with Teflon® - lined lids	1000 mL	Cool, 4º C +/-2	14 days (extraction) 40 days (analysis)
Propellants (Nitroquanidine & Nitrocellulose)	148	2 – 500mL amber glass bottles with Teflon® - lined lids	250 mL	Cool, 4º C +/-2	14 days (extraction) 40 days (analysis)
Metals	229	1 – 500mL poly bottle	250 mL	Cool, 4º C +/-2 HNO_3 to pH < 2	180 days (Hg 28 days)
Cyanide	39	1 – 250mL poly bottle	100 mL	Cool, 4º C +/-2 NaOH to pH > 12	14 days
Nitrate	78	1 – 250mL poly bottle (unpreserved) 1 – 250mL poly bottle (preserved)	100 mL (each)	Cool, 4º C +/-2 H_2SO_4 to pH <2	2 days (extraction) 28 days (analysis)
Hexavalent Chromium	28	1 – 250mL poly bottle	100 mL	Cool, 4º C +/-2	24 hours

QC = Quality Control

5.0 SAMPLE CUSTODY

5.1 FIELD CHAIN-OF-CUSTODY PROCEDURES

Sample handling, packaging, and shipment procedures will follow those identified in Section 6.0 of the FW SAP and as amended in Section 6.0 of the Characterization of 14 RVAAP AOCs SAP Addendum.

5.2 LABORATORY CHAIN-OF-CUSTODY PROCEDURES

Laboratory chain of custody (COC) will follow handling and custody procedures identified in the Site Wide SAP and sub-contracted laboratories LQM.

5.3 FINAL EVIDENCE FILES CUSTODY PROCEDURES

Custody of evidence files will follow those criteria defined in Section 5.3 of the FW QAPP.

6.0 CALIBRATION PROCEDURES AND FREQUENCY

6.1 FIELD INSTRUMENTS/EQUIPMENT

Field instruments and equipment calibrations will follow those set forth in Section 6.1 of the FW QAPP. This will be amended only as specified by the manufacturer's operating instructions.

6.2 LABORATORY INSTRUMENTS

Calibration of laboratory equipment will follow procedures identified in the laboratories' LQM, corporate, and facility-specific operating procedures.

7.0 ANALYTICAL PROCEDURES

7.1 LABORATORY ANALYSIS

Analytical methods, parameters and quantitation or reporting limits will be listed in Table 3-1 of this document and applicable amendments. The laboratory's LQM will be followed during the analysis of these samples. The following laboratory Standard Operating Procedures (SOP) will implement the defined EPA methods.

- GC/MS Volatile Organics Analysis Based on Method 8260B, SW-846, UMV-SOP-8260, 03/10/99.
- GC/MS Semi-volatile Analysis Based on Methods 8270B and 8270C, SW-846, UMB-SOP-8270, 07/23/99.
- Gas Chromatographic Analysis Based on Method 8000A, 8010B, 8020A, 8021A, 8080A, 8081, 8082, 8150B, and 8051, SW-846, UGE-SOP-8081A, 03/01/99 and UGE-SOP-8082, 03/01/99.
- Extraction and Cleanup of Organic Compounds from Waters and Soils, Based on SW-846 3500 Series, 3600 Series, 8150, 8151, and 600 Series Methods, CORP-OP-0001, Rev. 3.4, 4/15/99.
- Analysis of Nitroaromatic and Nitramine Explosives in water and soil by HPLC/UV and Liquid Chromatography/Thermospray/Mass Spectrometry, SAC-LC-0001.
- Total Organic Carbon and Total Inorganic Carbon, UWC-SOP-415.1, 06/25/99.
- Inductively Coupled Plasma-Atomic Emission Spectroscopy, Spectrometric Method for Trace Element Analysis, Methods 6010B, UME-SOP-6010B-1T, 02/05/99.
- Graphite Furnace Atomic Absorption Spectroscopy, SW-846 Methods 7000A, UME-SOP-ILM GF, 04/19/99.
- Mercury in Aqueous Samples by Cold Vapor Atomic Absorption, SW-846 7470A and MCAWW 245.1, UME-SOP-245.1, 04/19/99.
- Preparation and analysis of Nitrocellulose in Aqueous, Soil, and Sediments by Colorimetric Autoanalyzer, SAC-WC-0050, Rev. 0.
- Determination of nitroaromatics, nitramines, and specialty explosives in water and soil by high performance liquid chromatography/ultraviolet detector (HPLC/UV) and liquid chromatography/thermospray/mass spectrometry (LC/TSP/MS), SAC-LC-0001, Rev. 5.0.

Additional analytical methods to be used for this characterization activity include:

- Nitrate - EPA Method 353.2
- Hexavalent Chromium - SW-846 Method 7196A
- Geotechnical analysis to consist of Moisture Content (ASTM D2216), Atterburg Limits (ASTM D4318), Unified Soil Classification System (USCS) Classification (ASTM D2487), pH (EPA 150.1) and Specific Gravity (ASTM D854)

The laboratory will at all times maintain a safe and contaminant free environment for the analysis of samples. The laboratory will demonstrate, through instrument blanks, holding blanks, and analytical method blanks, that the laboratory environment and procedures will not and do not impact analytical results. The laboratory will also implement all reasonable procedures to maintain project-reporting levels for all sample analyses. Where contaminant and sample matrix analytical interferences impact the laboratory's ability to obtain project-reporting levels, the laboratory will institute sample clean-up processes, minimize dilutions, adjust instrument operational parameters, or propose alternative analytical methods or procedures. Elevated reporting levels will be kept to a minimum throughout the execution of this work.

Although this project falls under the requirements of the USACE Louisville Chemistry Guidance (LCG), the FW QAPP quantitation levels (as presented in Table 3-1) are the governing analytical detection limits for this project. Additionally, project specified reporting limits (RL) take precedence over those presented in the LCG. However, lower control limits (LCL) and upper control limits (UCL) defer to those prescribed in the LCG. In the event that a laboratory-proposed RL is greater than three times the method detection limit (MDL), a USACE-approved variance will be required prior to USACE acceptance of the adjusted RL. The contracted laboratory's reporting limit and control limit (CL) compliance tables (and annotated variances) for all the applicable analytical methods are presented in Appendix A of this QAPP.

7.2 FIELD SCREENING ANALYTICAL PROTOCOLS

No analytical field screening will be performed during this project.

8.0 INTERNAL QUALITY CONTROL CHECKS

8.1 FIELD SAMPLE COLLECTION

Field QC/QA sample types, numbers, and frequencies are identified in Section 1.5 of this document and are explicitly presented in Tables 1-1 through 1-16. In general, field duplicates (blind, QC) will be collected at a frequency of ten (10) percent for each matrix. Similarly, full-suite analyses of each sample matrix will be randomly assigned and collected at a frequency of ten (10) percent for each matrix. Field equipment rinseates for ground and surface water will be collected at a frequency of ten (10) percent for samples collected with non-dedicated equipment. Field equipment rinseates for soil and sediment samples will be collected at a frequency of one per week of soil sampling and one per week of sediment sampling. All shipments containing volatile organic compound samples will contain laboratory-produced volatile organic compound trip blanks. MS/MSDs will be collected at a frequency of five (5) percent for each sample matrix. QA split samples will be collected on ten (10) percent of the total number of field samples collected for each matrix and sent to the designated QA laboratory. In addition, one multi-incremental field blank will be collected during each AOC field sampling activity.

8.2 FIELD MEASUREMENT

Field measurements for VOCs will be recorded for each AOC soil or sediment sample and for each split spoon interval during monitoring well installation using a hand held photo-ionization detector (PID). Field measurements for pH, temperature, dissolved oxygen (surface water) and conductivity will be recorded for each groundwater and surface water sample. All field measurement procedures and criteria will follow Section 4.3.3 of the FW SAP.

8.3 SAMPLE PROCESSING

A majority of the surface soil samples will be collected using a multi-incremental (MI) sampling method. This method is described in detail in Attachment 2 of the SAP Addendum for the Characterization of 14 RVAAP AOCs. An additional requirement of the multi-incremental sampling technique involves careful sample processing and preparation. All multi-incremental sample processing procedures and criteria will follow those outlined in Section 6.1 of the SAP Addendum for the Characterization of 14 RVAAP AOCs. For multi-incremental samples, two types of QA/QC samples will be collected: duplicates, which are two samples that are comprised of soil from the same processed soil sample; and splits, which are two separate samples (each comprised of 30 different aliquots) collected from the same multi-incremental sample area. These QA/QC samples will assess the sample collection method applied in the field and the sample processing method employed in the Building 1036 sample processing area.

8.4 LABORATORY ANALYSIS

Analytical QC/QA procedures will follow those identified in the referenced EPA methodologies. These will include method blanks, LCS, MS, MSD, laboratory duplicate analysis, calibration standards, internal standards, surrogate standards, and calibration check standards as required by specific methods. The laboratory will conform to its LQM, facility-specific appendices, and implement its established SOPs to perform the various analytical methods required by the project. QC/QA frequencies will follow those identified in Section 8.3 of the FW QAPP and as amended in Section 8.1 of this document.

9.0 DATA REDUCTION, VALIDATION, AND REPORTING

9.1 DATA REDUCTION

Sample collection and field measurements will follow the established protocols defined in the FW QAPP, FW SAP, and the SAP Addendum for the Characterization of 14 RVAAP AOC. Laboratory data reduction will follow the laboratories' LQM guidance and conform to general direction provided by the FW QAPP.

9.2 DATA VALIDATION

The USACE – Louisville District will validate the data in accordance with the requirements set forth in the FW QAPP. The schedule assumes data validation will be completed in 30 days.

9.3 DATA REPORTING

Analytical data reports will follow the direction provided in the FW QAPP.

10.0 PERFORMANCE AND SYSTEM AUDITS

10.1 FIELD AUDITS

Informal field audits will be conducted on an on-going basis to ensure the consistency of implementation. This includes field training, daily review of field forms and observing field procedures. The MKM QA Officer and/or the MKM Field Team Leader will perform a minimum of one formal field audit for the media being sampled during the investigation. This audit will encompass the sampling of groundwater from the wells, surface water, soils and sediment. USACE, EPA Region V, or Ohio EPA audits may be conducted at the discretion of the respective agency.

10.2 LABORATORY AUDITS

Routine Missouri River Division HTRW CX on-site laboratory audits will be conducted at the discretion of the USACE. EPA Region V or Ohio EPA audits may be conducted at the discretion of the respective agency. Internal performance and systems audits will be conducted by the laboratory's QA staff as defined in the laboratory's LQM.

11.0 PREVENTIVE MAINTENANCE PROCEDURES

11.1 FIELD INSTRUMENTS AND EQUIPMENT

Preventative maintenance of all field analytical and sampling equipment will follow direction provided in Section 11.1 of the FW QAPP.

11.2 LABORATORY INSTRUMENTS

Routine and preventive maintenance for all laboratory instruments and equipment will follow the direction of the laboratory's LQM.

12.0 SPECIFIC ROUTINE PROCEDURES TO ASSESS DATA PRECISION, ACCURACY, AND COMPLETENESS

12.1 FIELD MEASUREMENTS DATA

Field data will be assessed as outlined in Section 12.1 of the FW QAPP.

12.2 LABORATORY DATA

Laboratory data will be assessed as outlined in Section 12.2 of the FW QAPP. Laboratory data, in the form of electronic data deliverables (EDD) will be provided by the USACE-approved subcontracted lab for use in the USACE Automated Data Review (ADR)/Environmental Data Management System (EDMS) program.

As stated in Section 3.7 of the SOW, a contractor-generated project-specific library and the most current Louisville Chemistry Guidance (LCG) master library, with all of the methods to be analyzed under this SOW, will be used as reference for all complied EDDs. The project-specific library will accurately reflect all of the analytical requirements as documented in the Table 3-1 of the FW-QAAP and will be provided to both the USACE and the sub-contract laboratory for use in screening submittals and use in the respective ADR programs.

Data review must comply with the LCG criteria and provide compatibility with EDMS software. In addition, libraries will be created in ADR/EDMS for deriving site of constituents of potential concern (COPCs). All LCG updates will be required to be updated as needed in the ADR database.

All electronic data submitted by the sub-contracted laboratory will be error-free, and in complete agreement with the hardcopy data. Data files are to be delivered electronically as well as in hard. All electronic data must be submitted with a transmittal letter certifying that electronic data is in agreement with all hardcopy data reports and has been found to be free of the errors using the latest version of ADR software. The contract laboratory, at its cost, will correct any errors identified by the USACE, Louisville District.

13.0 CORRECTIVE ACTIONS

13.1 SAMPLE COLLECTION/FIELD MEASUREMENTS

Field activity corrective action protocol will follow directions provided in Section 13.1 of the FW QAPP.

13.2 LABORATORY ANALYSES

Laboratory activity corrective action protocol will follow directions provided in Section 13.2 of the FW QAPP and the laboratory's LQM.

14.0 QA REPORTS TO MANAGEMENT

Procedures and reports will follow the protocol identified in Section 14 of the FW QAPP and those directed by the laboratory's LQM.

