GROUNDWATER ASSESSMENT PLAN FOR THE RAMSDELL QUARRY LANDFILL

RAVENNA ARMY AMMUNITION PLANT
RAVENNA, OHIO 44266

Prepared for

OPERATIONS SUPPORT COMMAND
AMSIO-ACE-D
Procurement Directorate
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SEPTEMBER 2001

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LETTER OF TRANSMITTAL

TO: Mark Patterson

RVAAP
Building 1037
RVAAP
8451 State Route 5
Ravenna, OH 44266

DATE	JOB NO
9/7/01	
ATTENTION: SAME	
RE: TRANSMITTAL OF GROUNDWATER ASSESSMENT PLAN FOR THE RAMSDELL LANDFILL QUARRY SEPTEMBER 2001	

We are sending you ☒ Attached ☐ Under separate cover via_____ the following items:

☐ Shop Drawings ☐ Prints ☐ Plans ☐ Samples ☐ Specifications
☐ Copy of Letter ☐ Change Order ☒ Plan

COPIES	DATE	NO.	DESCRIPTION
1	9-7-01	1	GROUNDWATER ASSESSMENT PLAN FOR THE RAMSDELL LANDFILL QUARRY, SEPTEMBER 2001

THESE are transmitted as checked below:

☐ For approval ☐ Approved as submitted ☐ Resubmit_____copies for approval
☒ For your use ☐ Approved as noted ☐ Submit_____copies for distribution
☒ As requested ☐ Returned for corrections ☐ Return_____corrected prints
☒ For review and comment ☐ _____
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REMARKS:
Copies have been provided as follows:
Jamal Singh, (OEPA) – 1 copy
Eileen Mohr/Todd Fisher, (OEPA) – 1 copy
Diane Kurlich, (OEPA) – 1 Copy
Irwin Dreyfus, (OSC) – 1 Copy
Bill Ingold, (OSC) – 1 Copy
Ernie Neal, (NES) – 1 Copy
MKM Houston Office – 1 Copy

Copy To: As noted
Signed: Richard C. Callahan

If enclosures are not as noted, kindly notify us at once.

TABLE OF CONTENTS

Table of Contents (Continued)

INTRODUCTION

The Ground Water Assessment Plan for the Ramsdell Quarry Landfill has been prepared to fulfill, in part, the requirements of the 1990 Ohio EPA Ground Water Monitoring regulations applicable for solid waste landfills closing on or before December 1990. During a 2001 semi-annual ground water detection monitoring event, the RVAAP experienced statistically significant change in a few ground water constituents. The results of the preliminary ground water monitoring data was confirmed in August 2001 and in turn reported to the Director of Ohio EPA as stipulated and required by the 1990 ground water regulations.

1. Site Background

Landfill Operation

The Ramsdell Quarry is located in the northeastern portion of the RVAAP and encompasses about 5.7 hectares. The quarry was originally excavated 30 to 40 feet below the existing grade. The excavated material, consisting primarily of sandstone and quartz pebble was used for road and ballast construction. Quarry operations were discontinued about 1941. The western and southern portions of the quarry were subsequently used for landfill operations between 1941 and 1989. Beginning in 1976 the landfill disposed of only non-hazardous solid waste and continued until 1989 when the landfill ceased operation. In addition, from 1946 to sometime in the early 1950s, the bottom of the quarry was used to burn waste explosives. Liquid wastes from annealing operations were also deposited in the quarry during this time period. In 1978, the State of Ohio permitted a portion of the quarry as a sanitary landfill. Interviews with former RVAAP personnel indicated that much of the explosive waste residue and debris were removed in the 1980s. Formal closure of the landfill/quarry was completed in May of 1990 under State of Ohio solid waste regulations effective in March of 1990.

Development of a Ground Water Monitoring Program.

Pursuant to the Ohio EPA March 1990 regulations, the RVAAP developed and implemented a ground water monitoring program. In 1988 the RVAAP completed the drilling and completion of 5 boreholes into groundwater monitoring wells MW-1 through MW-5. These wells constituted the initial groundwater monitoring system. Evaluation of the original placement of these wells determined that only one of the wells proved to be located immediately downgradient of the landfill. This and other related issues lead to the development and implementation of a follow-on ground water investigation of the Ramsdell Quarry initiated in 1998 and completed in 1999. The report titled, Final Report on

the Ground Water Investigation of the Ramsdell Quarry Landfill (Appendix I to this Plan), provides information on the installation of a new ground water monitoring system, consisting of RQL MW-006 through RQL MW-009. Since July 1998, the RVAAP has used the RQL MW-006 through RQL MW-009 groundwater monitoring system to meet the requirements of O.A.C. 3745-27-10 effective March 1990. Monitoring wells RQL MW-010 through RQL MW-011 were also installed as part of the 1998 groundwater investigation to further assess the hydrogeologic conditions of the site. These monitoring wells could be used to compliment the groundwater monitoring program and evaluate the rate and extent of groundwater constituents, as required as part of the assessment process.

2. Submission of Plan – O.A.C. 3745-27-10(E)(1).

Scheduled Semi-annual Sampling Event

On April 30, 2001 the RVAAP conducted its scheduled semi-annual sampling event. On June 5, 2001 the RVAAP received initial data indicating that a statistically significant change (SSC) had occurred at well RQL MW-007 for the indicator parameters specific conductance and total suspended solids when compared with the background well RQL MW-006. On June 15, 2001 the RVAAP notified the Director of the Ohio EPA of the results of the April 30, 2001 sampling event regarding the SSCs at well RQL MW-007 as required by O.A.C. 3745-27-10. On June 26, 2001 the RVAAP re-sampled well RQL MW-007 for the indicator parameters specific conductance and total dissolved solids as required by O.A.C. 3745-27-10.

Notification of the Director Regarding of an SSC

On August 24, 2001 the RVAAP notified the Director of the Ohio EPA that it had confirmed that an SSC was exhibited in well number RQL MW-007 for the indicator parameter total dissolved solids as required by O.A.C. 3745-27-10. The indicator parameter specific conductance did not reconfirm as an SSC during the June 26, 2001 sampling event.

Ground Water Assessment Plan Submission

As required by O.A.C. 3745-27-10, the RVAAP is hereby submitting a ground water assessment plan.

Additional Ground Water Monitoring Sampling

Ground Water Sampling Event #1

The ground water assessment plan requires the RVAAP to re-sample wells RQL MW-006 and RQL MW-007 by September 25, 2001 and perform analyses on the ground water samples for all parameters listed in Appendix II of the March 1, 1990 rules. Additionally, analyses will also be completed for specific explosives materials and propellents. All data collected will satisfy the requirements of the Ramsdell Quarry Landfill Groundwater Monitoring Plan and the Data Quality Objectives in the RVAAP Facility-Wide Sampling and Analysis Plan. Ground water regulatory requirements stipulate that the data must be submitted to the Director of the Ohio EPA not more than 60 days after sampling event and not more than 15 days after receiving the results of the analysis.

Upgradient/Background Monitoring Well - RQL MW-006

The Ohio EPA has previously indicated some concern regarding the effectiveness of RQL MW-006, the upgradient/background well. Pursuant to O.A.C. 3745-27-10, effective March 1990, the basis for submission of an assessment monitoring plan program is statistically significant change or concentration of constituents between the upgradient well and down gradient wells. Considering this fact, we recommend the following steps be taken to address both the effectiveness of MW-006 and the implementation of the assessment plan.

- Conduct the sampling Event #1 (RQL MW-006 and (RQL MW-007)
- Evaluate the ground water data from Event #1.
- Compare analytical data from Event #1, historical RQL ground water data, and previous site ground water studies (i.e. Jan.1999 Report on the Ground water Investigation of the Ramsdell Quarry Landfill).
- Establish agreement with OEPA regarding the status and effectiveness of RQL MW-006 (upgradient background well).

A final determination will then be made regarding the continued use and effectiveness of RQL MW-006 or the development of an alternative upgradient point that complies with the requirements of O.A.C. 3745-27-10.

Options upon Completion of Ground Water Sampling Event #1

If the ground water analyses resulting from Event #1 indicate that no analyzed constituents are reported above background for RQL MW-007, a request would be made to Ohio EPA to return to detection ground water monitoring. However, if

the data reflects constituents in RQL MW-007 above background, the RVAAP would proceed to Event #2.

Ground Water Sampling Event #2

After the completion of the Event #1 sampling, the RVAAP will evaluate the ground water data generated during Event #1 to determine if additional sampling of down gradient wells RQL MW-008 and RQL MW-009 is required. The decision to complete additional sampling and analyses on RQL MW-008 and RQL MW-009 is driven by a positive determination from the Event #1 sampling indicating the presence of Appendix II constituents or explosives / propellents above background levels in RQL MW-007.

Options upon Completion of Ground Water Sampling Event #2

a. If the ground water data reported for down gradient wells RQL MW-008 and RQL MW-009 either indicate or do not indicate concentration of constituents above background, the RVAAP would propose, in either situation, to proceed to additional ground water sampling to determine the rate and extent of groundwater constituents.

Ground Water Sampling Event #3

As noted under the Options in Ground Water Sampling Event #2 above, the presence of ground water constituents above background in RQL MW-007, RQL MW-008 and/or RQL MW-009, the RVAAP would be required to make a further determination of the rate and extent of the presence of analyzed constituents. As stipulated in the applicable 1990 ground water regulations, sampling Event #3 would involve the sampling, as necessary and appropriate, either RQL MW-010 or RQL mw-011 or both wells, for any constituents found in RQL MW-007, RQL MW-008 and/or RQL MW-009 above the approved and agreed-to background well to help define the extent and migration of any constituents.

Options upon Completion of the Ground Water Sampling Event #3

b. If any of the ground water constituents evaluated in sample event #3 appear above or below the background level established in the prior sampling events, the RVAAP would study the collective data generated under the assessment plan to determine what additional actions would be taken.

Following are the additional components required in the ground water assessment plan.

3. *Sampling Background and Affected Well O.A.C. 3745-27-10(E)(2)(a).*

Not later than September 25, 2001 the RVAAP will resample RQL MW-006 and RQL MW-007 and analyze those samples for the constituents listed in the Appendix II to the O.A.C. 3745-27-10 ground water rule effective March 1, 1990 and the specific explosives and propellents associated with RVAAP.

4. *Sampling Wells not Previously Sampled - O.A.C. 3745-27-10 (E) (2) (b).*

If it is determined that any Appendix II, explosive or propellent constituents are present in RQL mw-007 above background (as background is ultimately defined and agreed to) the RVAAP will proceed to sample RQL MW-008 and RQL MW-009 and analyze those samples for those constituents.

5. *Analytical Results from Sampling Background Well and Affected Well - O.A.C. 3745-27-10 (E) (2) (c).*

All analytical results will be submitted to the Director of the Ohio EPA by the RVAAP not later than 60 days after each sampling event and no later than 15 days after receiving the analytical results.

6. *Hydrogeologic Conditions - O.A.C. 3734-27-10 (E) (3) (a).*

The hydrogeologic conditions at the RVAAP Ramsdell Quarry are described in depth in the Final Report on the Ground Water Investigation of the Ramsdell Quarry Landfill completed in January 1999. A copy of this report is attached to this assessment plan. Although aspects of the hydrogeologic characteristics at the Ramsdell Quarry Landfill are still under discussion, the RVAAP believes that the report does provides the best representation and description of the site hydrogeologic conditions. Please see Section 2.0 for a general description of the site hydrogeologic conditions.

7. Number, Location, Depth, and Construction of Detection Monitoring Wells - O.A.C. 3745-27-10 (E) (3) (b) (i).

The Ramsdell Quarry O.A.C. 3745-27-10 ground water monitoring system consists of an upgradient well, RQL MW-006, and three downgradient wells RQL MW-007, RQL MW-008 and RQL MW-009. The depth, construction and location of these wells is described in Appendix I to this report as:

a. Table 2-1. Ramsdell Quarry Ground Monitoring Well Construction Data; and

b. Figure 2-1. Ramsdell Quarry Site Map and Ground Water Sampling Locations within the previously described and attached Ground Water Report.

8. Summary of Detection Monitoring Data – O.A.C. 3745-10 (E) (3) (b) (ii).

Attached to the assessment plan, as Appendix II, is a summary of the detection monitoring program data for the ground water monitoring system that includes wells RQL MW-006, RDL MW-007, RQL MW-008, and RQL MW-009.

9. Summary of Statistical Analysis Applied to the Data - O.A.C. 3745-27-10 (E) (3) (b) (iii).

A summary of the statistical data for Ramsdell Quarry ground water detection monitoring is included in Appendix II along with the summary of the detection monitoring data.

10. Proposed Number, Location, Depth and Construction of Assessment Monitoring Wells - O.A.C. 3745-27-10 (E) (3) (c) (i).

At this time the RVAAP is not planning to install any additional wells at the Ramsdell Quarry Landfill. The Ramsdell Quarry ground water monitoring network presently includes two wells downgradient of the existing O.A.C. 3745-27-10 ground water monitoring system. These wells, RQL MW-010 and RQL MW-011 will be used as assessment monitoring wells if constituents are found in the affected well/wells above background. The location, depth and construction of these wells are described in Table 2-1, of Appendix I.

11. Proposed Methods for Gathering Additional Hydrogeologic Information- O.A.C. 3745-27-10 (E) (3) (c) (ii.)

Presently, there are no plans to gather additional hydrogeologic information. As previously noted, the RVAAP will conduct Ground Water Sampling #1 and evaluate the applicable data. At that point a determination will be made as to the need for an additional upgradient sampling point and the necessity for any additional hydrogeologic evaluation.

12. Planned Use of Supporting Methodologies - O.A.C. 3745-27-10 (E) (3) (c) (iii).

At this time there are no additional use of supporting methodologies planned. The affected well (RQL MW-007) and the background well (RQL MW-006) will be sampled and the data analyzed. If appropriate, the remaining ground water wells that constitute the ground water monitoring program will be sampled and that data analyzed. Finally, a determination will be made regarding sampling the in-place wells, RQL MW-010 and RQL MW-011, to determine the rate and extent of any constituents.

13. Measurement of Ground Water Elevation- O.A.C. 3745-27-10 (E) (3) (d) (i).

Ground water elevations will be taken in accordance with in-place Ramsdell/RVAAP ground water monitoring plans and procedures. A copy of the existing Ramsdell ground water monitoring plan is attached as Appendix III.

14. Detection of Immiscible Layers- O.A.C 3745-27-10 (E) (3) (d) (ii).

Detection and notation of immiscible layers in samples collected will be noted and recorded in accordance with in-place Ramsdell/RVAAP ground water monitoring plans and procedures.

15. Well Evacuation - O.A.C. 3745-27-10 (E) (3) (d) (iii) (a).

Well evacuation will be conducted in accordance with in-place Ramsdell/RVAAP ground water monitoring plans and procedures.

16. Sample Withdrawal - O.A.C. 3745-27-10 (E) (3) (d) (iii) (b).

Sample withdrawal will be conducted in accordance with in-place Ramsdell/RVAAP ground water monitoring plans and procedures.

17. Sample Containers and Handling - O.A.C. 3745-27-10 (E) (3) (d) (iii) (c).

Sample containers and handling procedures will follow in-place Ramsdell/RVAAP ground water monitoring plans and procedures.

18. Sample Preservation - O.A.C. 3745-27-10 (E) (3) (d) (iii) (d).

Sample preservation procedures will follow in-place Ramsdell/RVAAP ground water monitoring plans and procedures.

19. Procedures and Forms for Recording Data - O.A.C. 3745-27-10 (E) (3) (d) (iv) (a.)

Forms utilized to record sample collection and field measurements will be the procedures and forms currently in-place as part of the Ramsdell/RVAAP ground water monitoring plans and procedures.

20. Calibration of Field Devices - O.A.C. 3745-27-10 (E) (3) (d) (iv) (b).

The calibration of field devices will follow in-place Ramsdell/RVAAP ground water monitoring/calibration of field equipment plans and procedures.

21. Decontamination of Equipment – O.A.C. 3745-27-10 (E) (3) (d) (v).

The decontamination of equipment will follow in-place Ramsdell/RVAAP ground water monitoring plans and procedures.

22. Methods for Sample Analysis – O.A.C. 3745-27-10 (E) (3) (d) (vi).

The methods for sample analysis will be the same as those used for detection ground water sample analyses and in accordance with in-place Ramsdell/RVAAP ground water monitoring plans and procedures.

23. Standardization Field Tracking Reporting Forms – O.A.C. 3745-27-10 (E) (3) (d) (vii) (a).

The field tracking forms used will be the same forms used for the ground water detection sampling events and in accordance with in-place Ramsdell/RVAAP ground water monitoring plans and procedures.

24. Preparation Sample Labels – O.A.C. 3745-27-10 (E) (3) (d) (vii) (b).

Sample labels will be prepared in accordance with in-place Ramsdell/RVAAP ground water monitoring plans and procedures.

25. Collection of Replicate Samples – O.A.C. 3745-27-10 (E) (3) (d) (viii) (a).

Replicate samples will be collected and handled in accordance with in-place Ramsdell/RVAAP ground water monitoring plans and procedures.

26. Submission of Field-bias Blanks – O.A.C. 3745-27-10 (E) (3) (d) (viii) (b).

The submission of field blanks will be handled in accordance with in-place Ramsdell/RVAAP ground water monitoring plans and procedures.

27. Potential Interferences – O.A.C. 3745-27-10 (E) (3) (d) (viii) (c).

At this time, based upon historical groundwater monitoring results, it is not anticipated that chemical interferences will be a problem for sample collection and analysis.

28. Use of Statistical Data Evaluation – O.A.C. 3745-27-10 (E) (3) (d) (viii) (e) (i).

At this time it is only anticipated that statistical data evaluation will be used in the evaluation of RQL MW-006 as an appropriate background well.

29. Use of Computer Models – O.A.C. 3745-27-10 (E) (3) (d) (viii) (e) (ii).

There is no planned use of computer models in the sampling phase of the assessment plan. Based upon the data generated it may be necessary to utilize computer models to help interpret the data generated.

30. Use of Previously Gathered Information – O.A.C. 3745-27-10 (E) (3) (d) (viii) (e) (iii).

As previously noted, the RVAAP has completed an in-depth hydrogeologic study of the Ramsdell Quarry Landfill that is included as Appendix I with this assessment plan. This report and the historical ground water monitoring data, attached as Appendix II, are also included in this report and will be used to assist in data interpretation.

31. Additional Assessment Criteria – O.A.C. 3745-27-10 (E) (3) (d) (viii) (e) (iv).

There are no additional assessment criteria at this time.

32. Schedule of Implementation – O.A.C. 3745-27-10 (E) (3) (d) (viii) (f).

Date	*Action Item*
4/30/01	Semi-annual sampling event
6/05/01	Receipt of initial data indicating SSC
6/15/01	Notification to Director of possible SSC
6/26/01	Re-sampling of RQL MW-006 and RQL MW-007
8/24/01	Notification to Director of confirmation of SSC
9/10/01	Submission of Assessment Plan
By 9/25/01	Completion of sampling for Appendix II, explosive and propellent constituents in RQL MW-006 and RQL MW-007
By 11/26/01 (but not later than 15 days after receipt of data)	Submission of data from the required sampling of designated monitoring wells

Additional scheduling will be developed based upon the review of the data of the initial sampling and the review of the adequacy of the existing background well.

33. Summary

In summary, the Ramsdell ground water monitoring assessment plan consists of 1 to 3 rounds of sampling and data analysis, based upon the analytical results received. The first round consists of sampling the background well and the affected downgradient well for the Appendix II, explosive and propellent constituents. All data collected will satisfy the requirements of the Ramsdell Quarry Landfill Groundwater Monitoring Plan and the Data Quality Objectives in the RVAAP Facility-Wide Sampling and Analysis Plan. In addition, an evaluation of the validity and continued use of the upgradient well will be conducted as well as an assessment of any parameters noted above background in the affected well (RQL MW-007). The second round of sampling, if necessary and appropriate, will consist of sampling RQL MW-008 and RQL MW-009 for any constituents that were detected in the affected well above background. The third round of sampling, if necessary and appropriate, will consist of sampling RQL MW-010 and/or RQL MW-011 for any constituents detected in RQL MW-007, RQL MW-008 or RQL MW-009 above background. The information from the third round of sampling will, if necessary and appropriate, be used to determine the rate and extent of any ground water constituents.

FINAL

INITIAL PHASE REPORT
GROUNDWATER INVESTIGATION
RAMSDELL QUARRY LANDFILL

RAVENNA ARMY AMMUNITION PLANT
RAVENNA, OHIO

PREPARED FOR

US Army Corps of Engineers®

LOUISVILLE DISTRICT

CONTRACT No. DACA27-97-D-0025
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Prepared for:
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January 1999

CONTENTS

List of Figures

List of Tables

List of Acronyms

amsl	above mean sea level
AOC	area of concern
BGS	below ground surface
DNB	dinitrobenzene
DNT	dinitrotoluene
MCL	Maximum Contaminant Level
OAC	Ohio Administrative Code
Ohio EPA	Ohio Environmental Protection Agency
OVA	organic vapor analyzer
PAH	polynuclear aromatic hydrocarbon
PID	photoionization detector
PVC	polyvinyl chloride
RQL	Ramsdell Quarry Landfill
RVAAP	Ravenna Army Ammunition Plant
SVOC	semivolatile organic compound
TAL	Target Analyte List
TNT	trinitrotoluene
USACE	U.S. Army Corps of Engineers
USAEHA	U.S. Army Environmental Hygiene Agency
UXO	unexploded ordnance
VOC	volatile organic compound

EXECUTIVE SUMMARY

This report documents the results of the initial phase of the Groundwater Investigation of Ramsdell Quarry Landfill (RQL) at Ravenna Army Ammunition Plant (RVAAP), Ravenna, Ohio. The initial phase of the Groundwater Investigation was conducted for RVAAP by Science Applications International Corporation under contract DACA27-97-D-0025, Delivery Order No. 003, with the U.S. Army Corps of Engineers (USACE), Louisville District. The Groundwater Investigation is conducted in a manner consistent with the Department of Defense Installation Restoration Program guidelines, following work plans reviewed and commented on by the Ohio Environmental Protection Agency, Northeast District Office, Division of Solid and Infectious Waste.

ES.1 OBJECTIVES

This Groundwater Investigation Report summarizes the results of the initial phase of field activities conducted in July 1998 at RQL. The specific objectives of the Groundwater Investigation are as follows:

- to assess the hydrogeologic conditions and groundwater quality of shallow groundwater beneath the site using monitoring wells of known integrity suited to this purpose;
- to evaluate the RQL pond water and sediment for evidence of contamination, either via the groundwater pathway, or by surface runoff of contaminated soils to the pond;
- to establish whether there is a hydraulic connection between shallow groundwater and the pond and to continuously monitor water levels in six monitoring wells and the pond for one year for this purpose; and
- to provide for the quarterly collection of samples of upgradient and downgradient groundwater and surface water for one year, and during two significant hydrogeologic events, to maintain compliance with post-closure monitoring requirements.

ES.2 FIELD INVESTIGATION

The RQL Groundwater Investigation is organized in two distinct phases of data collection and analysis. The initial phase, completed in July 1998, consisted of the following activities:

- installation, development, testing, sampling, and instrumentation of six new monitoring wells;
- testing, sampling, and water level measurements at five monitoring wells constructed in 1988;
- sampling of sediments and surface water at the RQL pond;
- construction of an instrumented staff gauge at the RQL pond; and
- surveying of all monitoring wells and pond sediment/surface water sampling locations.

The initial field effort was conducted in accordance with the *Facility-Wide Sampling and Analysis Plan for Ravenna Army Ammunition Plant* (USACE 1996a) and the *Sampling and Analysis Plan Addendum for the Groundwater Investigation of the Former Ramsdell Quarry Landfill* (USACE 1998). The initial phase of the investigation specifically addresses the first two objectives as stated above, and provides

the basis for the remaining objectives to be accomplished. These field activities are the subject of this report.

The follow-up phase consists of the collection of groundwater samples from each of the six newly installed monitoring wells and collection of samples from one surface water location. This work is to be repeated for the next three quarters and in two separate hydrogeologic events (i.e., either a storm or a prolonged dry period), ending in 1999. The purpose of this monitoring is to establish a statistically sound data set to determine whether contaminants are migrating via groundwater from the former landfill. In addition, follow-up work will consist of continuous water-level measurements using data loggers on the six new wells, and monthly manual water level readings on the previously installed monitoring wells, for a period of one year following the installation of the six new wells. The results of sampling in each quarter will be the subject of three individual quarterly reports.

ES.3 GROUNDWATER HYDROGEOLOGY AND FLOW

Six monitoring wells were installed as a part of the initial phase of the Groundwater Investigation. A staff gauge was installed in the pond to provide correlative pond surface elevation data to groundwater elevations. RQL and the adjacent pond are underlain by weathered, fractured fine- to medium-grained, sandstones of the Sharon Member of the Pennsylvanian Pottsville Formation. All of the wells are completed in the most shallow water-bearing zone in this stratigraphic unit. Open, recemented, and highly weathered fractures were observed throughout the drilled intervals. Fracturing occurs both along bedding planes and as joints in massive zones. Groundwater circulates along fractures, as evidenced by limonitic or black oxidized stainings and coatings on the rock or on grains. The pervasive character of fracturing in the sandstone suggests that vertical movement of groundwater through both the primary and secondary porosity takes place at RQL to some degree.