15.0 REFERENCES

Additional references to the FW QAPP are:

Severn Trent Laboratories, Inc. Chicago. *Laboratory Quality Manual (LQM)*, Revision 3, May 7, 2004.

Severn Trent Laboratories, Inc. Sacramento. *Laboratory Quality Manual (LQM)*, Revision 1, February 1, 2003.

APPENDIX A

Laboratory Reporting and Control Limits Compliance Tables

Appendix A

Laboratory Reporting and Control Limits Compliance Table

RVAAP 14 AOC Characterization

Severn Trent Laboratories, Inc. **Revision 1: 10/6/04**

Test Description	Test Matrix	Units	Lab MDL	Proposed Lab RL	Project PQL	Proposed Lab RL < Project PQL	LCG Control Limit			.	USACE Comments
							LCL	UCL	RPD	Request Variance	
Method: Low-Level Metals Analysis (ICAP Trace) (6010B)										x	
Arsenic	Water	ug/L	5.2	**20**			80	120	20	X (RL)	
Cadmium	Water	ug/L	0.44	2			80	120	20		
Copper	Water	ug/L	1.6	10			80	120	20		
Lead	Water	ug/L	2.9	7.5			80	120	20		
Manganese	Water	ug/L	0.71	10			80	120	20		
Selenium	Water	ug/L	5.0	**15**			80	120	20	X (RL)	
Thallium	Water	ug/L	6.9	**25**			80	120	20	X (RL)	
Vanadium	Water	ug/L	2.1	10			80	120	20		
Method: Low-Level Metals Analysis (ICAP Trace) (6010B)										x	
Arsenic	Solid	mg/Kg	0.51	**2.0**			80	120	20	X (RL)	
Cadmium	Solid	mg/Kg	0.08	0.50			80	120	20		
Copper	Solid	mg/Kg	0.90	**3.0**			80	120	20	X (RL)	
Lead	Solid	mg/Kg	0.43	**2.0**			80	120	20	X (RL)	
Manganese	Solid	mg/Kg	0.13	1			80	120	20		
Selenium	Solid	mg/Kg	0.40	**1.5**			80	120	20	X (RL)	
Thallium	Solid	mg/Kg	0.66	2.5			80	120	20		
Vanadium	Solid	mg/Kg	0.21	1.0			80	120	20		
Method: Metals Analysis (ICAP Trace) (6010B)										x	
Aluminum	Water	ug/L	24.2	**150**	100	No	80	120	20	X (RL-Proj)	Variance approved
Antimony	Water	ug/L	11.8	**40**	5	No	80	120	20		Run by GFAA
Arsenic	Water	ug/L	5.2	**20**	5	No	80	120	20		Run by GFAA
Barium	Water	ug/L	1.5	10	10	Yes	80	120	20		
Beryllium	Water	ug/L	0.17	**2**	1	No	80	120	20	X (RL-Proj)	Variance approved
Boron	Water	ug/L	2.8	**50**			80	120	20	X (RL)	
Cadmium	Water	ug/L	0.44	**2**	1	No	80	120	20		Run by GFAA
Calcium	Water	ug/L	23.5	100	100	Yes	80	120	20		
Chromium	Water	ug/L	1.5	**10**	5	No	80	120	20		Run by GFAA
Cobalt	Water	ug/L	1.0	5	5	Yes	80	120	20		
Copper	Water	ug/L	1.6	**10**	5	No	80	120	20	X (RL-Proj)	Variance approved
Iron	Water	ug/L	39.6	**125**	100	No	80	120	20	X (RL-Proj)	Variance approved
Lead	Water	ug/L	2.9	**9.0**	3	No	80	120	20	X (RL)	Run by GFAA
Magnesium	Water	ug/L	12.4	100	100	Yes	80	120	20		
Manganese	Water	ug/L	0.71	10	10	Yes	80	120	20		
Molybdenum	Water	ug/L	2.9	20			80	120	20		
Nickel	Water	ug/L	1.9	10	10	Yes	80	120	20		
Potassium	Water	ug/L	110	**500**	200	No	80	120	20	X (RL-Proj)	Variance approved
Selenium	Water	ug/L	5.0	**15**	5	No	80	120	20		Run by GFAA
Silver	Water	ug/L	3.1	**10**	5	No	80	120	20		Run by GFAA
Sodium	Water	ug/L	495	**1500**	200	No	80	120	20	X (RL-LCG/Proj)	Variance approved
Strontium	Water	ug/L	2.5	10			80	120	20		
Thallium	Water	ug/L	6.9	**25**	2	No	80	120	20		Run by GFAA
Tin	Water	ug/L	3.3	50			80	120	20		
Vanadium	Water	ug/L	2.1	10	10	Yes	80	120	20		
Zinc	Water	ug/L	10	**30**	10	No	80	120	20	X (RL-Proj)	Variance approved
Method: Metals Analysis (ICAP Trace) (6010B)										x	
Aluminum	Solid	mg/Kg	2.4	**15**	10	No	80	120	20	X (RL-Proj)	Variance approved
Antimony	Solid	mg/Kg	0.90	**3**	0.5	No	80	120	20		By GFAA
Arsenic	Solid	mg/Kg	0.51	**1.5**	0.5	No	80	120	20		By GFAA
Barium	Solid	mg/Kg	0.16	1	1	Yes	80	120	20		
Beryllium	Solid	mg/Kg	0.044	**0.40**	0.1	No	80	120	20	X (RL-Proj)	Variance approved
Boron	Solid	mg/Kg	0.67	5			80	120	20		
Cadmium	Solid	mg/Kg	0.08	**0.25**	0.1	No	80	120	20	X (RL-Proj)	Variance approved
Calcium	Solid	mg/Kg	3.1	10	10	Yes	80	120	20		
Chromium	Solid	mg/Kg	0.22	**1.0**	0.5	No	80	120	20	X (RL-Proj)	Variance approved
Cobalt	Solid	mg/Kg	0.14	0.5	0.5	Yes	80	120	20		
Copper	Solid	mg/Kg	0.90	**3**	0.5	No	80	120	20	X (RL-LCG/Proj)	Variance approved
Iron	Solid	mg/Kg	3.0	10	10	Yes	80	120	20		
Lead	Solid	mg/Kg	0.43	**1.5**	0.3	No	80	120	20		By GFAA
Magnesium	Solid	mg/Kg	1.7	10	10	Yes	80	120	20		
Manganese	Solid	mg/Kg	0.13	1	1	Yes	80	120	20		
Molybdenum	Solid	mg/Kg	0.26	2			80	120	20		
Nickel	Solid	mg/Kg	0.25	1	1	Yes	80	120	20		
Potassium	Solid	mg/Kg	13.8	**50**	20	No	80	120	20	X (RL-Proj)	Variance approved

Appendix A

Laboratory Reporting and Control Limits Compliance Table

RVAAP 14 AOC Characterization

Test Description	Test Matrix	Units	Lab MDL	Proposed Lab RL	Project PQL	Proposed Lab RL < Project PQL	LCG Control Limit			.	USACE Comments
							LCL	UCL	RPD	Request Variance	
Selenium	Solid	mg/Kg	0.40	**1.5**	0.5	No	80	120	20		By GFAA
Silver	Solid	mg/Kg	0.31	**1.0**	0.5	No	80	120	20	X (RL-Proj)	Variance approved
Sodium	Solid	mg/Kg	86.7	**300**	20	No	80	120	20	X (RL-LCG/Proj)	Variance approved
Strontium	Solid	mg/Kg	0.11	1.0			80	120	20		
Thallium	Solid	mg/Kg	0.66	**2.5**	0.2	No	80	120	20		By GFAA
Tin	Solid	mg/Kg	1.03	5.0			80	120	20		
Vanadium	Solid	mg/Kg	0.21	1.0	1	Yes	80	120	20		
Zinc	Solid	mg/Kg	0.40	**2**	1	No	80	120	20	X (RL-LCG/Proj)	Variance approved
Method: Antimony (GFAA-7041)											
Antimony	Water	ug/L	2.5	**7.5**	5	No	80	120	20	X (RL-Proj)	Variance approved
Antimony	Solid	ug/Kg	440	**1400**	500	No	80	120	20	X (RL-Proj)	
Method: Arsenic (GFAA-7060A)											
Arsenic	Water	ug/L	0.51	2	5	Yes	80	120	20		
Arsenic	Solid	ug/Kg	190	**600**	500	No	80	120	20	X (RL-Proj)	Variance approved
Method: Cadmium (GFAA-7131A)											
Cadmium	Water	ug/L	0.15	0.5	1	Yes	80	120	20		
Cadmium	Solid	ug/Kg	16	50	100	Yes	80	120	20		
Method: Chromium (GFAA-7191)											
Chromium	Water	ug/L	0.45	2	5	Yes	80	120	20		
Chromium	Solid	ug/Kg	280	**900**	500	No	80	120	20		
Method: Lead (GFAA-7421)											
Lead	Water	ug/L	0.79	3	3	Yes	80	120	20		
Lead	Solid	ug/Kg	110	**350**	300	No	80	120	20	X (RL-Proj)	Variance approved
Method: Selenium (GFAA-7740)											
Selenium	Water	ug/L	0.6	2	5	Yes	80	120	20		
Selenium	Solid	ug/Kg	160	500	500	Yes	80	120	20		
Method: Thallium (GFAA-7841)											
Thallium	Water	ug/L	1.3	**4**	2	No	80	120	20	X (RL-Proj)	Variance approved
Thallium	Solid	ug/Kg	190	**600**	200	No	80	120	20	X (RL-Proj)	Variance approved
Method: Silver (GFAA-7761)											
Silver	Water	ug/L	0.7	3	5	Yes	80	120	20		
Method: Mercury (CVAA-7470A/7471A)											
Mercury	Water	ug/L	0.049	0.2	0.2	Yes	80	120	20		
Mercury	Solid	ug/Kg	8.6	33	100	Yes	80	120	20		
Method: Cyanide (9014)											
Cyanide, Total	Water	mg/L	0.0044	**0.015**	0.01	No	80	120	20	X (RL-Proj)	
Cyanide, Total	Solid	mg/Kg	0.22	**0.70**	0.5	No	80	120	20	X (RL-Proj)	
Method: Hexavalent Chromium (7196)										x	
Hexavalent Chromium	Water	mg/L	0.0016	0.01			**80**	**120**	**20**	X (Limit)	Approved
Hexavalent Chromium	Solid	mg/Kg	0.49	2			**70**	**130**	**20**	X (Limit)	Approved
Method: Organochlorine Pesticide Analysis (8081A)										x	
4,4'-DDD	Water	ug/L	0.036	**0.11**	0.05	No	50	137	30	X (RL-Proj)	Variance approved
4,4'-DDE	Water	ug/L	0.023	**0.10**	0.05	No	50	130	30	X (RL-Proj)	Variance approved
4,4'-DDT	Water	ug/L	0.049	**0.15**	0.05	No	50	145	30	X (RL-LCG/Proj)	Variance approved
Aldrin	Water	ug/L	0.028	**0.10**	0.05	No	53	128	30	X (RL-LCG/Proj)	Variance approved
alpha-BHC	Water	ug/L	0.047	**0.15**	0.05	No	44	137	30	X (RL-LCG/Proj)	Variance approved
alpha-Chlordane	Water	ug/L	0.016	**0.05**	0.05	Yes	50	122	30	X (RL-LCG)	Acceptable as proposed
beta-BHC	Water	ug/L	0.028	**0.10**	0.05	No	50	135	30	X (RL-LCG/Proj)	Variance approved
delta-BHC	Water	ug/L	0.025	**0.10**	0.05	No	58	160	30	X (RL-LCG/Proj)	Variance approved
Dieldrin	Water	ug/L	0.018	**0.10**	0.05	No	50	124	30	X (RL-Proj)	Variance approved
Endosulfan I	Water	ug/L	0.021	**0.10**	0.05	No	50	160	30	X (RL-LCG/Proj)	Variance approved
Endosulfan II	Water	ug/L	0.042	**0.15**	0.05	No	50	144	30	X (RL-Proj)	Variance approved
Endosulfan sulfate	Water	ug/L	0.044	**0.15**	0.05	No	50	160	30	X (RL-Proj)	Variance approved
Endrin	Water	ug/L	0.017	**0.10**	0.05	No	50	137	30	X (RL-Proj)	Variance approved
Endrin aldehyde	Water	ug/L	0.035	**0.15**	0.05	No	30	160	30	X (RL-LCG/Proj)	Variance approved
Endrin ketone	Water	ug/L	0.029	**0.10**	0.05	No	50	150	30	X (RL-Proj)	Variance approved
gamma-BHC (Lindane)	Water	ug/L	0.042	**0.15**	0.05	No	58	127	30	X (RL-LCG/Proj)	Variance approved
gamma-Chlordane	Water	ug/L	0.017	**0.10**	0.05	No	50	130	30	X (RL-LCG/Proj)	Variance approved
Heptachlor	Water	ug/L	0.041	**0.15**	0.05	No	48	150	30	X (RL-LCG/Proj)	Variance approved
Heptachlor epoxide	Water	ug/L	0.036	**0.15**	0.05	No	50	127	30	X (RL-Proj)	Variance approved
Methoxychlor	Water	ug/L	0.17	**0.60**	0.1	No	50	160	30	X (RL-Proj)	Variance approved
Toxaphene	Water	ug/L	0.14	0.50	2	Yes					
Surrogates										x	
Decachlorobiphenyl (surr)	Water	ug/L				Yes	**20**	150		X (Limit)	Variance approved
Tetrachloro-m-xylene (surr)	Water	ug/L				Yes	**50**	150		X (Limit)	Variance approved
Method: Organochlorine Pesticide Analysis (8081A/3541)										x	