Water level measurements in the six new wells and pond staff gauge indicate a local hydraulic gradient to the northeast. Water level measurements from the original five monitoring wells (which are screened deeper than the new wells) collected during the same week, and historical information for water levels in the summer months, illustrate the same general potentiometric surface geometry. These data indicate a high degree of vertical communication between the zones across permeable primary and secondary flow paths in the highly fractured and weathered sandstones at RQL.

The pond is small and shallow, and much of its former extent is now covered with vegetation. RQL pond is underlain by bedrock, covered to varying degrees by fine-grained sediment. The presence of this sediment may effectively reduce the amount of any hydraulic communication that may exist between the water-bearing zone in the sandstone and the pond, especially at times when the water level (i.e., the hydraulic head) in the pond is low. However, water levels in the pond have appeared to mimic those in the original monitoring wells and in the newly installed wells between the landfill toe and the pond.

ES.4 ANALYTICAL RESULTS

The results of the Groundwater Investigation initial sampling at RQL are summarized in the following sections.

ES.4.1 Groundwater

Groundwater contains low levels of explosives such as RDX, 1,3-dinitrobenzene, and nitrotoluenes. Two explosives were identified in the newly designated upgradient well, RQLmw-006. These explosives also occur in one or more of the downgradient wells. The propellant nitroglycerine was also identified in the upgradient well, and in one downgradient well, in low concentrations. These occurrences suggest a contaminant source upgradient of the former quarry, or reversal of flow in the groundwater system transporting contaminants upgradient. Arsenic, cobalt, and nickel were identified in filtered samples from RQLmw-006 and five or more downgradient wells. Volatile organic compounds (VOCs) and semivolatile organic compounds (SVOCs) were not present above detection levels in groundwater.

ES.4.2 Sediment

Sediment has accumulated to a depth of 1.2 m (4 ft) or greater in some places in the pond. Sediment samples from the 0- to 0.15-m (0- to 0.5-ft) sampling interval appear to harbor the greatest concentrations of contaminants. The explosive HMX was found in five of the eight locations, in two of these at depths of 0.15 to 0.60 m (0.5 to 2 ft) or greater. The propellant nitrocellulose was present in two samples in low concentrations.

Numerous polynuclear aromatic hydrocarbons were present in five of the eight sediment sampling locations in concentrations up to 2000 mg/kg. VOCs were generally not present above detection levels.

ES.4.3 Surface Water

The water depth in July 1998 varied from 0 to 0.97 m (0 to 3.18 ft). An instrumented staff gauge was established at the point where the water is deepest. Explosives, propellants, cyanide, VOCs, and SVOCs were not detected above detection levels in the pond water. Most of the metals in filtered surface water samples were non-detects, with the exception of iron, magnesium, and manganese, which were detected in most samples. Arsenic and barium were present in three or fewer samples at low concentrations.

ES.5 CONCLUSIONS

The results of the initial phase of sampling and measurements at RQL provide an assessment of summer (dry weather) conditions at the site, using new monitoring wells for the collection of chemical and hydraulic data. Follow-up sampling will provide information on the temporal variations in groundwater and surface water chemistry and movement. These data will be provided in quarterly monitoring reports and integrated in an annual summary report at the conclusion of the Groundwater Investigation.

1.0 INTRODUCTION

This report documents the results of the initial phase of the Groundwater Investigation of Ramsdell Quarry Landfill (RQL) at Ravenna Army Ammunition Plant (RVAAP), Ravenna, Ohio. The initial phase of the Groundwater Investigation was conducted for RVAAP by Science Applications International Corporation under contract DACA27-97-D-0025, Delivery Order No. 003, with the U.S. Army Corps of Engineers (USACE), Louisville District. The Groundwater Investigation is conducted in a manner consistent with the Department of Defense Installation Restoration Program guidelines, following work plans reviewed and commented on by the Ohio Environmental Protection Agency (Ohio EPA), Northeast District Office, Division of Solid and Infectious Waste.

The RQL Groundwater Investigation at RVAAP, in Ravenna, Ohio (Figure 1-1), was conducted in July 1998 to provide a supplemental characterization of the shallow groundwater flow regimes and chemical water quality at this closed solid waste disposal facility. With this evaluation, the USACE seeks to close data gaps and to address potential impacts upon the groundwater from the former RQL and pre-landfill disposal activities. Data from this investigation may be used to establish that the new groundwater monitoring system meets the requirements of Ohio Administrative Code (OAC) 3745-27-10(B). Although this groundwater investigation is independent of semiannual post-closure monitoring, groundwater monitoring activities performed in this investigation shall be, to the extent possible, consistent with the requirements of OAC 3745-27-10.

1.1 PURPOSE OF STUDY

The purposes of the RQL Groundwater Investigation are as follows:

- to assess the hydrogeologic conditions and groundwater quality in shallow groundwater beneath the site using monitoring wells of known integrity suited to this purpose;

- to evaluate the RQL pond water and sediment for evidence of contamination, via the groundwater pathway, or as a result of incipient contamination from historical operations on the quarry floor;

- to establish whether there is a hydraulic connection between shallow groundwater and the pond, and to continuously monitor water levels in six monitoring wells and the pond for one year for this purpose; and

- to provide for the quarterly collection of samples of upgradient and downgradient groundwater and surface water for one year, and during two significant hydrogeologic events, to maintain compliance with post-closure monitoring requirements.

The work performed for this investigation included the installation, development, testing, sampling, and instrumentation of six new monitoring wells, as well as the sampling and testing of the five existing monitoring wells, and pond sediment and surface water sampling.

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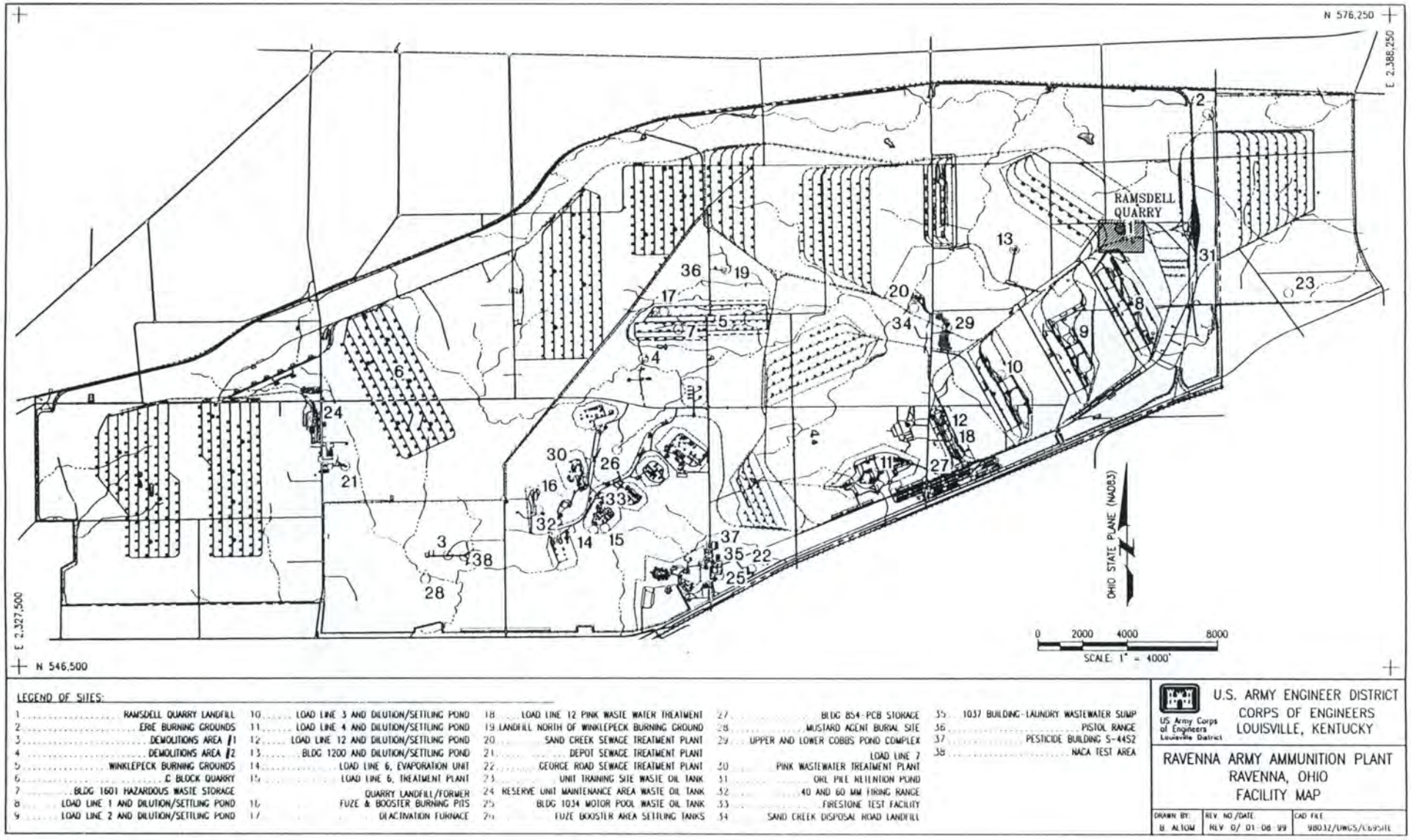

LEGEND OF SITES:

1 RAMSDELL QUARRY LANDFILL	10 LOAD LINE 3 AND DILUTION/SETTLING POND	18 LOAD LINE 12 PINK WASTE WATER TREATMENT	27 BLDG 854-PCB STORAGE	35 1037 BUILDING-LAUNDRY WASTEWATER SUMP
2 ERIE BURNING GROUNDS	11 LOAD LINE 4 AND DILUTION/SETTLING POND	19 LANDFILL NORTH OF WINKLEPECK BURNING GROUND	28 MUSTARD AGENT BURIAL SITE	36 PISTOL RANGE
3 DEMOLITIONS AREA #1	12 LOAD LINE 12 AND DILUTION/SETTLING POND	20 SAND CREEK SEWAGE TREATMENT PLANT	29 UPPER AND LOWER COBBS POND COMPLEX	37 PESTICIDE BUILDING S-4452
4 DEMOLITIONS AREA #2	13 BLDG 1200 AND DILUTION/SETTLING POND	21 DEPOT SEWAGE TREATMENT PLANT	LOAD LINE 7	38 NACA TEST AREA
5 WINKLEPECK BURNING GROUNDS	14 LOAD LINE 6, EVAPORATION UNIT	22 GEORGE ROAD SEWAGE TREATMENT PLANT	30 PINK WASTEWATER TREATMENT PLANT	
6 C BLOCK QUARRY	15 LOAD LINE 6, TREATMENT PLANT	23 UNIT TRAINING SITE WASTE OIL TANK	31 ORE PILE RETENTION POND	
7 BLDG 1601 HAZARDOUS WASTE STORAGE	QUARRY LANDFILL/FORMER	24 RESERVE UNIT MAINTENANCE AREA WASTE OIL TANK	32 40 AND 60 MM FIRING RANGE	
8 LOAD LINE 1 AND DILUTION/SETTLING POND	16 FUZE & BOOSTER BURNING PITS	25 BLDG 1034 MOTOR POOL WASTE OIL TANK	33 FIRESTONE TEST FACILITY	
9 LOAD LINE 2 AND DILUTION/SETTLING POND	17 DEACTIVATION FURNACE	26 FUZE BOOSTER AREA SETTLING TANKS	34 SAND CREEK DISPOSAL ROAD LANDFILL	

US Army Corps of Engineers Louisville District

U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
LOUISVILLE, KENTUCKY

RAVENNA ARMY AMMUNITION PLANT
RAVENNA, OHIO
FACILITY MAP

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Figure 1-1. RVAAP Installation Map

1.2 SITE BACKGROUND

1.2.1 Site Description

A detailed history of process operations and waste processes for each area of concern (AOC) at RVAAP is presented in the *Preliminary Assessment for the Ravenna Army Ammunition Plant, Ravenna, Ohio* (USACE 1996b). The following is a summary of the history and of the related contaminants for RQL.

RQL (designated AOC RVAAP-01) is located in the western and southern portion of the abandoned Ramsdell Quarry (Figure 1-1), in the northeast corner of RVAAP. The quarry was excavated about 9 to 12 m (30 to 40 ft) below existing grade into the Sharon Member sandstone and conglomerate bedrock.

The original unconsolidated glacial material overlying the sandstone was only a few feet (<10 ft) thick and appears to have been entirely removed. The quarry was abandoned before 1941 and was used as a landfill from 1941 until 1989. In addition, from 1946 to the 1950s, the bottom of the quarry was used to burn waste explosives from Load Line 1. Approximately 18,000 225-kg (500-lb) incendiary or napalm bombs were reported to have been burned in the abandoned quarry. Liquid residues from annealing operations were also dumped in the quarry. There is currently no historical information on how the quarry was used from the 1950s to 1976.

From 1976 until the landfill was closed in 1989, only nonhazardous solid waste was deposited in the abandoned quarry. In 1978, a portion of the abandoned quarry was permitted as a sanitary landfill by the State of Ohio. The permit required a 30-m (100-ft) buffer be maintained between the landfill and the pond; the extent of the pond prior to this time is not known.

Figures 1-2 and 1-3 depict current conditions at the RQL and adjacent pond. The closed landfill is U-shaped and has a compacted-soil cover that is vegetated and appears to be intact. The pond is generally less than 1.3 m (4 ft) deep and is underlain by thin deposits of sediment over bedrock.

Based upon available information and past uses of the abandoned quarry, wastes may include domestic, commercial, and industrial solid and liquid wastes, including explosives (e.g., TNT, RDX, Composition B), napalm, gasoline, acid dip liquor, annealing residue (e.g., sulfuric acid, shell casings, sodium orthosilicate, chromic acid, and alkali), aluminum chloride, and inert material. Interviews with former RVAAP personnel have indicated that much of the landfilled wastes and debris at the abandoned quarry were removed in the 1980s.

A much smaller quarry (also abandoned) was located directly southeast of RQL (Figure 1-3). Although some aerial photographs have shown a small pond in this location, the pond is evidently of seasonal character, because no standing water was present at this location at the time of the field investigation. No documentation about potential waste disposed in this quarry is available.

Closure of the permitted sanitary landfill was completed in May 1990 under State of Ohio solid waste regulations (OAC 3745-27-10). A requirement of closure was installation and semiannual monitoring of five monitoring wells (see Figure 1-3).

1.2.2 Previous Investigations

Groundwater samples from RQL have been collected since 1987, beginning with semiannual detection monitoring in five open boreholes. Monitoring wells MW-1 through MW-5 (shown in

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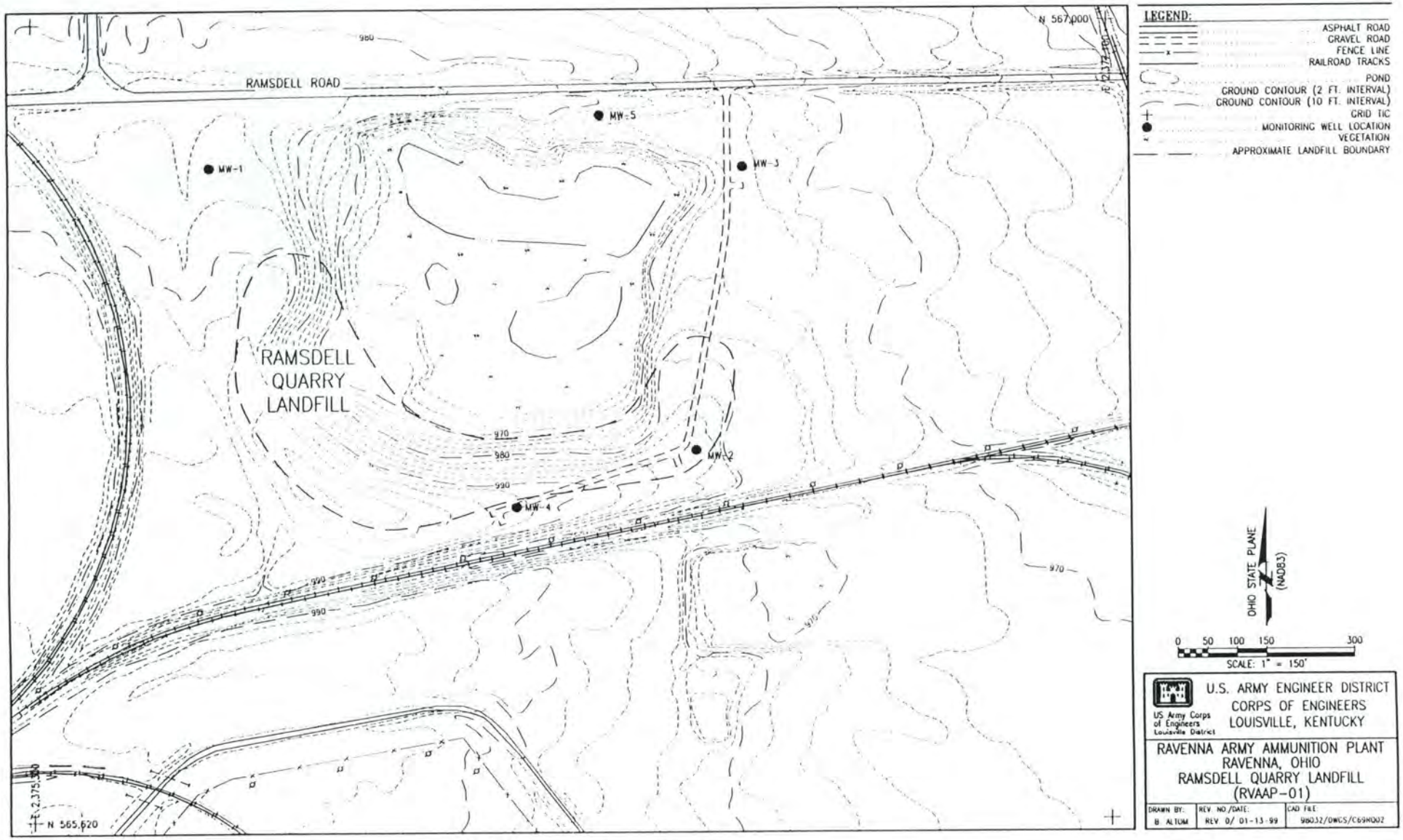

Figure 1-3. RQL Topography and Original Well Locations

Figure 1-3) were completed in these boreholes in January 1988 (USAEHA 1992), and semiannual monitoring continued until November 1991, when quarterly sampling was initiated. Quarterly sampling continued through February 1993. The wells have been sampled semiannually since February 1993.

RVAAP has performed semiannual groundwater monitoring of these constituents according to the requirements of OAC 3745-27-10 (March 1990), specified in a Groundwater Monitoring Plan for the Ramsdell Quarry Landfill (Revised), dated March 1995 (RVAAP 1995). In the semiannual monitoring program, unfiltered samples are analyzed for the volatile organic compounds (VOCs), five explosives, eleven metals, and indicator parameters listed in Table 1-1. In addition, the Portage County Health Department has sampled and analyzed surface water from the RQL pond.

The plan submitted to Ohio EPA for the closure of RQL in 1989 provides additional characterization information about the site. The closure plan contains stratigraphic information as well as lithologic cross-sections showing the elevation of the lower limit of waste placement for the sanitary landfill. According to the design drawings filed as a part of this plan, the lower limit of waste placement was many feet above the water level in the pond, which was presumed to mimic the elevation of the potentiometric surface.

Significant gaps in the monitoring data gathered before this Groundwater Investigation have been identified by Ohio EPA (Ohio EPA 1997) that prevent the determination of whether closure requirements are being met. The most significant deficiencies are as follows:

- Placement of the original monitoring wells (installed in 1988) is such that only one well (MW-5) is downgradient from the RQL. Prior to this effort, there were no monitoring wells located immediately downgradient of the toe of the landfill. Ohio regulations require a minimum of three downgradient wells at all times.

- Discrepancies in relative water level elevations in the five original wells during semiannual measurement events obscure whether a seasonal shift (reversal) in groundwater flow direction is occurring.

- Monitoring wells installed for detection monitoring in 1988 were screened 3 to 9 m (10 to 30 ft) below the water table, resulting in a concern that the present upgradient wells do not monitor the same water-bearing interval as the downgradient well.

- No information exists to determine the relationship between water levels in the uppermost groundwater zone and the surface of the pond.

- Explosives were detected in groundwater from all five monitoring wells in at least three sampling events, thus casting some doubt as to the integrity of the "upgradient" well (MW-4).

- Indicator parameters such as specific conductance and total dissolved solids continue to be analyzed, and upgradient/downgradient differences may result from variations in the sandstone intervals in which wells are screened rather than from the impact of the landfill on groundwater.

Table 1-1. List of Analytes for Ramsdell Quarry Landfill Semiannual Groundwater Monitoring

Inorganics (total)	Volatile Organic Compounds
Arsenic	Acetone
Barium	Acrolein
Cadmium	Acrylonitrile
Calcium	Benzene
Chromium	Bromodichloromethane
Copper	*cis*-1,3-Dichloropropene
Iron	*trans*-1,3-Dichloropropene
Lead	Ethylbenzene
Magnesium	Ethyl Methacrylate
Mercury	Bromoform
Potassium	Bromomethane
Nickel	2-Butanone
Selenium	Carbon Disulfide
Silver	Carbon Tetrachloride
Sodium	Chlorobenzene
Zinc	Chloroethane
Explosives	2-Chloroethyl Vinyl Ether
Trinitrotoluene	Chloroform
2,4-Dinitrotoluene	Chloromethane
2,6-Dinitrotoluene	Dichlorodifluoromethane
HMX	1,1-Dichloroethane
RDX	1,2-Dichloroethane
Inorganic/Indicator Parameters	2-Hexanone
Total Alkalinity	Methylene Chloride
Chloride	4-Methyl 2-Pentanone
Chemical Oxygen Demand	1,1-Dichloroethene
Cyanide	*trans*-1,2-Dichloroethene
Specific Conductivity	Styrene
Dissolved Fluoride	1,1, 2,2-Tetrachloroethene
MBAS, Colorimetric	Toluene
Nitrate (as N)	1,1,1-Trichloroethane
Ammonia (as N)	1,1,2-Trichloroethane
pH	Trichloroethene
Total Dissolved Solids	Trichlorofluoromethane
Sulfate	1,2,3-Trichloropropane
Total Organic Carbon	Vinyl Acetate
Temperature	Vinyl Chloride
Nitrate-nitrite	Xylene
Phosphorus	Phenols
Turbidity	

Source: USAEHA 1992

In summary, previous evaluations of groundwater at RQL have produced inconclusive results. Statistical analysis of water quality indicator parameters has shown some local impacts on the groundwater (e.g., specific conductance, total organic carbon, and total dissolved solids have been statistical triggers in both upgradient and downgradient wells).

USACE recently completed (February 1998) a topographic survey of RQL, including collection of new elevation data on the existing monitoring wells at the site. Topography of the site is now accurate to within 0.006 m (0.02 ft). A survey of the elevations of the existing wells was performed to correct discrepancies in water level elevations noted in the semiannual data. As a part of this Groundwater Investigation, the existing monitoring wells were re-surveyed, and the elevations shown for the wells in this report are the most recent.

1.3 REPORT ORGANIZATION

This Groundwater Investigation was designed to fill the data gaps described above, and to resolve uncertainties about the chemical quality and the physical groundwater regime beneath RQL. The field sampling efforts performed in this Groundwater Investigation consist of an initial phase and a follow-up phase. The initial field effort consisted of the following:

- installation, development, testing, sampling, and instrumentation of six new monitoring wells;
- sampling and water level measurements at the five existing wells;
- sampling of sediments and surface water at the RQL pond;
- construction of an instrumented staff gauge at the RQL pond; and
- surveying of all new monitoring wells and pond sediment/surface water sampling locations.

The follow-up phase will consist of the collection of groundwater samples from each of the six newly installed monitoring wells and the collection of surface water samples from one location, in each of the next three quarters and in two separate storm events, to compile statistics for the analytical parameters being evaluated at RQL. In addition, follow-up work will consist of continuous water level measurements using data loggers on the six new wells and the pond, and monthly manual water level readings on the previously installed monitoring wells, for a period of one year following the installation of the six new wells. Continuous monitoring of pond and water levels in the new monitoring wells will provide much useful data to analyze the relationship of the pond to the site groundwater regime. The results of sampling in each quarter will be the subject of each of three quarterly reports to USACE.

The initial phase of sampling is the subject of this report. Section 2 describes the field activities conducted, provides a discussion of the geologic and hydrologic conditions at RQL based on the field investigation findings, and discusses the analytical results from the initial field effort. Section 3 presents conclusions of the initial phase effort. Appendixes A through I contain boring logs, well construction diagrams, slug test data, analytical data, geotechnical data, survey data, UXO characterization results, sediment sampling logs, and daily quality control reports, respectively.