Appendix A

Laboratory Reporting and Control Limits Compliance Table

RVAAP 14 AOC Characterization

Test Description	Test Matrix	Units	Lab MDL	Proposed Lab RL	Project PQL	Proposed Lab RL < Project PQL	LCG Control Limit			.	
							LCL	UCL	RPD	Request Variance	USACE Comments
4,4'-DDD	Solid	ug/Kg	0.36	1.7	1.7	Yes	50	136	50		
4,4'-DDE	Solid	ug/Kg	0.65	**2.0**	1.7	No	50	120	50	X (RL-Proj)	Variance approved
4,4'-DDT	Solid	ug/Kg	0.37	1.7	1.7	Yes	55	160	50		
Aldrin	Solid	ug/Kg	0.13	1.7	1.7	Yes	55	133	50		
alpha-BHC	Solid	ug/Kg	0.16	1.7	1.7	Yes	50	120	50		
alpha-Chlordane	Solid	ug/Kg	0.12	1.7	1.7	Yes	50	120	50		
beta-BHC	Solid	ug/Kg	0.15	1.7	1.7	Yes	50	124	50		
delta-BHC	Solid	ug/Kg	0.11	1.7	1.7	Yes	50	146	50		
Dieldrin	Solid	ug/Kg	0.34	1.7	1.7	Yes	50	126	50		
Endosulfan I	Solid	ug/Kg	0.27	1.7	1.7	Yes	50	144	50		
Endosulfan II	Solid	ug/Kg	0.28	1.7	1.7	Yes	50	135	50		
Endosulfan sulfate	Solid	ug/Kg	0.29	1.7	1.7	Yes	50	160	50		
Endrin	Solid	ug/Kg	0.43	1.7	1.7	Yes	50	159	50		
Endrin aldehyde	Solid	ug/Kg	0.33	1.7	1.7	Yes	39	121	50		
Endrin ketone	Solid	ug/Kg	0.29	1.7	1.7	Yes	50	160	50		
gamma-BHC (Lindane)	Solid	ug/Kg	0.23	1.7	1.7	Yes	50	129	50		
gamma-Chlordane	Solid	ug/Kg	0.15	1.7	1.7	Yes	50	127	50		
Heptachlor	Solid	ug/Kg	0.18	1.7	1.7	Yes	58	147	50		
Heptachlor epoxide	Solid	ug/Kg	0.14	1.7	1.7	Yes	50	130	50		
Methoxychlor	Solid	ug/Kg	2.3	**8.3**	1.7	No	50	160	50	X (RL-Proj)	Variance approved
Toxaphene	Solid	ug/Kg	4.6	16.7	170	Yes					
Surrogates										x	
Decachlorobiphenyl (surr)	Solid	ug/Kg					**20**	150		X (Limit)	Variance approved
Tetrachloro-m-xylene (surr)	Solid	ug/Kg					**50**	150		X (Limit)	Variance approved
Method: PCB Analysis (8082)										x	
Aroclor 1016*	Water	ug/L	0.18	**0.6**	0.5	No	58	141	50	X (RL-Proj)	Variance approved
Aroclor 1221	Water	ug/L	0.42	**1.3**	0.5	No	**50**	**150**	**50**	X (Limit/RL)	Compound Not Spiked - OK
Aroclor 1232	Water	ug/L	0.35	**1.3**	0.5	No	**50**	**150**	**50**	X (Limit/RL)	Compound Not Spiked - OK
Aroclor 1242	Water	ug/L	0.43	**1.3**	0.5	No	**50**	**150**	**50**	X (Limit/RL)	Compound Not Spiked - OK
Aroclor 1248	Water	ug/L	0.48	**1.5**	0.5	No	**50**	**150**	**50**	X (Limit/RL)	Compound Not Spiked - OK
Aroclor 1254	Water	ug/L	0.35	**1.3**	0.5	No	**50**	**150**	**50**	X (Limit/RL)	Compound Not Spiked - OK
Aroclor 1260*	Water	ug/L	0.17	**0.6**	0.5	No	71	143	50	X (RL-Proj)	Variance approved
Surrogates										x	
Decachlorobiphenyl (surr)	Water	ug/L					**20**	150		X (Limit)	Variance approved
Tetrachloro-m-xylene (surr)	Water	ug/L					**35**	150		X (Limit)	Variance approved
* PCB spike solution contains AR1016/AR1260 only.										x	
Method: PCB Analysis (8082/3541)										x	
Aroclor 1016*	Solid	ug/Kg	8	33	33	Yes	53	143	50		
Aroclor 1221	Solid	ug/Kg	10.6	33	33	Yes	**50**	**150**	**50**	X (Limit)	Compound Not Spiked - OK
Aroclor 1232	Solid	ug/Kg	4.3	16.7	33	Yes	**50**	**150**	**50**	X (Limit)	Compound Not Spiked - OK
Aroclor 1242	Solid	ug/Kg	7.8	33	33	Yes	**50**	**150**	**50**	X (Limit)	Compound Not Spiked - OK
Aroclor 1248	Solid	ug/Kg	4.3	16.7	33	Yes	**50**	**150**	**50**	X (Limit)	Compound Not Spiked - OK
Aroclor 1254	Solid	ug/Kg	5.7	33	33	Yes	**50**	**150**	**50**	X (Limit)	Compound Not Spiked - OK
Aroclor 1260*	Solid	ug/Kg	9.9	33	33	Yes	71	134	50		
Surrogates										x	
Decachlorobiphenyl (surr)	Solid	ug/Kg					**50**	150		X (Limit)	Variance approved
Tetrachloro-m-xylene (surr)	Solid	ug/Kg					**50**	150		X (Limit)	Variance approved
* PCB spike solution contains AR1016/AR1260 only.										X (Limit)	
Method: Herbicides (8151)										x	
2,4,5-T	Water	ug/L	0.038	0.2			45		30		
2,4,5-TP (Silvex)	Water	ug/L	0.042	0.2			46		30		
2,4-D	Water	ug/L	0.49	**1.5**			33		30	X (RL)	
2,4-DB	Water	ug/L	0.36	**1.2**			27		30	X (RL)	
Dalapon	Water	ug/L	0.53	**3.0**			20	160	30	X (RL)	
Dicamba	Water	ug/L	0.029	0.2			37		30		
Dichlorprop	Water	ug/L	0.17	**1.0**			48		30	X (RL)	
Dinoseb	Water	ug/L	0.295	**1.0**			20		30	X (RL)	
MCPA	Water	ug/L	1059	**3200**						X (RL)	
MCPP	Water	ug/L	66.7	**500**						X (RL)	
Surrogate										x	
DCAA (surr)	Water	ug/L					**20**	150		X (Limit)	QAPP Limit = 50-150
Method: Herbicides (8151)										x	
2,4,5-T	Solid	ug/Kg	14	**42**			48	155	50	X (RL)	
2,4,5-TP (Silvex)	Solid	ug/Kg	18	**54**			46	147	50	X (RL)	
2,4-D	Solid	ug/Kg	88	**333**			33	138	50	X (RL)	
2,4-DB	Solid	ug/Kg	155	**470**			52	160	50	X (RL)	

Appendix A

Laboratory Reporting and Control Limits Compliance Table

RVAAP 14 AOC Characterization

							LCG Control Limit			.	
Test Description	**Test Matrix**	**Units**	**Lab MDL**	**Proposed Lab RL**	**Project PQL**	**Proposed Lab RL < Project PQL**	**LCL**	**UCL**	**RPD**	**Request Variance**	**USACE Comments**
Dalapon	Solid	ug/Kg	310	**930**			20	160	50	X (RL)	
Dicamba	Solid	ug/Kg	14.8	**45**			47	145	50	X (RL)	
Dichlorprop	Solid	ug/Kg	89	**333**			46	138	50	X (RL)	
Dinoseb	Solid	ug/Kg	3.5	**33**			20	125	50	X (RL)	
MCPA	Solid	ug/Kg	20837	**167000**						X (RL)	
MCPP	Solid	ug/Kg	19019	**167000**						X (RL)	
Surrogate										x	
DCAA (surr)	Solid	ug/Kg					**29**	150		X (Limit)	QAPP Limit = 50-150
Method: Volatile Organics (8260B)										x	
1,1,1,2-Tetrachloroethane	Water	ug/L	0.21	1.0			75	127	30		
1,1,1-Trichloroethane	Water	ug/L	0.08	1.0	1	Yes	70	127	30		
1,1,2,2-Tetrachloroethane	Water	ug/L	0.09	1.0	1	Yes	68	129	30		
1,1,2-Trichloroethane	Water	ug/L	0.15	1.0	1	Yes	75	136	30		
1,1-Dichloroethane	Water	ug/L	0.11	1.0	1	Yes	75	133	30		
1,1-Dichloroethene	Water	ug/L	0.12	1.0	1	Yes	75	125	30		
1,1-Dichloropropene	Water	ug/L	0.24	1.0			75	135	30		
1,2,3-Trichlorobenzene	Water	ug/L	0.24	1.0			75	133	30		
1,2,3-Trichloropropane	Water	ug/L	0.2	1.0			65	139	30		
1,2,4-Trichlorobenzene	Water	ug/L	0.23	1.0			75	130	30		
1,2,4-Trimethylbenzene	Water	ug/L	0.2	1.0			75	123	30		
1,2-Dibromo-3-chloropropane	Water	ug/L	0.46	2.0			75	132	30		
1,2-Dibromoethane (EDB)	Water	ug/L	0.13	1.0	1	Yes	75	127	30		
1,2-Dichlorobenzene	Water	ug/L	0.24	1.0			73	120	30		
1,2-Dichloroethane	Water	ug/L	0.09	1.0	1	Yes	67	132	30		
1,2-Dichloropropane	Water	ug/L	0.12	1.0	1	Yes	75	127	30		
1,3,5-Trimethylbenzene	Water	ug/L	0.2	1.0			75	121	30		
1,3-Dichlorobenzene	Water	ug/L	0.23	1.0			75	122	30		
1,3-Dichloropropane	Water	ug/L	0.23	1.0			75	133	30		
1,4-Dichlorobenzene	Water	ug/L	0.22	1.0			74	123	30		
1-Chlorohexane	Water	ug/L	0.23	1.0			75	132	30		
2,2-Dichloropropane	Water	ug/L	0.2	1.0			62	134	30		
2-Butanone (MEK)	Water	ug/L	1.2	10	10	Yes	45	150	30		
2-Chlorotoluene	Water	ug/L	0.22	1.0			75	121	30		
2-Hexanone	Water	ug/L	0.53	10	10	Yes	53	139	30		
4-Chlorotoluene	Water	ug/L	0.22	1.0			73	127	30		
4-Methyl-2-pentanone (MIBK)	Water	ug/L	0.65	10	10	Yes	59	150	30		
Acetone	Water	ug/L	1.8	10	10	Yes	51	157	30		
Acrolein	Water	ug/L	19	**200**			**50**	**150**	**30**	X(RL/Limit)	Compound Not Spiked
Acrylonitrile	Water	ug/L	5.4	**40**			**50**	**150**	**30**	X(RL/Limit)	Compound Not Spiked
Benzene	Water	ug/L	0.09	1.0	1	Yes	75	126	30		
Bromobenzene	Water	ug/L	0.22	1.0			74	123	30		
Bromochloromethane	Water	ug/L	0.1	1.0	1	Yes	75	127	30		
Bromodichloromethane	Water	ug/L	0.11	1.0	1	Yes	70	130	30		
Bromoform	Water	ug/L	0.11	1.0	1	Yes	72	136	30		
Bromomethane	Water	ug/L	0.1	1.0	1	Yes	35	153	30		
Carbon disulfide	Water	ug/L	0.2	**5.0**	1	No	**24**	123	30	X (Limit/RL)	Laboratory Reanalyzing
Carbon tetrachloride	Water	ug/L	0.13	1.0	1	Yes	71	132	30		
Chlorobenzene	Water	ug/L	0.08	1.0	1	Yes	75	127	30		
Chloroethane	Water	ug/L	0.08	1.0	1	Yes	72	129	30		
Chloroform	Water	ug/L	0.11	1.0	1	Yes	74	127	30		
Chloromethane	Water	ug/L	0.08	1.0	1	Yes	58	135	30		
cis-1,2-Dichloroethene	Water	ug/L	0.09	1.0		NA	73	133	30		
cis-1,3-Dichloropropene	Water	ug/L	0.12	1.0	1	Yes	73	132	30		
Dibromochloromethane	Water	ug/L	0.06	1.0	1	Yes	74	145	30		
Dibromomethane	Water	ug/L	0.26	1.0			76	132	30		
Dichlorodifluoromethane	Water	ug/L	0.14	1.0			59	134	30		
Ethylbenzene	Water	ug/L	0.07	1.0	1	Yes	75	120	30		
Ethylmethacrylate	Water	ug/L	0.36	**2.0**			**50**	**150**	**30**	X(RL/Limit)	Compound Not Spiked
Hexachlorobutadiene	Water	ug/L	0.24	1.0			75	133	30		
Iodomethane	Water	ug/L	1.3	**4.0**			50	150	30	X (RL)	
Isopropylbenzene	Water	ug/L	0.21	1.0			75	126	30		
m&p-Xylenes	Water	ug/L	0.18	2.0		NA	75	122	30		
Methylene chloride	Water	ug/L	0.35	**1.5**	1	No	69	118	30	X (RL-Proj)	Variance approved
Methyl-tert-butyl-ether (MTBE)	Water	ug/L	0.21	1.0			59	129	30		
Naphthalene	Water	ug/L	0.34	**2.0**			65	149	30	X (RL)	
n-Butylbenzene	Water	ug/L	0.22	1.0			75	126	30		