2.0 INVESTIGATION RESULTS

All sampling activities, including drilling, sample collection and preservation, decontamination, sample management, and documentation for the Groundwater Investigation at RQL were conducted according to guidance in the *Facility-Wide Sampling and Analysis Plan for Ravenna Army Ammunition Plant* (USACE 1996a) and the *Sampling and Analysis Plan Addendum for the Groundwater Investigation of the Former Ramsdell Quarry Landfill* (USACE 1998).

2.1 GROUNDWATER REGIME AND MONITORING

The purposes of the Groundwater Investigation at RQL are to determine the shallow groundwater hydrogeologic conditions, including groundwater flow direction, seasonal changes, and the hydraulic and geochemical relationships between the surface water in the pond and the groundwater. These characteristics must be clearly defined to evaluate whether the closed landfill is in compliance with Ohio solid waste regulations' post-closure requirements. Specifically, analytical results from the upgradient monitoring well (RQLmw-006) are to be compared with those results from the wells downgradient of the landfill (RQLmw-007, -008, and -009) to fulfill regulatory requirements for detection monitoring. Statistical comparisons are necessary to determine whether groundwater contamination is emanating from the landfill and migrating from the site. Additionally, data from the new monitoring wells RQLmw-010 and -011, in conjunction with other data, will provide information about the pond downgradient of the landfill.

2.1.1 Soil Borings and Subsurface Geology

As a former rock quarry, RQL's surroundings are characterized by bedrock exposed on the ground surface, with negligible natural soil cover. Figure 2-1 illustrates that, between the surface of the pond and the top of the closed landfill, there are approximately 13 m (40 ft) of topographic relief representing the former extent of quarrying in this area.

Six monitoring wells were installed to monitor the shallow groundwater at RQL. Drilling was accomplished using coring and air-rotary drilling equipment. The locations of the monitoring well borings are shown in Figure 2-1. These locations were selected based on water level data from the existing wells, which suggest that the groundwater flow direction in the uppermost water-bearing zone is northward, away from the landfill. Three of the borings (RQLmw-007, -008, and -009) are located below the toe (hydraulically downgradient) of RQL, two (RQLmw-010 and -011) are located downgradient of the pond, and one (RQLmw-006) is located upgradient of the landfill. Each of the new wells is located at least 30 m (100 ft) from any of the previously installed wells.

Lithologic logging was performed using cores from each of the six monitoring well borings. Correlations of stratigraphy between the new wells and the five original wells is problematic, because lithologies in the five original wells were logged from cuttings lifted from the borehole by compressed air, and the new wells were logged from undisturbed core samples. The core samples are more representative of subsurface conditions than the cuttings and are the basis of the geological interpretations in this report. Cores from the six new monitoring wells are stored at RVAAP.

The boring logs are presented in Appendix A. Information from the boring logs was used to construct a lithologic cross-section through the site (Figures 2-2 and 2-3). Figure 2-2 shows that the RQL is underlain by weathered, fractured, fine- to medium-grained quartzose sandstones of the

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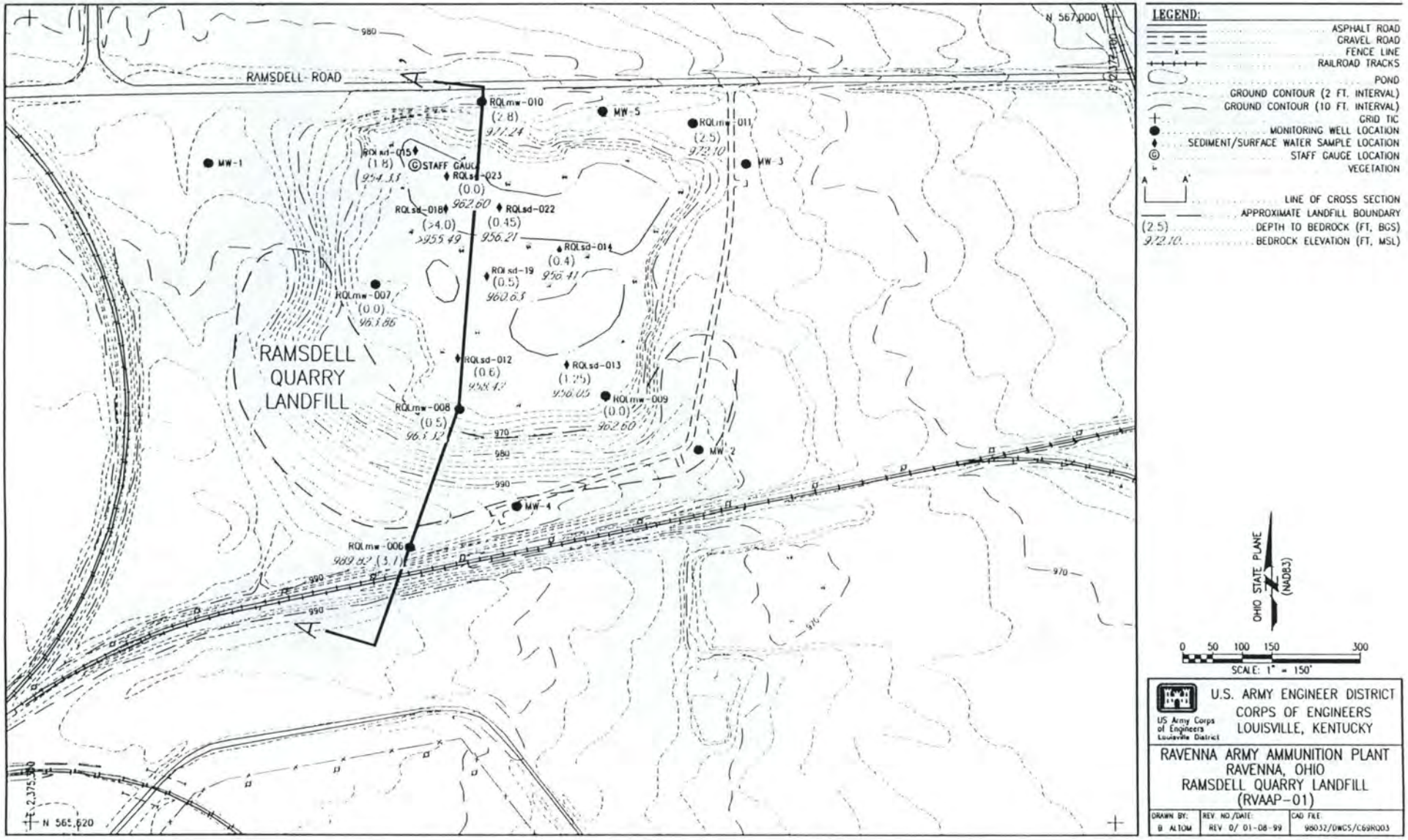
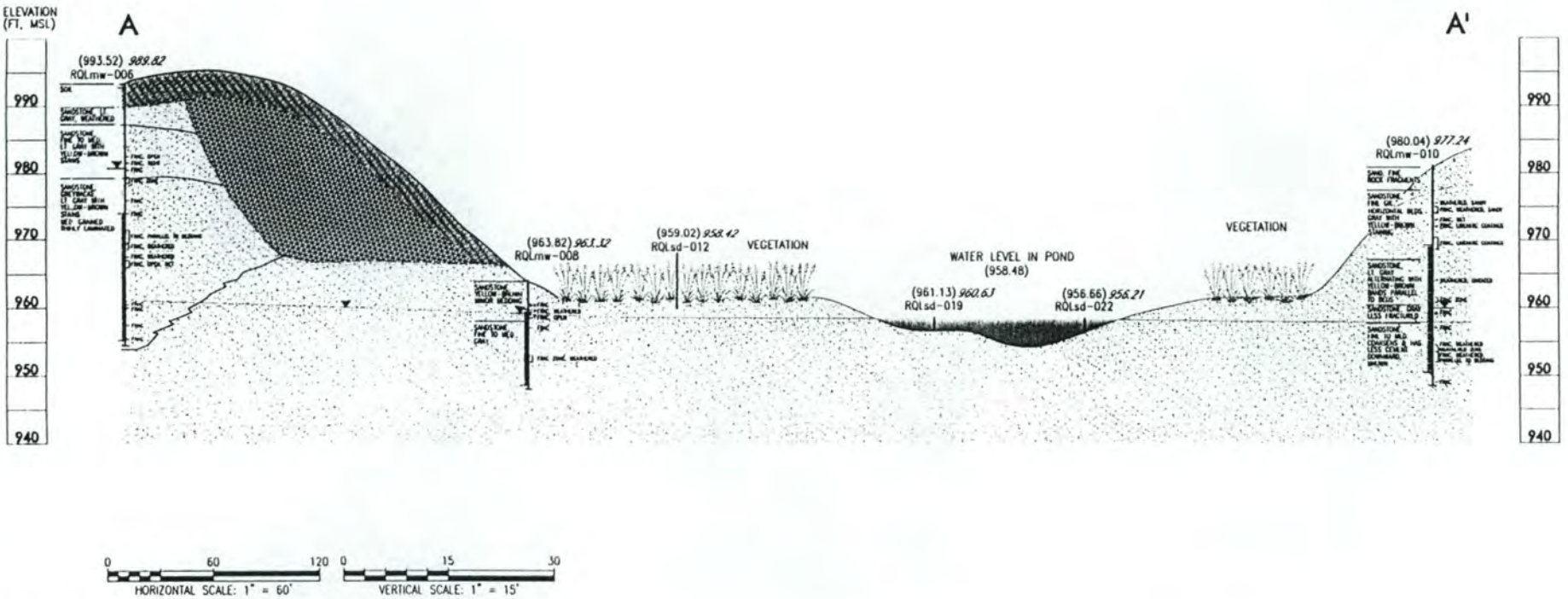


Figure 2-1. RQL Groundwater Investigation Monitoring Well and Pond Sampling Locations.



REFERENCE FIGURE 2-3 FOR CROSS-SECTION LOCATION

LEGEND:

- STATIC WATER LEVEL
- SOIL
- WASTE MATERIAL
- SAND
- SANDSTONE
- EXTENT UNKNOWN
- FRAC — FRACTURE ZONE
- 963.82 — BEDROCK ELEVATION (FT. MSL)
- (963.82) — GROUND SURFACE ELEVATION (FT. MSL)
- WATER LEVEL DURING DRILLING
- WELL SCREEN

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CORPS OF ENGINEERS
LOUISVILLE, KENTUCKY

RAVENNA ARMY AMMUNITION PLANT
RAVENNA, OHIO
RAMSDELL QUARRY LANDFILL
(RVAAP-01)

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Figure 2-3. Lithologic Cross Section A-A'

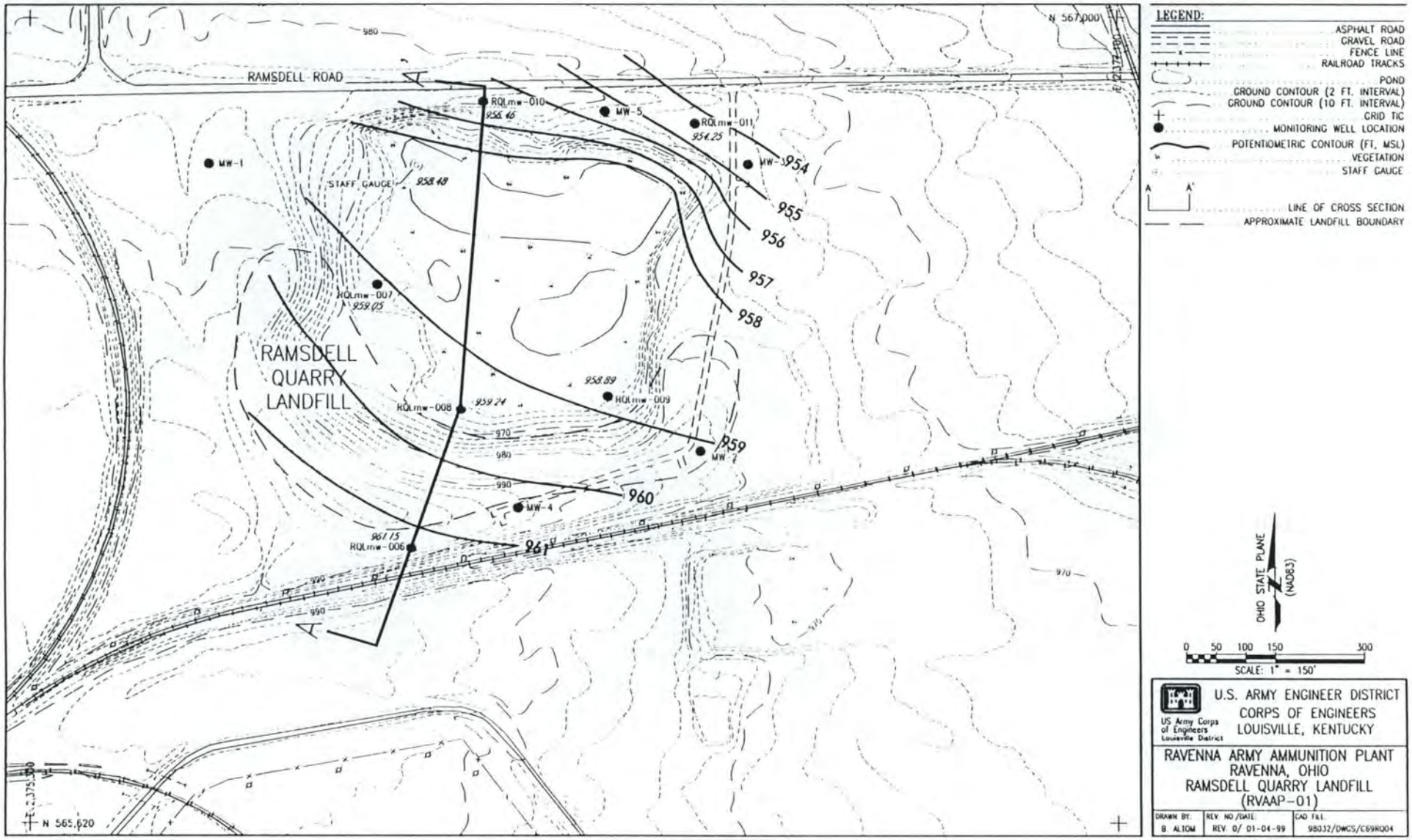

Figure 2-3. Potentiometric Surface Map for Ramsdell Quarry, July 1998 (New Monitoring Wells)