Appendix A

Laboratory Reporting and Control Limits Compliance Table

RVAAP 14 AOC Characterization

							LCG Control Limit			.	
Test Description	**Test Matrix**	**Units**	**Lab MDL**	**Proposed Lab RL**	**Project PQL**	**Proposed Lab RL < Project PQL**	**LCL**	**UCL**	**RPD**	**Request Variance**	**USACE Comments**
n-Propylbenzene	Water	ug/L	0.25	1.0			75	127	30		
o-Xylene	Water	ug/L	0.08	1.0		NA	75	118	30		
p-Isopropyltoluene	Water	ug/L	0.22	1.0			75	125	30		
sec-Butylbenzene	Water	ug/L	0.22	1.0			75	125	30		
Styrene	Water	ug/L	0.13	1.0	1	Yes	75	130	30		
tert-Butyl alcohol	Water	ug/L					**50**	**150**	**30**	X(RL/Limit)	Compound Not Spiked
tert-Butylbenzene	Water	ug/L	0.21	1.0			75	125	30		
Tetrachloroethene	Water	ug/L	0.09	1.0	1	Yes	75	129	30		
Toluene	Water	ug/L	0.1	1.0	1	Yes	75	125	30		
trans-1,2-Dichloroethene	Water	ug/L	0.14	1.0		NA	75	134	30		
trans-1,3-Dichloropropene	Water	ug/L	0.15	1.0	1	Yes	74	131	30		
trans-1,4-Dichloro-2-butene [2]	Water	ug/L	1.3	10			**36**	**150**	**30**	X (Limit)	Compound Not Spiked
Trichloroethene	Water	ug/L	0.1	1.0	1	Yes	67	128	30		
Trichlorofluoromethane	Water	ug/L	0.22	1.0			68	133	30		
Trichlorotrifluoroethane	Water	ug/L	0.22	1.0			50	150	30		
Vinyl acetate	Water	ug/L	0.47	**2.0**			30	150	30		
Vinyl chloride	Water	ug/L	0.08	1.0	1	Yes	73	134	30		
1,2-Dichloroethene (Total)	Water	ug/L	0.23	1.0	1	Yes					
Xylenes (Total)	Water	ug/L	0.28	1.0	2	Yes					
Surrogates											
1,2-Dichloroethane-d4 (surr)	Water	ug/L					50	150			
4-Bromofluorobenzene (surr)	Water	ug/L					50	150			
Dibromofluoromethane (surr)	Water	ug/L					50	150			
Toluene-d8 (surr)	Water	ug/L					50	150			
[1] LCG requests the following oxygenated compounds which are not analyzed for by STL Chicago: DIPE; ETBE; TAME.										x	Compounds not performed
[2] LCG Requests trans-1,4-Dichloro-2-butene										x	Only quant for trans.
Method: Volatile Organics (8260B)										x	
1,1,1,2-Tetrachloroethane	Solid	ug/Kg	0.73	5.0			75	127	50		
1,1,1-Trichloroethane	Solid	ug/Kg	1.1	5.0	5	Yes	75	133	50		
1,1,2,2-Tetrachloroethane	Solid	ug/Kg	0.96	5.0	5	Yes	68	144	50		
1,1,2-Trichloroethane	Solid	ug/Kg	1.1	5.0	5	Yes	71	129	50		
1,1-Dichloroethane	Solid	ug/Kg	1	5.0	5	Yes	80	126	50		
1,1-Dichloroethene	Solid	ug/Kg	1.3	5.0	5	Yes	70	129	50		
1,1-Dichloropropene	Solid	ug/Kg	0.8	5.0			75	123	50		
1,2,3-Trichlorobenzene	Solid	ug/Kg	0.99	5.0			64	129	50		
1,2,3-Trichloropropane	Solid	ug/Kg	1.1	5.0			61	145	50		
1,2,4-Trichlorobenzene	Solid	ug/Kg	0.79	5.0			69	139	50		
1,2,4-Trimethylbenzene	Solid	ug/Kg	0.82	5.0			74	126	50		
1,2-Dibromo-3-chloropropane	Solid	ug/Kg	1.1	5.0			70	128	50		
1,2-Dibromoethane (EDB)	Solid	ug/Kg	0.82	5.0	5	Yes	62	150	50		
1,2-Dichlorobenzene	Solid	ug/Kg	0.73	5.0			75	132	50		
1,2-Dichloroethane	Solid	ug/Kg	0.94	5.0	5	Yes	75	121	50		
1,2-Dichloropropane	Solid	ug/Kg	1	5.0	5	Yes	72	124	50		
1,3,5-Trimethylbenzene	Solid	ug/Kg	0.58	5.0			75	125	50		
1,3-Dichlorobenzene	Solid	ug/Kg	0.91	5.0			75	122	50		
1,3-Dichloropropane	Solid	ug/Kg	0.93	5.0			75	128	50		
1,4-Dichlorobenzene	Solid	ug/Kg	0.89	5.0			74	126	50		
1-Chlorohexane	Solid	ug/Kg	1	5.0			75	129	50		
2,2-Dichloropropane	Solid	ug/Kg	1.3	5.0			75	134	50		
2-Butanone (MEK)	Solid	ug/Kg	3.9	15	20	Yes	50	150	50		
2-Chlorotoluene	Solid	ug/Kg	1	5.0			73	128	50		
2-Hexanone	Solid	ug/Kg	1.1	10	20	Yes	55	144	50		
4-Chlorotoluene	Solid	ug/Kg	0.77	5.0			75	127	50		
4-Methyl-2-pentanone (MIBK)	Solid	ug/Kg	1	10	20	Yes	50	150	50		
Acetone	Solid	ug/Kg	4.6	15	20	Yes	50	150	50		
Acrolein	Solid	ug/Kg	38	**200**			**50**	**150**	**50**	X(RL/Limit)	Compound Not Spiked
Acrylonitrile	Solid	ug/Kg	7	40			**50**	**150**	**50**	X (Limit)	Compound Not Spiked
Benzene	Solid	ug/Kg	1.1	5.0	5	Yes	75	126	50		
Bromobenzene	Solid	ug/Kg	0.71	5.0			75	123	50		
Bromochloromethane	Solid	ug/Kg	1.1	5.0	5	Yes	75	127	50		
Bromodichloromethane	Solid	ug/Kg	0.96	5.0	5	Yes	71	130	50		
Bromoform	Solid	ug/Kg	0.75	5.0	5	Yes	62	141	50		
Bromomethane	Solid	ug/Kg	1.3	5.0	5	Yes	57	153	50		
Carbon disulfide	Solid	ug/Kg	1.2	5.0	5	Yes	**27**	123	50	X (Limit)	Variance approved
Carbon tetrachloride	Solid	ug/Kg	1.1	5.0	5	Yes	69	132	50		
Chlorobenzene	Solid	ug/Kg	1.1	5.0	5	Yes	75	126	50		

Appendix A

Laboratory Reporting and Control Limits Compliance Table

RVAAP 14 AOC Characterization

Test Description	Test Matrix	Units	Lab MDL	Proposed Lab RL	Project PQL	Proposed Lab RL < Project PQL	LCG Control Limit			.	
							LCL	UCL	RPD	Request Variance	USACE Comments
Chloroethane	Solid	ug/Kg	1	5.0	5	Yes	62	140	50		
Chloroform	Solid	ug/Kg	1.1	5.0	5	Yes	75	132	50		
Chloromethane	Solid	ug/Kg	1.1	5.0	5	Yes	56	144	50		
cis-1,2-Dichloroethene	Solid	ug/Kg	1.1	5.0		NA	70	129	50		
cis-1,3-Dichloropropene	Solid	ug/Kg	0.93	5.0	5	Yes	72	132	50		
Dibromochloromethane	Solid	ug/Kg	0.79	5.0	5	Yes	61	147	50		
Dibromomethane	Solid	ug/Kg	0.69	5.0			62	132	50		
Dichlorodifluoromethane	Solid	ug/Kg	0.75	5.0			43	134	50		
Ethylbenzene	Solid	ug/Kg	1.1	5.0	5	Yes	75	120	50		
Ethylmethacrylate	Solid	ug/Kg	1.5	**10**			**50**	**150**	**50**	X(RL/Limit)	Compound Not Spiked
Hexachlorobutadiene	Solid	ug/Kg	1	5.0			55	133	50		
Iodomethane	Solid	ug/Kg	3.5	**11**			50	150	50	X (RL)	
Isopropylbenzene	Solid	ug/Kg	0.75	5.0			76	126	50		
m&p-Xylenes	Solid	ug/Kg	2.3	10		NA	75	124	50		
Methylene chloride	Solid	ug/Kg	2.9	**10**	5	No	66	131	50	X (RL-Proj)	Variance approved
Methyl-tert-butyl-ether (MTBE)	Solid	ug/Kg	0.64	5.0			58	146	50		
Naphthalene	Solid	ug/Kg	1	5.0			49	160	50		
n-Butylbenzene	Solid	ug/Kg	0.84	5.0			74	136	50		
n-Propylbenzene	Solid	ug/Kg	0.86	5.0			74	136	50		
o-Xylene	Solid	ug/Kg	1.1	5.0		NA	75	125	50		
p-Isopropyltoluene	Solid	ug/Kg	0.68	5.0			74	130	50		
sec-Butylbenzene	Solid	ug/Kg	0.81	5.0			75	125	50		
Styrene	Solid	ug/Kg	1.1	5.0	5	Yes	75	130	50		
tert-Butyl alcohol	Solid	ug/Kg					**50**	**150**	**50**	X(RL/Limit)	Compound Not Spiked
tert-Butylbenzene	Solid	ug/Kg	0.78	5.0			75	120	50		
Tetrachloroethene	Solid	ug/Kg	1.2	5.0	5	Yes	75	129	50		
Toluene	Solid	ug/Kg	1.1	5.0	5	Yes	75	125	50		
trans-1,2-Dichloroethene	Solid	ug/Kg	1.1	5.0		NA	75	123	50		
trans-1,3-Dichloropropene	Solid	ug/Kg	0.79	5.0	5	Yes	69	131	50		
trans-1,4-Dichloro-2-butene [2]	Solid	ug/Kg	2.2	10			**50**	**150**	**50**	X (Limit)	Compound Not Spiked
Trichloroethene	Solid	ug/Kg	1.1	5.0	5	Yes	69	128	50		
Trichlorofluoromethane	Solid	ug/Kg	0.71	5.0			61	139	50		
Trichlorotrifluoroethane	Solid	ug/Kg	1.8	**6.0**			50	145	50	X (RL)	
Vinyl acetate	Solid	ug/Kg	0.56	5.0			50	150	50		
Vinyl chloride	Solid	ug/Kg	1.1	5.0	5	Yes	75	134	50		
1,2-Dichloroethene (Total)	Solid	ug/Kg	2.1	**10**	5	No				X (RL-Proj)	Variance approved
Xylenes (Total)	Solid	ug/Kg	3.4	10	10	Yes					
Surrogates											
1,2-Dichloroethane-d4 (surr)	Solid	ug/Kg					50	150			
4-Bromofluorobenzene (surr)	Solid	ug/Kg					50	150			
Dibromofluoromethane (surr)	Solid	ug/Kg					50	150			
Toluene-d8 (surr)	Solid	ug/Kg					50	150			
[1] LCG requests the following oxygenated compounds which are not analyzed for by STL Chicago: DIPE; ETBE; TAME.										x	Compounds not performed
[2] LCG Requests total 1,4-Dichloro-2-butene										x	Only quant for trans.
Method: Semivolatile Organics Low Level "L" Matrix (8270C)										x	
1,2,4-Trichlorobenzene	Water	ug/L	0.34	2.0	10	Yes	30	120	30		
1,2-Dichlorobenzene	Water	ug/L	0.35	2.0	10	Yes	30	120	30		
1,2-Diphenylhydrazine	Water	ug/L	0.27	5.0			50	150	30		
1,3-Dichlorobenzene	Water	ug/L	0.43	2.0	10	Yes	30	120	30		
1,4-Dichlorobenzene	Water	ug/L	0.33	2.0	10	Yes	30	115	30		
2,2-oxybis (1-chloropropane)	Water	ug/L	0.28	2.0	10	Yes	50	150	30		
2,4,5-Trichlorophenol	Water	ug/L	1.4	10	25	Yes	36	135	30		
2,4,6-Trichlorophenol	Water	ug/L	0.21	5.0	10	Yes	39	115	30		
2,4-Dichlorophenol	Water	ug/L	0.91	10	10	Yes	34	115	30		
2,4-Dimethylphenol	Water	ug/L	1.3	10	10	Yes	31	120	30		
2,4-Dinitrophenol	Water	ug/L	3.3	20	25	Yes	29	146	30		
2,4-Dinitrotoluene	Water	ug/L	0.13	1.0	10	Yes	34	151	30		
2,6-Dinitrotoluene	Water	ug/L	0.11	0.5	10	Yes	43	122	30		
2-Chloronaphthalene	Water	ug/L	0.26	2.0	10	Yes	35	115	30		
2-Chlorophenol	Water	ug/L	0.12	5.0	10	Yes	30	120	30		
2-Methylnaphthalene	Water	ug/L	0.13	0.5	10	Yes	32	115	30		
2-Methylphenol (o-cresol)	Water	ug/L	0.26	2.0	10	Yes	30	116	30		
2-Nitroaniline	Water	ug/L	0.22	5.0	25	Yes	36	140	30		
2-Nitrophenol	Water	ug/L	0.82	10	10	Yes	33	115	30		
3,3-Dichlorobenzidine	Water	ug/L	0.72	5.0	10	Yes	30	160	30		
3-Nitroaniline	Water	ug/L	2.1	10	25	Yes	30	138	30		

Appendix A

Laboratory Reporting and Control Limits Compliance Table

RVAAP 14 AOC Characterization

Test Description	Test Matrix	Units	Lab MDL	Proposed Lab RL	Project PQL	Proposed Lab RL < Project PQL	LCG Control Limit			Request Variance	USACE Comments
							LCL	UCL	RPD	.	
4,6-Dinitro-2-methylphenol	Water	ug/L	2.4	20	25	Yes	42	144	30		
4-Bromophenyl phenyl ether	Water	ug/L	0.19	5.0	10	Yes	43	118	30		
4-Chloro-3-methylphenol	Water	ug/L	2.4	10	10	Yes	31	121	30		
4-Chloroaniline	Water	ug/L	2.8	10	10	Yes	30	133	30		
4-Chlorophenyl phenyl ether	Water	ug/L	0.75	5.0	10	Yes	40	115	30		
4-Methylphenol (m/p-cresol)	Water	ug/L	0.1	2.0	10	Yes	31	115	30		
4-Nitroaniline	Water	ug/L	2.3	10	25	Yes	30	140	30		
4-Nitrophenol	Water	ug/L	3.7	**20**	25	Yes	30	138	30	X (RL-LCG)	No variance required.
Acenaphthene	Water	ug/L	0.12	1.0	10	Yes	31	120	30		
Acenaphthylene	Water	ug/L	0.12	1.0	10	Yes	37	115	30		
Aniline	Water	ug/L	5.8	20			30	127	30		
Anthracene	Water	ug/L	0.15	1.0	10	Yes	45	118	30		
Benzo(a)anthracene	Water	ug/L	0.049	0.20	10	Yes	43	138	30		
Benzo(a)pyrene	Water	ug/L	0.084	0.40	10	Yes	38	144	30		
Benzo(b)fluoranthene	Water	ug/L	0.067	0.40	10	Yes	31	146	30		
Benzo(ghi)perylene	Water	ug/L	0.19	1.0	10	Yes	35	129	30		
Benzo(k)fluoranthene	Water	ug/L	0.072	0.40	10	Yes	40	127	30		
Benzoic acid	Water	ug/L	3	**20**	25	Yes	30	136	30	X (RL-LCG)	No variance required.
Benzyl alcohol	Water	ug/L	2.2	**20**	10	No	29	115	30	X (RL-Proj)	Laboratory Reanalyzing
Bis(2-chloroethoxy)methane	Water	ug/L	0.31	2.0	10	Yes	30	115	30		
Bis(2-chloroethyl)ether	Water	ug/L	0.30	2.0	10	Yes	30	115	30		
Bis(2-ethylhexyl)phthalate	Water	ug/L	3.9	**15**	10	No	30	154	30	X (RL-Proj)	
Butyl benzyl phthalate	Water	ug/L	0.39	2.0	10	Yes	37	136	30		
Carbazole	Water	ug/L	0.29	5.0	10	Yes	49	126	30		
Chrysene	Water	ug/L	0.045	0.50	10	Yes	42	142	30		
Dibenzo(a,h)anthracene	Water	ug/L	0.13	0.40	10	Yes	38	130	30		
Dibenzofuran	Water	ug/L	0.13	2.0	10	Yes	40	115	30		
Diethyl phthalate	Water	ug/L	0.15	2.0	10	Yes	43	132	30		
Dimethyl phthalate	Water	ug/L	0.21	2.0	10	Yes	42	116	30		
Di-n-butyl phthalate	Water	ug/L	0.36	5.0	10	Yes	46	123	30		
Di-n-octyl phthalate	Water	ug/L	2.5	10	10	Yes	36	151	30		
Fluoranthene	Water	ug/L	0.14	1.0	10	Yes	47	132	30		
Fluorene	Water	ug/L	0.13	1.0	10	Yes	41	115	30		
Hexachlorobenzene	Water	ug/L	0.097	0.50	10	Yes	42	123	30		
Hexachlorobutadiene	Water	ug/L	0.64	5.0	10	Yes	30	120	30		
Hexachlorocyclopentadiene	Water	ug/L	0.65	**20**	10	No	30	115	30	X (RL-Proj)	Variance approved
Hexachloroethane	Water	ug/L	0.61	5.0	10	Yes	30	120	30		
Indeno(1,2,3-cd)pyrene	Water	ug/L	0.086	0.40	10	Yes	37	130	30		
Isophorone	Water	ug/L	0.26	2.0	10	Yes	33	115	30		
Naphthalene	Water	ug/L	0.16	1.0	10	Yes	30	119	30		
Nitrobenzene	Water	ug/L	0.16	1.0	10	Yes	31	115	30		
n-Nitrosodimethylamine	Water	ug/L	0.59	5.0			30	115	30		
n-Nitroso-di-n-propylamine	Water	ug/L	0.081	0.50	10	Yes	30	132	30		
n-Nitrosodiphenylamine	Water	ug/L	0.13	1.0	10	Yes	35	124	30		
Pentachlorophenol	Water	ug/L	1.7	10	25	Yes	30	150	30		
Phenanthrene	Water	ug/L	0.14	1.0	10	Yes	45	117	30		
Phenol	Water	ug/L	0.35	5.0	10	Yes	30	115	30		
Pyrene	Water	ug/L	0.12	1.0	10	Yes	35	139	30		
Pyridine	Water	ug/L	4.9	20			**10**	150	30	X (Limit)	LCG LCL = 50
Surrogates										x	
2,4,6-Tribromophenol (surr)	Water	ug/L					**39**	150		X (Limit)	Variance approved
2-Fluorobiphenyl (surr)	Water	ug/L					**43**	150		X (Limit)	Variance approved
2-Fluorophenol (surr)	Water	ug/L					**20**	150		X (Limit)	Variance approved
Nitrobenzene-d5 (surr)	Water	ug/L					**42**	150		X (Limit)	Variance approved
Phenol-d5 (surr)	Water	ug/L					**20**	150		X (Limit)	Variance approved
Terphenyl-d14 (surr)	Water	ug/L					**10**	150		X (Limit)	Variance approved
Method: Semivolatile Organics Low Level "Y" Matrix (8270C/3541)										x	
1,2,4-Trichlorobenzene	Solid	ug/Kg	13.6	167	330	Yes	30	120	50		
1,2-Dichlorobenzene	Solid	ug/Kg	14.1	167	330	Yes	30	115	50		
1,2-Diphenylhydrazine	Solid	ug/Kg	11	167			50	150	50		
1,3-Dichlorobenzene	Solid	ug/Kg	13.4	167	330	Yes	30	115	50		
1,4-Dichlorobenzene	Solid	ug/Kg	15.3	167	330	Yes	34	123	50		
2,2-oxybis (1-chloropropane)	Solid	ug/Kg	15.9	167	330	Yes	30	131	50		
2,4,5-Trichlorophenol	Solid	ug/Kg	44.7	330	800	Yes	34	128	50		
2,4,6-Trichlorophenol	Solid	ug/Kg	37.4	167	330	Yes	35	120	50		
2,4-Dichlorophenol	Solid	ug/Kg	15.5	330	330	Yes	32	121	50		

Appendix A

Laboratory Reporting and Control Limits Compliance Table

RVAAP 14 AOC Characterization

Test Description	Test Matrix	Units	Lab MDL	Proposed Lab RL	Project PQL	Proposed Lab RL < Project PQL	LCG Control Limit			.	
							LCL	UCL	RPD	Request Variance	USACE Comments
2,4-Dimethylphenol	Solid	ug/Kg	16.2	330	330	Yes	33	119	50		
2,4-Dinitrophenol	Solid	ug/Kg	104	**670**	800	Yes	34	160	50	X (RL-LCG)	No variance required.
2,4-Dinitrotoluene	Solid	ug/Kg	10.4	33	330	Yes	34	154	50		
2,6-Dinitrotoluene	Solid	ug/Kg	9.2	33	330	Yes	32	133	50		
2-Chloronaphthalene	Solid	ug/Kg	15.6	167	330	Yes	32	115	50		
2-Chlorophenol	Solid	ug/Kg	13.5	167	330	Yes	30	115	50		
2-Methylnaphthalene	Solid	ug/Kg	10	33	330	Yes	30	120	50		
2-Methylphenol (o-cresol)	Solid	ug/Kg	10.5	67	330	Yes	30	123	50		
2-Nitroaniline	Solid	ug/Kg	10.8	167	800	Yes	30	148	50		
2-Nitrophenol	Solid	ug/Kg	14.7	330	330	Yes	30	126	50		
3,3-Dichlorobenzidine	Solid	ug/Kg	14.7	167	330	Yes	31	137	50		
3-Nitroaniline	Solid	ug/Kg	138	**670**	800	Yes	30	135	50	X (RL-LCG)	No variance required.
4,6-Dinitro-2-methylphenol	Solid	ug/Kg	169	**670**	800	Yes	30	160	50	X (RL-LCG)	No variance required.
4-Bromophenyl phenyl ether	Solid	ug/Kg	10	167	330	Yes	34	120	50		
4-Chloro-3-methylphenol	Solid	ug/Kg	34.6	330	330	Yes	30	125	50		
4-Chloroaniline	Solid	ug/Kg	53.8	**670**	330	No	32	121	50	X (RL-LCG/Proj)	Laboratory Reanalyzing
4-Chlorophenyl phenyl ether	Solid	ug/Kg	9.9	167	330	Yes	33	118	50		
4-Methylphenol (m/p-cresol)	Solid	ug/Kg	11.9	67	330	Yes	30	127	50		
4-Nitroaniline	Solid	ug/Kg	44.8	**670**	800	Yes	30	148	50	X (RL-LCG)	No variance required.
4-Nitrophenol	Solid	ug/Kg	212	**670**	800	Yes	36	147	50	X (RL-LCG)	No variance required.
Acenaphthene	Solid	ug/Kg	8.3	33	50	Yes	30	135	50		
Acenaphthylene	Solid	ug/Kg	8.3	33	50	Yes	33	120	50		
Aniline	Solid	ug/Kg	63.2	**670**			50	150	50	X (RL)	
Anthracene	Solid	ug/Kg	10.9	33	50	Yes	35	122	50		
Benzo(a)anthracene	Solid	ug/Kg	9.9	33	50	Yes	33	139	50		
Benzo(a)pyrene	Solid	ug/Kg	9.5	33	50	Yes	30	144	50		
Benzo(b)fluoranthene	Solid	ug/Kg	8.9	33	50	Yes	30	140	50		
Benzo(ghi)perylene	Solid	ug/Kg	11	33	50	Yes	30	146	50		
Benzo(k)fluoranthene	Solid	ug/Kg	9.4	33	50	Yes	30	150	50		
Benzoic acid	Solid	ug/Kg	196	**670**	800	Yes	30	160	50	X (RL-LCG)	No variance required.
Benzyl alcohol	Solid	ug/Kg	73.7	**670**	330	No	30	117	50	X (RL-LCG/Proj)	Laboratory Reanalyzing
Bis(2-chloroethoxy)methane	Solid	ug/Kg	8.8	67	330	Yes	30	126	50		
Bis(2-chloroethyl)ether	Solid	ug/Kg	8.9	67	330	Yes	30	121	50		
Bis(2-ethylhexyl)phthalate	Solid	ug/Kg	32	**167**	33	No	34	149	50	X (RL-Proj)	Laboratory Reanalyzing
Butyl benzyl phthalate	Solid	ug/Kg	10.3	67	330	Yes	30	153	50		
Carbazole	Solid	ug/Kg	11.8	**167**	50	No	30	142	50	X (RL-Proj)	Laboratory Reanalyzing
Chrysene	Solid	ug/Kg	10.5	33	50	Yes	33	142	50		
Dibenzo(a,h)anthracene	Solid	ug/Kg	9.5	33	50	Yes	34	148	50		
Dibenzofuran	Solid	ug/Kg	8.8	67	330	Yes	34	120	50		
Diethyl phthalate	Solid	ug/Kg	9.5	67	330	Yes	32	126	50		
Dimethyl phthalate	Solid	ug/Kg	8.9	67	330	Yes	36	124	50		
Di-n-butyl phthalate	Solid	ug/Kg	11.4	167	330	Yes	36	135	50		
Di-n-octyl phthalate	Solid	ug/Kg	10.4	330	330	Yes	50	160	50		
Fluoranthene	Solid	ug/Kg	10.7	33	50	Yes	32	122	50		
Fluorene	Solid	ug/Kg	9	33	50	Yes	32	127	50		
Hexachlorobenzene	Solid	ug/Kg	9.5	33	330	Yes	32	127	50		
Hexachlorobutadiene	Solid	ug/Kg	9	167	330	Yes	30	118	50		
Hexachlorocyclopentadiene	Solid	ug/Kg	305	**1000**	330	No	30	123	50	X (RL-LCG/Proj)	Variance approved
Hexachloroethane	Solid	ug/Kg	8.6	167	330	Yes	30	115	50		
Indeno(1,2,3-cd)pyrene	Solid	ug/Kg	10.2	33	50	Yes	34	147	50		
Isophorone	Solid	ug/Kg	19.6	167	330	Yes	34	115	50		
Naphthalene	Solid	ug/Kg	8.4	33	50	Yes	30	115	50		
Nitrobenzene	Solid	ug/Kg	8.6	33	330	Yes	30	115	50		
n-Nitrosodimethylamine	Solid	ug/Kg	14.6	167			36	115	50		
n-Nitroso-di-n-propylamine	Solid	ug/Kg	13.2	67	330	Yes	35	147	50		
n-Nitrosodiphenylamine	Solid	ug/Kg	10.4	33	330	Yes	50	134	50		
Pentachlorophenol	Solid	ug/Kg	110	330	800	Yes	30	160	50		
Phenanthrene	Solid	ug/Kg	15.1	50	50	Yes	35	119	50		
Phenol	Solid	ug/Kg	7.1	167	330	Yes	30	120	50		
Pyrene	Solid	ug/Kg	12	50	50	Yes	32	147	50		
Pyridine	Solid	ug/Kg	19.6	**670**			30	125	50	X (RL)	
Surrogates										x	
2,4,6-Tribromophenol (surr)	Solid	ug/Kg					**29**	150		X (Limit)	Variance approved
2-Fluorobiphenyl (surr)	Solid	ug/Kg					**50**	150		X (Limit)	Variance approved
2-Fluorophenol (surr)	Solid	ug/Kg					**38**	150		X (Limit)	Variance approved
Nitrobenzene-d5 (surr)	Solid	ug/Kg					**43**	150		X (Limit)	Variance approved