Sharon Member of the Pennsylvanian Pottsville Formation. Lithologies appear to be quite uniform across the site, with the exception of an occurrence of a more competent (unfractured), gray, poorly sorted sandstone with thinly bedded shale at RQLmw-006 and RQLmw-011. This lithology differs significantly from the surrounding quartz sandstones in that it contains a wider range of particle sizes and other non-quartz minerals. Thin bedding-plane laminations, consisting of finer-grained gray or black material, were observed in all cores. The Sharon Member is characterized by widespread cross-bedding. Bedding planes or laminations in cores range in orientation from horizontal to approximately 100 degrees from the core axis.

Open, recemented, and highly weathered fractures were observed in each of the cores. Fracturing occurs both parallel to and at oblique angles to bedding planes, as well as in massive zones. Weathering along fractures has been sufficient to completely break down the cement in some cases. Groundwater circulates along fractures, as evidenced by limonitic or black oxidized stainings and coatings on the rock or on grains. The pervasive character of fracturing in the sandstone suggests that vertical movement of groundwater through permeable primary and secondary flow pathways takes place at RQL to some degree.

2.1.2 Monitoring Well Installation

Following air-rotary overdrilling of the cored boreholes to achieve a 15-cm (6-in.) diameter borehole, monitoring wells were constructed at each of the six locations. All six wells were constructed as above-ground installations. Details of monitoring well construction are provided in Appendix B of this report. Well installation followed procedures described in the *Facility-Wide Sampling and Analysis Plan* (USACE 1996a) and the *Sampling and Analysis Plan Addendum for the Groundwater Investigation of the Former Ramsdell Quarry Landfill* (USACE 1998), with the following exceptions noted. Concurrence with Ohio EPA and USACE technical managers was obtained before each modification was made.

(1) RQLmw-006, RQLmw-010, and RQLmw-011 were completed with 6-m (20-ft) screens instead of 3-m (10-ft) screens, to ensure that the wells would produce a sufficient amount of water for sampling, or to ensure that the potentiometric surface intersected the screen. Because of the presence of water near the tops of the holes during drilling (potentially fracture storage), it was difficult to determine where the most productive water-bearing zones were.

(2) RQLmw-007, -008, and -009 were constructed with a modified surface casing designed to prevent frost heaving effects, because of these wells' proximity to the pond. The water level in the pond may rise high enough to partially inundate the well pads. A corrugated polyvinyl chloride (PVC) liner was placed outside the protective casing prior to filling the annular space from the frost line to the surface with concrete. The construction change allows the well pads to heave without affecting the protective well casing or well riser/screen string.

(3) Because the static water levels at RQLmw-007, -008, and -009 were close to the ground surface elevation, the filter pack in each well was reduced to a height of 0.30 to 0.33 m (1 to 1.1 ft) above the top of the screen, rather than the specified 1 m (3 ft), to allow adequate space for a 0.6-m (2-ft) bentonite seal and 0.85 to 1 m (2.8 to 3 ft) of grout. This modification to approved well construction specifications allows for construction of shallow wells with 3-m (10-ft) screens, without compromising the integrity of the filter pack or seal.

(4) Additional development of well RQLmw-006 was required over 12 days to achieve stable field parameter values (i.e., pH, conductance; see Appendix B).

There are noteworthy differences in the construction details between the previously existing and the newly installed wells. The six newly installed wells are constructed of 5-cm (2-in.) diameter PVC risers and 3-m (10-ft) or 6-m (20-ft) screens, with Global #7 filter packs and bentonite grout seals (as noted above), in accordance with the *Facility-Wide Sampling and Analysis Plan* (USACE 1996a). The screens were set such that the span of the monitored intervals ranged from 1.79 to 11.97 m (5.9 to 39.4 ft) below ground surface (BGS). Well construction diagrams for the six wells, designated RQLmw-006 through RQLmw-011, are provided in Appendix B of this report. The original wells, designated MW-1 through MW-5, were installed in 1988. They were constructed of 5-cm (2-in.) PVC pipe with 3-m (10-ft) screens; the interval spanned by the well screens ranges from 10.6 to 16.7 m (35 to 55 ft) BGS (Table 2-1). The borings for these wells extended to the top of the Meadville Shale, or roughly 48 m (160 ft) BGS, and were later backfilled with clean sand and gravel to 3 m (10 ft) below the base of the screen when the wells were installed (Ohio Drilling Co. 1988). Bentonite pellets were emplaced from that depth to the bottom of the screen. No well construction diagrams have been provided for these wells. Some differences in chemical quality are to be expected between the water from the new monitoring wells and the water from the original wells. For example, the condition of the grout seals and nonstandard construction may affect groundwater chemistry and sample quality in the original wells. Details of the completion of the monitoring wells are summarized in Table 2-1.

Table 2-1. Static Water Level Measurements, July 23 to 28, 1998

Monitoring Well ID	Water Level (ft below top of casing)	1998 Surveyed Top of Casing Elevation (ft amsl)	1998 Surveyed Ground Surface Elevation (ft amsl)	Water Level Elevation (ft amsl)	Screened Interval Elevation (ft amsl)
MW-1	27.88	986.13	985.53	958.25	930–940[a]
MW-2	24.28	981.90	982.74	957.62	942–952[a]
MW-3	19.90	975.54	973.55	955.64	929–939[a]
MW-4	32.04	991.80	990.85	959.76	935–945[a]
MW-5	21.65	977.38	976.14	955.73	938–948[a]
RQLmw-006	34.24	995.39	993.52	961.15	954.12–974.12
RQLmw-007	6.86	965.91	963.86	959.05	947.91–957.91
RQLmw-008	6.84	966.08	963.82	959.24	947.82–957.82
RQLmw-009	5.69	964.58	962.60	958.89	946.7–956.7
RQLmw-010	25.68	982.14	980.04	956.46	947.58–967.58
RQLmw-011	22.32	976.57	974.60	954.25	942.2–962.2
Pond Staff Gauge	--	961.66	--	958.48	---

[a]Estimated according to Ohio Drilling Co. (1988)
amsl = above mean sea level

2.1.3 Slug Test Results

Following sampling of the six newly installed and the five previously existing monitoring wells at RQL, slug tests were performed on each well to determine the hydraulic conductivity of the geologic material surrounding each well.

Slug testing followed the provisions of the *Sampling and Analysis Plan Addendum for the Groundwater Investigation of the Former Ramsdell Quarry Landfill* (USACE 1998). These analyses estimate horizontal hydraulic conductivities in the screened interval of each well. Rising-head tests were completed after each well had fully recovered from groundwater sampling, using automated data collection software and a notebook computer.

The results of the slug tests performed during July 1998 are presented in Appendix C. They reveal moderately high horizontal hydraulic conductivities in the weathered and fractured sandstone units underlying RQL. Typical hydraulic conductivities for sandstones range from 10^{-3} to 10^{-8} cm/s (Freeze and Cherry 1979). The calculated results for the 11 wells at RQL are shown in Table 2-2. The wells generally show conductivities in the sandstone ranging from 10^{-3} to 7×10^{-4} cm/s. However, it should be noted that, because construction details on the original wells (e.g., height of seal above the screen, borehole diameter) were not available, assumptions regarding well dimensions and completion were used to interpret the slug test data for these wells. The five original wells generally have hydraulic conductivities slightly higher than those in the new wells. Hydraulic conductivities in new wells screened below 16 ft BGS (i.e., 20-ft screens) were approximately an order of magnitude less than in the shallow wells screened above 16 ft BGS. Fracturing in the sandstone units undoubtedly contributes to the high observed conductivities in the monitoring wells at RQL.

2.1.4 Groundwater Sampling

2.1.4.1 Water Levels

New monitoring wells were developed following completion, according to criteria defined in the *Sampling and Analysis Plan Addendum for the Groundwater Investigation of the Former Ramsdell Quarry Landfill* (USACE 1998). Following well development, water levels were measured from the top of casing. Water levels measured during the initial phase of fieldwork have been tied to the surveyed elevation of the top of casing at each well, to present accurately the potentiometric surface and groundwater flow direction at RQL (Table 2-1).

Static water levels above the top of the well screen were observed in each of the original wells, and in RQLmw-007, RQLmw-008, and RQLmw-009, adjacent to the pond. These findings suggest either (1) a confined or semiconfined water-bearing zone, rather than an unconfined, "water table" system; or (2) hydraulic communication along fracture zones. In the wells at the toe of the landfill, this effect may result from the presence of the pond. In the other wells, elevated water levels may be the result of hydraulic communication among the fractures in the sandstone.

Figure 2-3 is a potentiometric surface map for shallow groundwater, as measured on July 23 – 28, 1998, using data from the six new wells. Initial water levels were collected on the day the well was sampled, due to an oversight in the field. Water level measurements in the six new wells indicate a local hydraulic gradient to the northeast. Water level measurements from the original five monitoring wells for the same dates, and historical information for water levels in the summer months, illustrate the same general potentiometric surface trend with respect to the newly surveyed top-of-casing elevations. However, July 1998 water levels in the original wells indicate

Table 2-2. Horizontal Hydraulic Conductivities Measured During the RQL Groundwater Investigation

Monitoring Well ID	Screened Interval (depth BGS, ft)	Total Depth (ft)	Geologic Material Adjacent to Screen	Hydraulic Conductivity (cm/s)
MW-1	45-55	54.26	gray-white sandstone	1.6×10^{-3}
MW-2	35-45	44.60	white sandstone	4.7×10^{-3}
MW-3	35-45	46.86	brown sandstone	2.3×10^{-3}
MW-4	45-55	56.98	white sandstone	1.8×10^{-3}
MW-5	33-43	40.76	brown sandstone	1.5×10^{-3}
RQLmw-006	19.4 - 39.4	42.08	weathered, fractured sandstone	2.0×10^{-4}
RQLmw-007	5.95 - 15.95	18.66	weathered, fractured sandstone	9.2×10^{-3}
RQLmw-008	6 – 16	18.70	fractured sandstone	5.4×10^{-3}
RQLmw-009	5.9 - 15.9	18.84	fractured sandstone	2.0×10^{-3}
RQLmw-010	12.46 - 32.46	35.36	weathered, fractured sandstone	6.7×10^{-4}
RQLmw-011	12.4 - 32.4	35.36	weathered, fractured sandstone	3.9×10^{-4}

Source: MW-1 through MW-5, according to Ohio Drilling Co. (1988).

potentiometric surface elevations from 0.30 to 0.60 m (1 to 2 ft) lower than those observed in the newly installed wells. One possible explanation for the disparities in water levels in wells screened in a deeper stratigraphic interval is that vertical communication is taking place to varying degrees in the highly fractured and weathered sandstones at RQL.