Appendix A

Laboratory Reporting and Control Limits Compliance Table

RVAAP 14 AOC Characterization

							LCG Control Limit			.	
Test Description	**Test Matrix**	**Units**	**Lab MDL**	**Proposed Lab RL**	**Project PQL**	**Proposed Lab RL < Project PQL**	**LCL**	**UCL**	**RPD**	**Request Variance**	**USACE Comments**
Phenol-d5 (surr)	Solid	ug/Kg					42	150		X (Limit)	Variance approved
Terphenyl-d14 (surr)	Solid	ug/Kg					50	150		X (Limit)	Variance approved
Method: Explosives by 8330 (HPLC) (8330)										x	
1,3,5-Trinitrobenzene	Water	ug/L	0.080	0.25	0.2	No	53	135	30	X (RL-Proj)	Variance approved
1,3-Dinitrobenzene	Water	ug/L	0.053	0.16	0.2	Yes	54	120	30		
2,4,6-TNT	Water	ug/L	0.068	0.25	0.2	No	37	120	30	X (RL-Proj)	Variance approved
2,4-Dinitrotoluene	Water	ug/L	0.042	0.16	0.1	No	58	136	30	X (RL-Proj)	Variance approved
2,6-Dinitrotoluene	Water	ug/L	0.207	0.78	0.1	No	52	144	30	X (RL-Proj)	Variance approved
2-Amino-4,6-Dinitrotoluene	Water	ug/L	0.082	0.31	0.2	No	53	120	30	X (RL-Proj)	Variance approved
2-Nitrotoluene	Water	ug/L	0.163	0.50	0.2	No	52	120	30	X (RL-Proj)	Variance approved
3-Nitrotoluene	Water	ug/L	0.102	0.31	0.2	No	48	136	30	X (RL-Proj)	Variance approved
4-Amino-2,6-Dinitrotoluene	Water	ug/L	0.138	0.50	0.2	No	58	159	30	X (RL-Proj)	Variance approved
4-Nitrotoluene	Water	ug/L	0.337	1.0	0.2	No	46	136	30	X (RL-Proj)	Variance approved
HMX	Water	ug/L	0.225	0.78	0.5	No	45	140	30	X (RL-Proj)	Variance approved
Nitrobenzene	Water	ug/L	0.092	0.30	0.2	No	49	120	30	X (RL-Proj)	Variance approved
RDX	Water	ug/L	0.130	0.50	0.5	Yes	39	120	30		
Tetryl	Water	ug/L	0.218	0.78	0.2	No	30	120	30	X (RL-Proj)	Variance approved
Surrogates											
1,2-Dinitrobenzene (surr)	Water	ug/L					50	150			
Method: Explosives by 8330 (HPLC) (8330)										x	
1,3,5-Trinitrobenzene	Solid	mg/Kg	0.0175	0.10	0.25	Yes	50	135	50		
1,3-Dinitrobenzene	Solid	mg/Kg	0.0178	0.10	0.25	Yes	50	120	50		
2,4,6-TNT	Solid	mg/Kg	0.0338	0.10	0.25	Yes	44	120	50		
2,4-Dinitrotoluene	Solid	mg/Kg	0.0356	0.11	0.25	Yes	50	136	50		
2,6-Dinitrotoluene	Solid	mg/Kg	0.0475	0.20	0.25	Yes	50	144	50		
2-Amino-4,6-Dinitrotoluene	Solid	mg/Kg	0.0360	0.20	0.25	Yes	50	120	50		
2-Nitrotoluene	Solid	mg/Kg	0.0332	0.20	0.25	Yes	59	120	50		
3-Nitrotoluene	Solid	mg/Kg	0.0500	0.20	0.25	Yes	50	136	50		
4-Amino-2,6-Dinitrotoluene	Solid	mg/Kg	0.0972	0.30	0.25	No	50	159	50	X (RL-LCG/Proj)	Variance approved
4-Nitrotoluene	Solid	mg/Kg	0.0466	0.50	0.25	No	58	136	50	X (RL-LCG/Proj)	Laboratory Reanalyzing
HMX	Solid	mg/Kg	0.113	0.40	1.0	Yes	60	140	50		
Nitrobenzene	Solid	mg/Kg	0.0222	0.10	0.25	Yes	50	120	50		
RDX	Solid	mg/Kg	0.0586	0.20	1.0	Yes	59	120	50		
Tetryl	Solid	mg/Kg	0.0434	0.20	1.0	Yes	37	120	50		
Surrogates											
1,2-Dinitrobenzene (surr)	Solid	mg/Kg					50	150			
Method: Polynuclear Aromatic Hydrocarbons (HPLC-8310)										x	
Acenaphthene	Water	ug/L	0.38	2.5			57	125	30	X (RL)	
Acenaphthylene	Water	ug/L	0.3	1.3			61	125	30		
Anthracene	Water	ug/L	0.017	0.10			60	125	30		
Benzo(a)anthracene	Water	ug/L	0.032	0.13			73	126	30		
Benzo(a)pyrene	Water	ug/L	0.024	0.13			54	128	30		
Benzo(b)fluoranthene	Water	ug/L	0.027	0.10			75	125	30		
Benzo(ghi)perylene	Water	ug/L	0.047	0.20			71	128	30		
Benzo(k)fluoranthene	Water	ug/L	0.029	0.10			75	125	30		
Chrysene	Water	ug/L	0.033	0.13			75	125	30		
Dibenzo(a,h)anthracene	Water	ug/L	0.054	0.30			75	125	30		
Fluoranthene	Water	ug/L	0.039	0.13			74	125	30		
Fluorene	Water	ug/L	0.035	0.25			73	125	30		
Indeno(1,2,3-cd)pyrene	Water	ug/L	0.048	0.25			75	125	30		
Naphthalene	Water	ug/L	0.21	1.3			52	125	30		
Phenanthrene	Water	ug/L	0.015	0.10			75	125	30		
Pyrene	Water	ug/L	0.14	0.50			62	132	30	X (RL)	
Surrogates										x	
Decafluorobiphenyl	Water	ug/L					33	150		X (Limit)	QAPP Limit = 50-150
Benzo(e)pyrene	Water	ug/L					50	150			
Method: Polynuclear Aromatic Hydrocarbons (HPLC-8310/3541)										x	
Acenaphthene	Soil	ug/Kg	29	90			60	127	50		
Acenaphthylene	Soil	ug/Kg	14	43			62	125	50		
Anthracene	Soil	ug/Kg	0.4	1.7			66	125	50		
Benzo(a)anthracene	Soil	ug/Kg	0.8	4.2			74	133	50		
Benzo(a)pyrene	Soil	ug/Kg	1.2	4.2			55	131	50		
Benzo(b)fluoranthene	Soil	ug/Kg	0.6	2.0			75	125	50		
Benzo(ghi)perylene	Soil	ug/Kg	2.1	6.7			73	130	50		
Benzo(k)fluoranthene	Soil	ug/Kg	0.7	3.0			75	127	50		
Chrysene	Soil	ug/Kg	0.6	4.2			75	125	50		

Appendix A

Laboratory Reporting and Control Limits Compliance Table

RVAAP 14 AOC Characterization

							LCG Control Limit			.	
Test Description	**Test Matrix**	**Units**	**Lab MDL**	**Proposed Lab RL**	**Project PQL**	**Proposed Lab RL < Project PQL**	**LCL**	**UCL**	**RPD**	**Request Variance**	**USACE Comments**
Dibenzo(a,h)anthracene	Soil	ug/Kg	3.2	16.7			75	127	50		
Fluoranthene	Soil	ug/Kg	1.3	4.2			74	126	50		
Fluorene	Soil	ug/Kg	1.0	8.3			71	125	50		
Indeno(1,2,3-cd)pyrene	Soil	ug/Kg	1.0	4.2			73	130	50		
Naphthalene	Soil	ug/Kg	7.4	42			67	158	50		
Phenanthrene	Soil	ug/Kg	1.3	4			75	126	50		
Pyrene	Soil	ug/Kg	7.6	**23**			67	135	50	X (RL)	
Surrogates										x	
Decafluorobiphenyl	Soil	ug/Kg					**38**	150		X (Limit)	QAPP Limit = 50-150
Benzo(e)pyrene	Soil	ug/Kg					50	150			
Method: Explosives by 8330 (HPLC) (8332)										x	
Nitroglycerine	Water	ug/L	0.26	1.0	3	Yes	**50**	**150**	**20**	X (Limit)	Approved
PETN	Water	ug/L	0.23	1.0							
Surrogates										x	
1,2-Dinitrobenzene (surr)	Water	ug/L					**60**	**140**		X (Limit)	Approved
Method: Explosives by 8330 (HPLC) (8332)										x	
Nitroglycerine	Soil	ug/Kg	140	500	3000	Yes	**50**	**150**	**20**	X (Limit)	Approved
PETN	Soil	ug/Kg	169	1000							
Surrogates										x	
1,2-Dinitrobenzene (surr)	Soil	ug/Kg					**80**	**120**		X (Limit)	Approved
Method: Metals TCLP Analysis (ICAP Trace - 6010B)										x	
Arsenic	TCLP	mg/L		0.100	na		**80**	**120**		X (Limit)	Approved
Barium	TCLP	mg/L		1.0	na		**80**	**120**		X (Limit)	Approved
Cadmium	TCLP	mg/L		0.050	na		**80**	**120**		X (Limit)	Approved
Chromium	TCLP	mg/L		0.050	na		**80**	**120**		X (Limit)	Approved
Lead	TCLP	mg/L		0.050	na		**80**	**120**		X (Limit)	Approved
Selenium	TCLP	mg/L		0.100	na		**80**	**120**		X (Limit)	Approved
Silver	TCLP	mg/L		0.050	na		**80**	**120**		X (Limit)	Approved
Note: TCLP Matrix Spike Limits are 50-150%, LCS limits are listed.										x	
Method: Metals TCLP Analysis (CVAA - 7470A)										x	
Mercury	TCLP	ug/L		2.0	na		**80**	**120**		X (Limit)	Approved
Note: TCLP Matrix Spike Limits are 50-150%, LCS limits are listed.										x	
Method: TCLP Pesticides 8081A										x	
Chlordane*	TCLP	ug/L		10	na		**50**	**150**		X (Limit)	Approved
Endrin	TCLP	ug/L		5	na		**68**	**132**		X (Limit)	Approved
Heptachlor	TCLP	ug/L		2.5	na		**64**	**121**		X (Limit)	Approved
Heptachlor Epoxide	TCLP	ug/L		2.5	na		**65**	**119**		X (Limit)	Approved
Lindane (gamma-BHC)	TCLP	ug/L		2.5	na		**67**	**113**		X (Limit)	Approved
Methoxychlor	TCLP	ug/L		25	na		**69**	**146**		X (Limit)	Approved
Toxaphene	TCLP	ug/L		50	na		**65**	**138**		X (Limit)	Approved
Surrogates:										x	
DCB	TCLP	ug/L					**24**	**150**		X (Limit)	Approved
TCX	TCLP	ug/L					**35**	**150**		X (Limit)	Approved
*Only one isomer of technical chlordane (alpha- or gamma-) is spiked.										x	
Method: TCLP Herbicides 8151A											
2,4,5-TP (Silvex)	TCLP	ug/L									
2,4-D	TCLP	ug/L									
Surrogate:											
DCAA	TCLP	ug/L									
Method: TCLP GC/MS Volatile Organics 8260B										x	
Benzene	TCLP	ug/L		100	na		**74**	**116**		X (Limit)	Approved
Carbon Tetrachloride	TCLP	ug/L		100	na		**66**	**136**		X (Limit)	Approved
Chlorobenzene	TCLP	ug/L		100	na		**76**	**124**		X (Limit)	Approved
Chloroform	TCLP	ug/L		100	na		**74**	**128**		X (Limit)	Approved
1,2-Dichloroethane	TCLP	ug/L		100	na		**63**	**133**		X (Limit)	Approved
1,1-Dichloroethylene	TCLP	ug/L		100	na		**54**	**127**		X (Limit)	Approved
2-Butanone (MEK)	TCLP	ug/L		100	na		**54**	**145**		X (Limit)	Approved
Tetrachloroethylene	TCLP	ug/L		100	na		**69**	**128**		X (Limit)	Approved
Trichloroethylene	TCLP	ug/L		100	na		**70**	**120**		X (Limit)	Approved
Vinyl chloride	TCLP	ug/L		100	na		**67**	**137**		X (Limit)	Approved
Surrogates:										x	

Appendix A

Laboratory Reporting and Control Limits Compliance Table

RVAAP 14 AOC Characterization

Test Description	Test Matrix	Units	Lab MDL	Proposed Lab RL	Project PQL	Proposed Lab RL < Project PQL	LCG Control Limit			.	USACE Comments
							LCL	UCL	RPD	Request Variance	
1,2-Dichloroethane-d4	TCLP	ug/L					**61**	**132**		X (Limit)	Approved
4-Bromofluorobenzene	TCLP	ug/L					**73**	**122**		X (Limit)	Approved
Toluene-d8	TCLP	ug/L					**78**	**128**		X (Limit)	Approved
Dibromofluoromethane	TCLP	ug/L					**66**	**132**		X (Limit)	Approved
Method: TCLP GC/MS Semivolatiles 8270C										x	
2-Methylphenol (o-Cresol)	TCLP	ug/L		100	na		**37**	**100**		X (Limit)	Approved
4-Methylphenol (m,p-Cresol)	TCLP	ug/L		100	na		**35**	**106**		X (Limit)	Approved
1,4-Dichlorobenzene	TCLP	ug/L		100	na		**38**	**100**		X (Limit)	Approved
2,4-Dinitrotoluene	TCLP	ug/L		100	na		**56**	**115**		X (Limit)	Approved
Hexachlorobenzene	TCLP	ug/L		100	na		**50**	**113**		X (Limit)	Approved
Hexachlorobutadiene	TCLP	ug/L		100	na		**41**	**100**		X (Limit)	Approved
Hexachloroethane	TCLP	ug/L		100	na		**34**	**100**		X (Limit)	Approved
Nitrobenzene	TCLP	ug/L		100	na		**41**	**105**		X (Limit)	Approved
Pentachlorophenol	TCLP	ug/L		500	na		**50**	**112**		X (Limit)	Approved
Pyridine	TCLP	ug/L		200	na		**16**	**100**		X (Limit)	Variance Approved
2,4,5-Trichlorophenol	TCLP	ug/L		500	na		**54**	**107**		X (Limit)	Approved
2,4,6-Trichlorophenol	TCLP	ug/L		100	na		**51**	**101**		X (Limit)	Approved
Surrogates:										x	
Nitrobenzene-d5	TCLP	ug/L					**50**	**150**		X (Limit)	Variance Approved
2-Fluorobiphenyl	TCLP	ug/L					**50**	**150**		X (Limit)	Variance Approved
Terphenyl-d14	TCLP	ug/L					**33**	**150**		X (Limit)	Variance Approved
Phenol-d5	TCLP	ug/L					**10**	**150**		X (Limit)	Variance Approved
2,4,6-Tribromophenol	TCLP	ug/L					**45**	**150**		X (Limit)	Variance Approved
2-Fluorophenol	TCLP	ug/L					**32**	**150**		X (Limit)	Variance Approved
Method: Specific Conductance @ 25 degrees C (120.1)											
Specific Conductance at 25 deg C	Water	umhos/cm									
Method: pH (Water) (150.1)											
pH	Water	pH Units	0.2								
Method: Solids, Total Dissolved (TDS) (160.1)											
Solids, Total Dissolved	Water	mg/L	4.9				80	120	20	X(Limit)	
Method: Solids, Total Suspended (TSS) (160.2)											
Solids, Total Suspended	Water	mg/L	4.8				80	120	20	X(Limit)	
Method: Solids, Total (TS-Water) (160.3)											
Solids, Total	Water	mg/L	4.8				80	120	20	X(Limit)	
Method: Solids, Total Volatile (TVS) (160.4)											
Solids, Total Volatile	Water	mg/L	4.8				80	120	20	X(Limit)	
Solids, Total Volatile Suspended	Water	mg/L					80	120	20	X(Limit)	
Method: Solids, Settleable (SS) (160.5)											
Solids, Settable	Water	mL/L	0.5								
Method: Turbidity (Nephelometric) (180.1)											
Turbidity	Water	NTU	0.053				80	120	20	X(Limit)	
Method: Ion Chromatography Analysis (300.0)											
Bromide	Water	mg/L	0.044				80	120	20	X(Limit)	
Chloride	Water	mg/L	0.032	0.2	0.2	Yes	80	120	20		
Fluoride	Water	mg/L	0.025				80	120	20	X(Limit)	
Nitrate as N (NO3-N)	Water	mg/L	0.033				80	120	20	X(Limit)	
Nitrite as N (NO2-N)	Water	mg/L	0.051				80	120	20	X(Limit)	
Phosphate, Ortho as P	Water	mg/L	0.084				80	120	20	X(Limit)	
Sulfate	Water	mg/L	0.141				80	120	20	X(Limit)	
Bromide	Solid	mg/Kg	0.44				80	120	20	X(Limit)	
Chloride	Solid	mg/Kg	0.89				80	120	20	X(Limit)	
Fluoride	Solid	mg/Kg	0.25				80	120	20	X(Limit)	
Nitrate as N (NO3-N)	Solid	mg/Kg	0.33				80	120	20	X(Limit)	
Nitrite as N (NO2-N)	Solid	mg/Kg	0.51				80	120	20	X(Limit)	
Phosphate, Ortho as P	Solid	mg/Kg	0.84				80	120	20	X(Limit)	
Sulfate	Solid	mg/Kg	1.41				80	120	20	X(Limit)	
Method: Alkalinity (310.1)											
Alkalinity, Total as CaCO3	Water	mg/L	2.6				80	120	20	X(Limit)	
Bicarbonate Alkalinity	Water	mg/L	2.6								
Carbonate Alkalinity	Water	mg/L	2.6								
Hydroxide Alkalinity	Water	mg/L	2.6								
Phenophthalein Alkalinity	Water	mg/L	2.6								
Alkalinity, Total as CaCO3	Solid	%	0.026				80	120	20	X(Limit)	
Bicarbonate Alkalinity	Solid	%	0.026								
Carbonate Alkalinity	Solid	%	0.026								

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Laboratory Reporting and Control Limits Compliance Table

RVAAP 14 AOC Characterization

Test Description	Test Matrix	Units	Lab MDL	Proposed Lab RL	Project PQL	Proposed Lab RL < Project PQL	LCG Control Limit			.	USACE Comments
							LCL	UCL	RPD	Request Variance	
Hydroxide Alkalinity	Solid	%	0.026								
Phenophthalein Alkalinity	Solid	%	0.026								
Method: Chloride (Colorimetric) (325.2)											
Chloride	Water	mg/L	1.65				80	120	20	X(Limit)	
Chloride	Solid	mg/Kg	16.5				80	120	20	X(Limit)	
Method: Chlorine, Total Residual (DPD) (330.4)											
Chlorine, Tot.Residual	Water	mg/L					80	120	20	X(Limit)	
Method: Cyanide, Amenable to Chlorination (ATC-335.1)											
Cyanide, Amenable to Chlor.	Water	mg/L					80	120	20	X(Limit)	
Cyanide, Amenable to Chlor.	Solid	mg/Kg					80	120	20	X(Limit)	
Method: Cyanide, Total (Tit., Spec.) (335.2)											
Cyanide, Total	Water	mg/L	0.005				80	120	20	X(Limit)	
Cyanide, Free	Water	mg/L	0.005				80	120	20	X(Limit)	
Cyanide, Total	Solid	mg/Kg	0.25				80	120	20	X(Limit)	
Cyanide, Free	Solid	mg/Kg	0.25				80	120	20	X(Limit)	
Method: Fluoride (ISE) (340.2)											
Fluoride	Water	mg/L	0.013				80	120	20	X(Limit)	
Fluoride	Solid	mg/Kg	0.33				80	120	20	X(Limit)	
Method: Nitrogen, Ammonia (Dist./Nessler.) (350.2)											
Ammonia (NH3), as N	Water	mg/L	0.05				80	120	20	X(Limit)	
Ammonia, Unionized	Water	mg/L	0.0004				80	120	20	X(Limit)	
Ammonia (NH3), as N	Solid	mg/Kg	7.2				80	120	20	X(Limit)	
Method: Nitrogen, Total Kjeldahl (351.3)											
Nitrogen, Total Kjeldahl as N	Water	mg/L	0.13				80	120	20	X(Limit)	
Nitrogen, Total Kjeldahl as N	Solid	mg/Kg	13				80	120	20	X(Limit)	
Method: Nitrogen, NO2, NO3 (Auto Cd Red.) (353.2)										x	
Nitrate + Nitrite as N	Water	mg/L	0.068				80	120	20	X(Limit)	
Nitrate as N (NO3-N)	Water	mg/L	0.057	**0.2**	0.1	No	80	120	20	X (RL-Proj)	
Nitrate + Nitrite as N	Solid	mg/Kg	0.68				80	120	20	X(Limit)	
Nitrate as N (NO3-N)	Solid	mg/Kg	0.57	2.0	na		**80**	**120**	**20**	X (Limit)	Approved
Method: Nitrite, Spectrophotometric (354.1)											
Nitrite as N (NO2-N)	Water	mg/L	0.005				80	120	20	X(Limit)	
Nitrite as N (NO2-N)	Solid	mg/Kg	0.05				80	120	20	X(Limit)	
Method: Dissolved Oxygen (Membrane Electrode) (360.1)											
Dissolved Oxygen (electrode)	Water	mg/L	NA								
Method: Phosphorous, All Forms (365.2)											
Phosphate, Ortho as PO4	Water	mg/L	0.006				80	120	20	X(Limit)	
Phosphate, Ortho as P	Water	mg/L	0.002				80	120	20	X(Limit)	
Phosphorous, Total as PO4	Water	mg/L	0.031				80	120	20	X(Limit)	
Phosphorous, Organic as P	Water	mg/L	0.01				80	120	20	X(Limit)	
Phosphorous, Total as P	Water	mg/L	0.01				80	120	20	X(Limit)	
Phosphate, Ortho as PO4	Solid	mg/Kg	0.06				80	120	20	X(Limit)	
Phosphate, Ortho as P	Solid	mg/Kg	0.02				80	120	20	X(Limit)	
Phosphorous, Total as PO4	Solid	mg/Kg	6.1				80	120	20	X(Limit)	
Phosphorous, Organic as P	Solid	mg/Kg	2				80	120	20	X(Limit)	
Phosphorous, Total as P	Solid	mg/Kg	2				80	120	20	X(Limit)	
Method: Sulfate, Turbimetric (375.4)											
Sulfate	Water	mg/L	2.5				80	120	20	X(Limit)	
Sulfate	Solid	mg/Kg	14.2				80	120	20	X(Limit)	
Method: Sulfide (Titrimetric, iodine) (376.1)											
Sulfide	Water	mg/L	0.5				80	120	20	X(Limit)	
Sulfide as H2S (Calc.)	Water	mg/L									
Sulfide	Solid						80	120	20	X(Limit)	
Sulfide as H2S (Calc.)	Solid										
Method: Biochemical Oxygen Demand (BOD 5 day) (405.1)											
Biochemical Oxygen Demand	Water	mg/L					80	120	20	X(Limit)	
Method: Organic Carbon (415.1)											
Inorganic Carbon, Diss. (DIC)	Water	mg/L	0.43				80	120	20	X(Limit)	
Organic Carbon, Diss. (DOC)	Water	mg/L	0.43				80	120	20	X(Limit)	
Total Carbon (TC)	Water	mg/L	0.43				80	120	20	X(Limit)	
Inorganic Carbon, Tot. (TCI)	Water	mg/L	0.43				80	120	20	X(Limit)	
Organic Carbon, Tot. (TOC)	Water	mg/L	0.29	1	1.0	Yes	80	120	20		
Method: Phenolics, Total Recoverable (420.2)											
Phenolics, Total Recoverable	Water	mg/L	0.0025				80	120	20	X(Limit)	
Phenolics, Total Recoverable	Solid	mg/Kg	0.25				80	120	20	X(Limit)	
Method: Viscosity, Brookfield (VISC-B)											