The data in Table 2-1 show that the upgradient well, RQLmw-006, is screened approximately 2.7 m (9 ft) above the screened interval in the previous upgradient well, MW-4. MW-1 is also screened significantly lower than any of the new wells, at 283 to 286 m (930 to 940 ft) amsl. However, RQLmw-007, -008, -009, -010, and -011 are screened at depths that overlap with the screened intervals of MW-2, MW-3, and MW-5. Figure 2-4 is a potentiometric surface map for shallow groundwater, as measured on July 23-28, 1998, using data from the original five wells.

2.1.4.2 Discussion of Analytical Results

All eleven monitoring wells were initially sampled for explosives, propellants (nitroguanidine, nitrocellulose, and nitroglycerine), Target Analyte List (TAL) metals, cyanide, VOCs, and semivolatile organic compounds (SVOCs). Groundwater was submitted for analysis of both total (unfiltered) and dissolved (filtered) TAL metals. The validated analytical data for the groundwater sampling effort are presented in their entirety in Appendix D. Tables in Appendix D present the data both by analyte and by sample station. Standard method reporting limits for some VOC compounds (vinyl chloride, tetrachloroethene, trichloroethene) are higher than promulgated drinking water standards; however, any estimated detected values less than reporting limits are provided.

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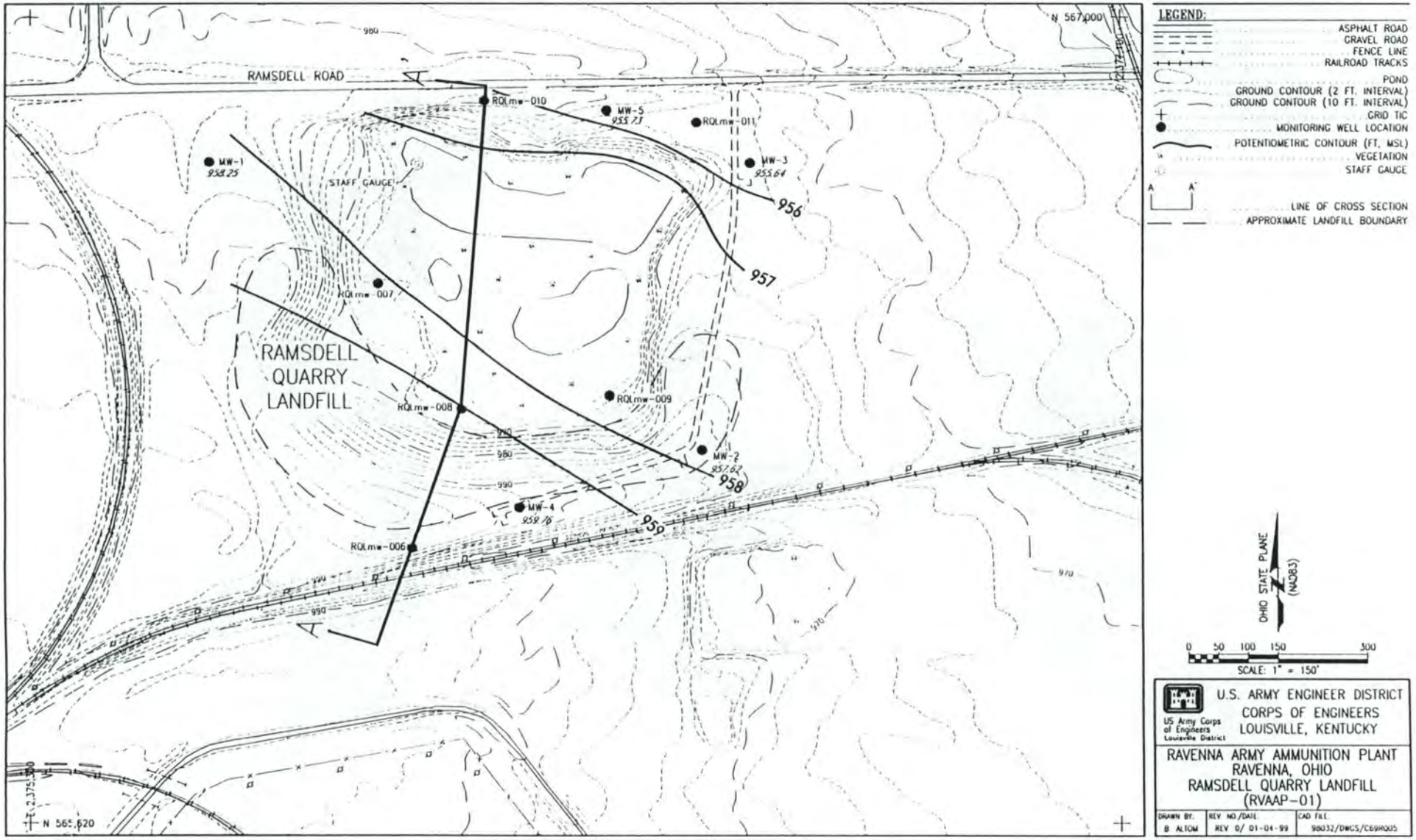

Figure 2-4. Potentiometric Surface Map for Ramsdell Quarry, July 1998 (Previously Installed Monitoring Wells)

The eleven wells were field screened for VOCs using a hand-held photoionization detector (PID) organic vapor analyzer (OVA) during groundwater sample collection. Generally, volatile organics were not detected in the breathing zone; however, 0.2 to 95 ppm of organic vapors were measured above the cores for RQLmw-006, -007, -008, and -009. In addition, field measurements of pH, temperature, specific conductance, and dissolved oxygen were recorded for each sample.

Aside from construction differences, there were differing approaches to the purging and sampling of the two sets of monitoring wells in the initial phase of this Groundwater Investigation. The six new wells were purged using a micro-purge method and dedicated equipment, including sampling pumps and tubing. Very small amounts of water (typically less than 3 gallons) were removed from the wells during micro-purging, and samples were withdrawn from the wells using the dedicated pump. Samples from the newly installed wells will continue to be sampled with this equipment throughout the Groundwater Investigation. In contrast, the previously existing wells were purged using conventional equipment and methods described in the *Facility-Wide Sampling and Analysis Plan* (USACE 1996a). Three well volumes were removed from the wells (from 20 to 28 gallons), and purging was terminated when water quality readings of pH, turbidity, and conductivity stabilized for three consecutive readings. Purging and sampling were accomplished using disposable Teflon bailers. Conventional purging and sampling were performed on the original wells because a one-time use of dedicated equipment for the sampling of these wells was not cost-justified. No re-development of the original wells was attempted as a part of this study. These differences may contribute further to the observed variations in the analytical results between the two sets of wells from the initial phase of sampling.

The following sections discuss the chemical quality of groundwater at RQL.

Explosives

Trace quantities of nine explosives were detected in RQL groundwater. The results of groundwater analyses are as follows:

- No explosives were detected in groundwater from RQLmw-007, -009, or -010.
- Trinitrotoluene (TNT) was found in MW-5 at 0.27 µg/L.
- 2,6-Dinitrotoluene (DNT) was present at 0.085J µg/L in MW-4 (a "J" indicates an estimated quantity).
- 2,4-DNT was present at 0.13 µg/L in RQLmw-008.
- HMX was found in RQLmw-008 at 0.06J µg/L, and at 0.076J µg/L in RQLmw-011.
- RDX was found in MW-2, MW-3, and RQLmw-006, at 0.14J, 0.28J, and 0.12J µg/L, respectively.
- Tetryl was found in MW-1 at 0.0685 µg/L, and at 0.12 µg/L in MW-4.
- 1,3-Dintrobenzene (DNB) was detected at 0.099J µg/L in RQLmw-006.
- 4-Nitrotoluene was detected at 0.082 µg/L in MW-5.
- Nitrobenzene was detected once, at 0.091J µg/L in RQLmw-011.

Figure 2-5 displays the distributions of these explosives in groundwater samples.

Propellants

Nitroglycerine was detected in two samples of groundwater. RQLmw-008 had 2J µg/L of nitroglycerine; RQLmw-006 had 2.8J µg/L. No other propellants were detected in RQL groundwater during the initial phase of sampling.

TAL Metals and Cyanide

Metals were analyzed in both filtered and unfiltered samples from each groundwater sampling location. Both sets of results are discussed below. However, filtered sample results are more representative of the true composition of the groundwater than the unfiltered results. Essential nutrients such as calcium, potassium, and sodium were present above detection levels in all samples, but are not further discussed as they are not considered potential contaminants at RQL.

In the unfiltered groundwater samples, the results of the analyses are as follows:

- Neither antimony nor silver were detected.
- Cadmium, chromium, and vanadium were detected only in MW-2, at 19, 23.3, and 22.4J µg/L, respectively.
- MW-2 was the locus of maximum concentrations for 11 of the 23 TAL metals.
- Arsenic was detected in all wells, except for MW-3, RQLmw-009, and RQLmw-010, at concentrations ranging from 3.3J to 108 µg/L; concentrations exceeded the Maximum Contaminant Level (MCL) in samples from wells MW-2 (108 µg/L), RQLmw-007 (89.4 µg/L), and RQLmw-008 (51.6 µg/L).
- Cobalt was detected in MW-1, MW-2, MW-4, RQLmw-006, RQLmw-008, and RQLmw-011 at concentrations ranging from 29.7 to 196 µg/L.
- Trace amounts of mercury were reported from 0.09J to 0.29 µg/L in 8 of 11 wells.
- Lead was detected only in three wells: at 4.2 µg/L in MW-1, 74.8 µg/L in MW-2, and 2.4 µg/L in MW-4.
- In the upgradient well RQLmw-006, arsenic, barium, and cobalt were present at 15, 30.2J, and 196 µg/L, respectively. Iron, manganese, nickel , and zinc were present at 1760, 5550, 937, and 47.8 µg/L, respectively.

Arsenic was present in the unfiltered groundwater samples at concentrations above the MCL for drinking water (0.05 mg/L) in all three locations where it was detected (MW-2 at 108 µg/L; RQLmw-007 at 59.4 µg/L; and RQLmw-008 at 51.6 µg/L). MCLs for cadmium, nickel, thallium, and lead were exceeded at MW-2.

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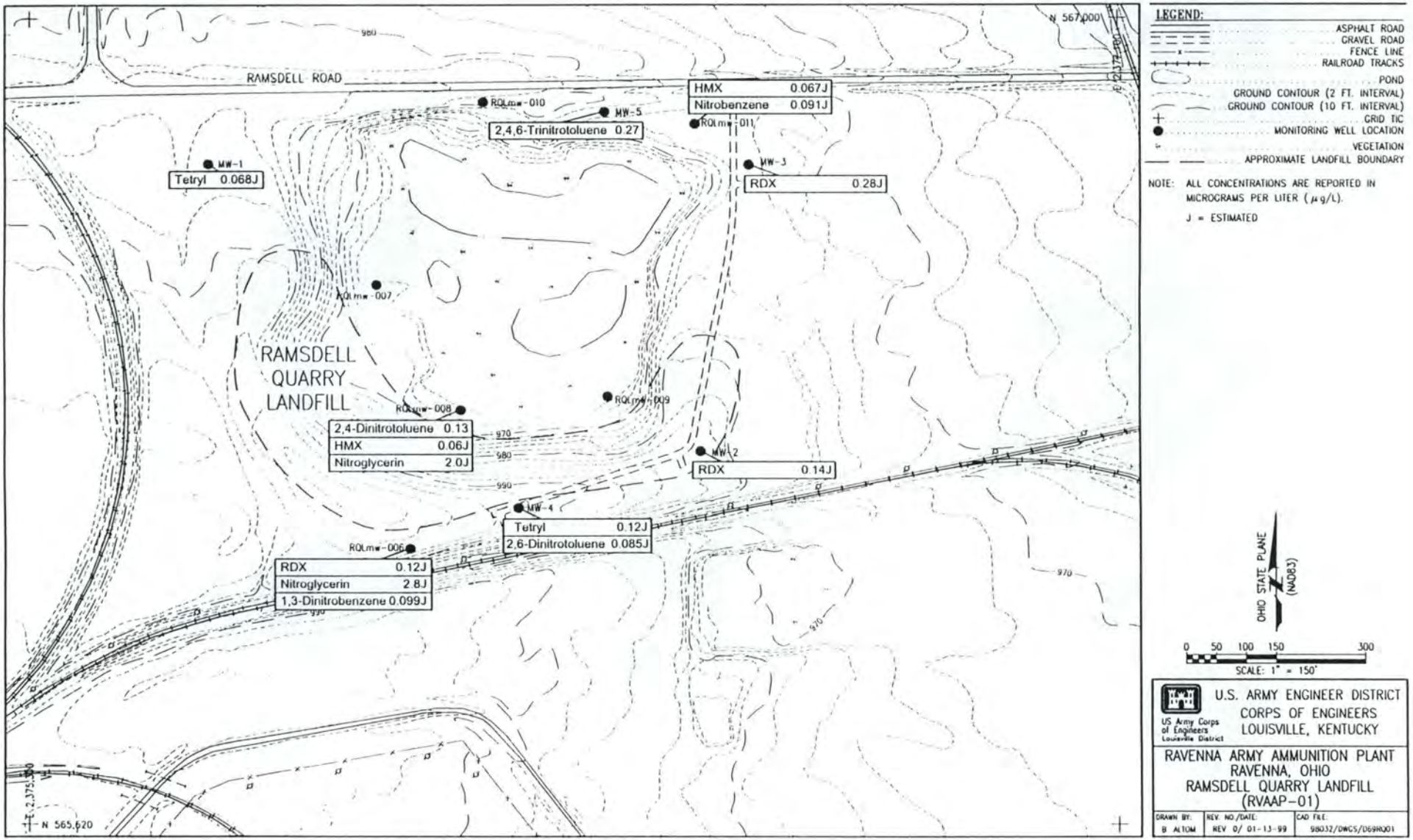

Figure 2-5. Summary of Explosives Results in Groundwater

For the filtered groundwater samples, the results of the analyses are as follows:

- Five of the 23 TAL metals analyzed in filtered groundwater were not detected. These were antimony, chromium, lead, selenium, and silver.