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Laboratory Reporting and Control Limits Compliance Table

RVAAP 14 AOC Characterization

Test Description	Test Matrix	Units	Lab MDL	Proposed Lab RL	Project PQL	Proposed Lab RL < Project PQL	LCG Control Limit			.	USACE Comments
							LCL	UCL	RPD	Request Variance	
Viscosity	Water	cP	0.1								
Method: Viscosity, Kinematic (VISC-K)											
Viscosity	Water	cSt									
Method: Chemical Oxygen Demand (HACH) (HACH)											
Chemical Oxygen Demand	Water	mg/L	3								
Chemical Oxygen Demand	Solid	mg/Kg	200								
Method: Total Organic Carbon (Soils) (TOCS)											
Organic Carbon, Tot. (TOC)	Solid	mg/Kg	64				53	140	30	X(Limit)	
Method: Ignitability (Pensky-Martens Closed-Cup 1010)											
Ignitability (Flashpoint)	Solids	degrees F									
Method: O&G/TPH Gravimetric (HEM) (1664)											
Oil and Grease (HEM)	Water	mg/L	1.4								
TPH, Recoverable (SGT-HEM)	Water	mg/L	2.5				66	114	24	X(Limit)	
Method: Alkalinity (2320B)											
Alkalinity, Total as CaCO3	Water	mg/L	2.6								
Bicarbonate Alkalinity	Water	mg/L	2.6								
Carbonate Alkalinity	Water	mg/L	2.6								
Hydroxide Alkalinity	Water	mg/L	2.6								
Phenophthalein Alkalinity	Water	mg/L	2.6								
Alkalinity, Total as CaCO3	Solid	mg/Kg	260								
Bicarbonate Alkalinity	Solid	mg/Kg	260								
Carbonate Alkalinity	Solid	mg/Kg	260								
Hydroxide Alkalinity	Solid	mg/Kg	260								
Phenophthalein Alkalinity	Solid	mg/Kg	260								
Method: Specific Conductance @ 25 degrees C (2510B)											
Specific Conductance at 25 deg C	Water	umhos/cm									
Method: Solids, Total (TS-Water) (2540B)											
Solids, Total (TS-Water)	Water	mg/L	4.8								
Method: Solids, Total Dissolved (TDS) (2540C)											
Solids, Total Dissolved	Water	mg/L	4.9								
Method: Solids, Total Suspended (TSS) (2540D)											
Solids, Total Suspended	Water	mg/L	4.8								
Method: % Solids Determination											
% Solids	Solid	%									
Method: Biochemical Oxygen Demand (BOD 5 day)											
Biochemical Oxygen Demand (BOD5)	Water	mg/L					80	120	20	X(Limit)	
Carbonaceous BOD (CBOD)	Water	mg/L									
Method: Reactivity, Cyanide (7332)										x	
Reactivity, Cyanide	Water	mg/L	0.01				0	66	127	X(Limit)	
Reactivity, Cyanide	Solid	mg/Kg	1.7	5	na		**0**	**66**	**127**	X (Limit)	Laboratory will perform Total Analysis Initially
Method: Reactivity, Sulfide (7342)										x	
Reactivity, Sulfide	Water	mg/L	1				0	200	200	X(Limit)	
Reactivity, Sulfide	Solid	mg/Kg	133	500	na		**25**	**116**	**50**	X (Limit)	Laboratory will perform Total Analysis Initially
Method: Cyanide (Colorimetric) (9010B/9014)										x	
Cyanide, Total	Water	mg/L	0.0044	**0.014**	0.01	No	80	120	20	X (RL-Proj)	Varriance approved
Cyanide, Amenable to Chlor.(ATC)	Water	mg/L	0.005	0.5							
Cyanide, Free	Water	mg/L	0.005								
Cyanide, Total	Solid	mg/Kg	0.22	**0.70**	0.5	No	80	120	20	X (RL-Proj)	Variance approved
Cyanide, Amenable to Chlor.(ATC)	Solid	mg/Kg	0.25								
Cyanide, Free	Solid	mg/Kg	0.25								
Method: Halide, Total Organic as Cl (TOX) (9020)											
Total Organic Halide as Cl (TOX)	Water	mg/L	0.002								
Method: Sulfide, Total (9034)											
Sulfide	Water	mg/L	0.56				80	120	20	X(Limit)	
Sulfide	Solid	mg/Kg	19.8								
Method: Sulfate, Turbimetric (9038M)											
Sulfate	Water	mg/L	2.5								
Sulfate	Solid	mg/Kg	14.2								
Method: pH (Liquid) (9040B)											
Corrosivity (pH-Liquids)	Water	pH Units									
pH	Water	pH Units	0.2								
Method: pH (Soil) (9045C)											
Corrosivity (pH Solid)	Solid	pH Units	0.2	0.2	na						
pH	Solid	pH Units									

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RVAAP 14 AOC Characterization

Test Description	Test Matrix	Units	Lab MDL	Proposed Lab RL	Project PQL	Proposed Lab RL < Project PQL	LCG Control Limit			.	USACE Comments
							LCL	UCL	RPD	Request Variance	
Method: Ion Chromatography Analysis (9056)											
Bromide	Water	mg/L	0.044								
Chloride	Water	mg/L	0.089								
Fluoride	Water	mg/L	0.025								
Nitrate as N (NO3-N)	Water	mg/L	0.033								
Nitrite as N (NO2-N)	Water	mg/L	0.051								
Phosphate, Ortho as P	Water	mg/L	0.084								
Sulfate	Water	mg/L	0.141								
Bromide	Solid	mg/Kg	0.44								
Chloride	Solid	mg/Kg	0.89								
Fluoride	Solid	mg/Kg	0.25								
Nitrate as N (NO3-N)	Solid	mg/Kg	0.33								
Nitrite as N (NO2-N)	Solid	mg/Kg	0.51								
Phosphate, Ortho as P	Solid	mg/Kg	0.84								
Sulfate	Solid	mg/Kg	1.41								
Method: Organic Carbon (9060)											
Inorganic Carbon, Diss. (DIC)	Water	mg/L	0.43								
Organic Carbon, Diss. (DOC)	Water	mg/L	0.43								
Inorganic Carbon, Tot. (TCI)	Water	mg/L	0.43								
Organic Carbon, Tot. (TOC)	Water	mg/L	0.15				80	120	20	X(Limit)	
Method: Organic Carbon (Lloyd Kahn)											
Total Organic Carbon (Soils)	Solid	mg/Kg	64				53	140	30	X(Limit)	
Method: Phenolics, Total Recoverable (9066)											
Phenolics, Total Recoverable	Water	mg/L	0.0025								
Phenolics, Total Recoverable	Solid	mg/Kg	0.25								
Method: Oil and Grease (Soxhlet Extraction) (9071)											
Oil and Grease (HEM)	Solid	mg/Kg	116								
TPH, Recoverable (SGT-HEM)	Solid	mg/Kg	116								
Method: Halide, Total Organic as Cl (TOX) (9076)											
Halide, Tot. Org. as Cl (TOX)	Solid	mg/Kg	2.5								
Method: Paint Filter Test											
Paint Filter Test	Solid	mL/100g									
Method: SW-846 8270C/SW-846 3550 (Low Level)											
1,4-Dichlorobenzene	Solid	ug/Kg	2.1	16.7							
2,4,6-Trichlorophenol	Solid	ug/Kg	1.2	16.7							
2,4-Dimethylphenol	Solid	ug/Kg	2.9	16.7							
2,4-Dinitrotoluene	Solid	ug/Kg	1.7	16.7							
2,6-Dinitrotoluene	Solid	ug/Kg	2.2	16.7							
2-Chlorophenol	Solid	ug/Kg	1.5	16.7							
2-Methylnaphthalene	Solid	ug/Kg	1.5	16.7							
2-Methylphenol (o-cresol)	Solid	ug/Kg	4.3	16.7							
2-Nitroaniline	Solid	ug/Kg	2.0	16.7							
3,3-Dichlorobenzidine	Solid	ug/Kg	3.6	33.0							
4-Methylphenol (m/p-cresol)	Solid	ug/Kg	3.4	16.7							
Acenaphthene	Solid	ug/Kg	1.4	16.7			46	125			
Acenaphthylene	Solid	ug/Kg	0.91	16.7			44	125			
Anthracene	Solid	ug/Kg	0.86	16.7			53	125			
Benzo(a)anthracene	Solid	ug/Kg	1.2	16.7			52	125			
Benzo(a)pyrene	Solid	ug/Kg	2.2	16.7			50	125			
Benzo(b)fluoranthene	Solid	ug/Kg	2.1	16.7			45	125			
Benzo(ghi)perylene	Solid	ug/Kg	1.9	16.7			38	126			
Benzo(k)fluoranthene	Solid	ug/Kg	2.8	16.7			45	125			
Bis(2-chloroethyl)ether	Solid	ug/Kg	2.0	16.7							
Bis(2-ethylhexyl)phthalate	Solid	ug/Kg	2.8	33.3							
Carbazole	Solid	ug/Kg	0.58	16.7							
Chrysene	Solid	ug/Kg	1.8	16.7			53	125			
Dibenzo(a,h)anthracene	Solid	ug/Kg	2.2	16.7			41	125			
Dibenzofuran	Solid	ug/Kg	1.2	16.7							
Di-n-butyl phthalate	Solid	ug/Kg	16.9	**51**							
Fluoranthene	Solid	ug/Kg	1.1	16.7			54	125			
Fluorene	Solid	ug/Kg	1.6	16.7			49	125			
Hexachlorobenzene	Solid	ug/Kg	1.8	16.7							
Hexachlorocyclopentadiene	Solid	ug/Kg	1.5	16.7							
Indeno(1,2,3-cd)pyrene	Solid	ug/Kg	2.1	16.7			38	125			
Naphthalene	Solid	ug/Kg	1.8	16.7			40	125			
Nitrobenzene	Solid	ug/Kg	2.5	16.7							

Appendix A

Laboratory Reporting and Control Limits Compliance Table

RVAAP 14 AOC Characterization

Test Description	Test Matrix	Units	Lab MDL	Proposed Lab RL	Project PQL	Proposed Lab RL < Project PQL	LCG Control Limit			.	
							LCL	UCL	RPD	Request Variance	USACE Comments
n-Nitroso-di-n-propylamine	Solid	ug/Kg	2.3	16.7							
n-Nitrosodiphenylamine	Solid	ug/Kg	2.9	16.7							
Pentachlorophenol	Solid	ug/Kg	5.4	66.7							
Phenanthrene	Solid	ug/Kg	1.0	16.7			50	125			
Phenol	Solid	ug/Kg	1.6	16.7							
Pyrene	Solid	ug/Kg	2.0	16.7			46	125			
Surrogates	Solid										
Nitrobenzene-d5	Solid						37	125			
2-Fluorobiphenyl	Solid						43	125			
Terphenyl-d14	Solid						32	125			
Phenol-d5	Solid						40	125			
2,4,6-Tribromophenol	Solid						36	126			
2-Fluorophenol	Solid						37	125			
Method: 8330 Mod. (STL Sacramento)											
Nitroglycerine	Water										
PETN	Water										
Nitroguanidine	Water	ug/L		20	20	Yes					
Nitroglycerine	Soil										
PETN	Soil										
Nitroguanidine	Soil	mg/Kg		0.25	0.25	Yes					
Method: (No Bid)											
Perchlorate	Water										
Perchlorate	Soil										
Method: 353.2 Mod. (STL Sacramento)											
Nitrocellulose	Water	ug/L		500	500	Yes					
Nitrocellulose	Soil	mg/Kg		2.0	5	Yes					

Abbreviations:
LCG - Louisville Chemistry Guidance (USACE)
LCL - Lower Control Limit
UCL - Upper Control Limit
MDL - Method Detection Limit
PQL - Project Quantitation Level
RPD - Relative Percent Difference
USACE - US Army Corps of Engineers

Notes:
Discussions are on-going to resolve discrepancies between FW limits and laboratory limits.