- The upgradient well RQLmw-006 had low estimated concentrations of arsenic (9.9J µg/L) and barium (29.7 µg/L). Cobalt was present at 206 µg/L. The concentration of iron was 1240 µg/L. Manganese was present at 5460 µg/L, and nickel at 945 µg/L. Zinc was measured at 41.7 µg/L.

- Cadmium was detected in well MW-2 (2.4 µg/L) and copper in MW-4 (3.4 µg/L).

In the monitoring wells, filtered TAL metals were detected as shown in Table 2-3. The maximum value for arsenic exceeds the primary MCL for drinking water. The maximum values for iron and manganese exceed secondary MCLs.

Table 2-3. Summary of Filtered TAL Metals Results for Groundwater at RQL (concentrations in µg/L)

Analyte	No. of Detects	Minimum	Maximum	Location of Maximum
Antimony	ND			
Arsenic	6	3.1	62.7	RQLmw-007
Barium	9	16.7	62.6	RQLmw-007
Beryllium	1	0.91J	--	RQLmw-011
Cadmium	1	2.4		RQLmw-002
Chromium	ND			
Cobalt	6	18.7J	206	RQLmw-006
Copper	1	3.4		RQLmw-004
Iron	9	93.5J	140,000	RQLmw-008
Lead	ND			
Magnesium	11	9190	67,700	RQLmw-007
Manganese	11	12.6J	6960	RQLmw-005
Mercury	9	0.081J	0.1J	RQLmw-011
Nickel	11	15J	945	RQLmw-006
Selenium	ND			
Silver	ND			
Thallium	5	1.1J	1.9J	RQLmw-008
Zinc	10	29.6	1040	RQLmw-002
Cyanide was not present at concentrations above detection limits in the groundwater at RQL.				

ND = not detected

NOTE: Number of detects shown in table includes duplicates as well as primary samples.

VOCs

The occurrence of VOCs was limited to 4 of the 11 monitoring wells during the initial phase of sampling. No VOCs were reported at concentrations above detection levels in monitoring wells MW-1 through MW-5, RQLmw-007 or -009. However, VOCs were reported near or below the laboratory detection levels (estimated quantities) in three monitoring wells. RQLmw-006 had acetone, benzene, and carbon disulfide (8.1J, 0.52J, and 2.4J µg/L, respectively). Acetone was detected in well RQLmw-008 at a

concentration of 9 µg/L. RQLmw-010 and -011 both had toluene in low concentrations, at 0.72J and 0.51J µg/L, respectively.

SVOCs

No SVOCs were present at concentrations above detection limits in the groundwater at RQL. Two sets of SVOC analyses for groundwater samples are presented in Appendix C. Two analyses were required because matrix spike/matrix spike duplicate recoveries were less than 10%. In addition, surrogate compound recoveries were zero. Analytical method protocol specified re-extraction and re-analysis of the samples. Due to the time delay, the re-extraction occurred outside the official holding time and the subsequent data are qualified as estimated (J flag) or undetected estimated (UJ) with a reason code of A01 (extraction holding times exceeded). Validation concludes that the original data should be rejected while the re-analysis should be used with the estimated qualification.

2.1.5 Geotechnical Results

One geotechnical soil sample was collected from each of two representative soil intervals during drilling of monitoring well boreholes. One geotechnical soil sample each was collected from monitoring well boreholes RQLmw-006 and RQLmw-011. Soil cover was not present at the remaining boreholes. The samples were analyzed for grain size, moisture content, Atterberg limits, and Unified Soil Classification, in accordance with the *Sampling and Analysis Plan Addendum for the Groundwater Investigation of the Former Ramsdell Quarry Landfill* (USACE 1998). Results of the geotechnical analyses are presented in their entirety in Appendix E.

2.1.6 Survey Results

Appendix F presents the survey (X,Y, and Z) coordinates of all sampling points established during the RQL Groundwater Investigation. Table 2-1 summarizes the elevation data for the six newly installed and five original monitoring wells, all of which were surveyed in July 1998.

2.2 POND SURFACE WATER AND SEDIMENT SAMPLING

The chemical water quality of the pond at RQL was evaluated through sampling of both surface water and sediment in the initial phase of the Groundwater Investigation. Because of the potential for unexploded ordnance (UXO) submerged in the pond, all sampling activities in the RQL pond were overseen by a certified UXO specialist. No evidence of UXO was encountered during the investigation. However, non-UXO debris such as steel-reinforced concrete, pipes, scrap metal, culverts, and an empty metal drum were identified in the pond (see Appendix G).

The RQL pond is shown in Figure 2-1. The pond is small and shallow, and about 50% of its former area is now vegetated with cattails. Although the pond is underlain by bedrock, thin deposits of fine-grained sediment have accumulated on top of the rock, in places to a depth of 1.2 m (4 ft) or greater. Portions of the pond with sufficient water to allow sediment to accumulate are quite limited; however, in the main body of the pond (northernmost body) the distribution is laterally continuous. Water depths and sediment thicknesses were measured at each of the sediment sampling stations during sample collection (Table 2-4). The maximum water depth encountered was 0.9 m (3 ft) in RQLsd-022. The maximum depth to bedrock was encountered at RQLsd-018, where the sediment thickness on top of rock is greater than 1.2 m (4 ft). Appendix H presents the descriptions of all sediments sampled. Sediment depths where cattails and other vegetation have grown are not known. The pond sediment may reduce the amount of any hydraulic communication to some degree between the water-bearing zone in the sandstone and the pond.

especially at times when the water level (i.e., hydraulic head) in the pond is low. However, the limited thickness and discontinuous distribution across the quarry limits this effect.

Table 2-4. Sediment Sampling Data, Ramsdell Quarry Landfill Pond

Sediment Sample Location ID	Sediment Thickness (ft)	Description
RQLsd-012 (-017)	0.6	Poorly sorted gravel, traces of silt and sand, dark grey
RQLsd-013 (-020)	1.25	Silty clay with organic debris and traces of fine sand, light grey
RQLsd-014 (-021)	0.4	Silt with organic debris and traces of gravel, black
RQLsd-015 (-024)	1.8	Silt and clay with traces of gravel, black
RQLsd-018	> 4.0	Silt with coarse sand to medium, organic debris
RQLsd-019	0.5	Clay with silt and traces of gravel, roots, light brown
RQLsd-022	0.45	Silt with gravel and sand, black
RQLsd-023	1.2	Silt with some gravel and clay, dark grey

2.2.1 Survey Results

The field sampling team measured the water level in the pond from the surveyed staff gauge. The water level elevation at RQL pond at the time of the initial sampling effort was 958.48 ft amsl.

2.2.2 Geotechnical Sampling Results

One geotechnical sample was collected at each of the sediment sampling locations from representative sediment sampling intervals. The samples were analyzed for grain size, Atterberg limits, and Unified Soil Classification, in accordance with the *Sampling and Analysis Plan Addendum for the Groundwater Investigation of the Former Ramsdell Quarry Landfill* (USACE 1998). Moisture content was not evaluated because the samples were water saturated. Results of the geotechnical analyses are presented in their entirety in Appendix E.

2.2.3 Surface Water Sampling Results

The objective of surface water sampling at RQL pond was to determine whether pre-existing contamination related to past burning activities has impacted sediment or water quality in the pond. Four locations were selected for surface water sample collection in the initial sampling effort (see Figure 2-1). These locations are also the sites of four of the eight sediment samples collected as part of this investigation (see Section 2.2.4). All surface water samples were analyzed for explosives, propellants, TAL metals, cyanide, VOCs, and SVOCs. Surface water was analyzed for both total (unfiltered) and dissolved (filtered) metals. Water from the pond will also be collected during the follow-up phases of sampling and analyzed for the same parameters as in the initial phase. The same location (RQLsw-015) will be sampled each time for consistency and to establish trends within the main body of the pond over time. Surface water samples were collected before sediment sampling began, to minimize the likelihood of sediment suspension affecting surface water quality. The analytical data for surface water collected during this investigation are presented in Appendix C.

2.2.3.1 Explosives

Explosives were not present at concentrations above detection limits in the surface water at RQL.

2.2.3.2 Propellants

Propellants were not present at concentrations above detection limits in the surface water at RQL.

2.2.3.3 TAL Metals and Cyanide

Metals were analyzed in both filtered and unfiltered samples from each surface water sampling location. Both sets of results are discussed below. However, filtered sample results are more representative of the true composition of the surface water than the unfiltered results. Essential nutrients such as calcium, potassium, and sodium were present above detection levels in all samples, but are not further discussed as they are not considered potential contaminants at RQL.

In the unfiltered surface water samples, antimony, beryllium, and silver were not detected. Barium, iron, magnesium, and manganese were detected in all four samples. The majority of the other metal ions were found in RQLsw-013, with RQLsw-014 and -015 having only barium, iron, magnesium, manganese, lead, and zinc above detection limits. The maximum concentration of every TAL metal detected was found at RQLsw-012. Arsenic concentrations ranged from 23 to 41.7 µg/L. Iron concentrations varied from 377 to 84,300 ug/L. Lead was present in RQLsw-013 and -012, at 38.2 and 110 µg/L, respectively. Magnesium was detected at concentrations from 30.800 to 202,000 µg/L, and manganese varied from 67.2 to 5130 µg/L.

Comparison of unfiltered surface water sample data to statewide water quality criteria for the protection of human health (OAC 3745-1-07) indicated exceedances for iron and manganese. Iron was present above the criterion for soluble iron (300 µg/L) in all four samples. Manganese also exceeded its criterion of 50 µg/L (total recoverable) in all four samples. No exceedances were observed for arsenic or zinc. Nitrate, chloride, dissolved solids, and sulfate also have criteria; however, these constituents were not analyzed as part of the investigation.

Most of the 23 metals and cyanide in filtered surface water samples were non-detects, with the exception of iron, magnesium, and manganese. Iron concentrations ranged from 51.5 to 213 µg/L. Magnesium concentrations ranged from 28,900 to 168,000 µg/L, and manganese from 8.8J to 316 µg/L. The maximum manganese value exceeds the statewide water quality criterion of 50 µg/L for total recoverable manganese. Aluminum was also present at RQLsw-012 at 92.9J µg/L, and at 72J µg/L at RQLsw-013. Arsenic was present at 3.7J µg/L at RQLsw-013. Barium was detected in RQLsw-012 at 45.8J µg/L, RQLsw-013 at 15.2J µg/L, 38.5 µg/L at RQLsw-014, and 22.9J µg/L at RQLsw-015; however, barium was also present in laboratory blanks. No other metals were detected in the filtered samples.

2.2.3.4 VOCs

VOCs were not present at concentrations above detection limits in the surface water at RQL.

2.2.3.5 SVOCs

SVOCs were not present at concentrations above detection limits in the surface water at RQL.

2.2.4 Sediment Sampling Results

The objective of sediment sampling was to determine if the former landfill or pre-landfill waste disposal activities have resulted in a release of contaminants to the pond. Eight locations in the pond were targeted for sediment sample collection during the initial field effort. These samples were analyzed for explosives.

propellants, TAL metals, cyanide, VOCs, and SVOCs. The analytical results for sediments (dry weight basis) are presented in their entirety in Appendix C of this report. Geotechnical analyses of sediments included grain size, Atterberg limits, and Unified Soil Classification (moisture content was omitted because the samples were all water saturated). Sediment sampling locations are shown in Figure 2-1.

Sediments were collected at each location from the sediment-water interface to a depth of 0.5 ft below the interface, or refusal. If there was no refusal, sediment was sampled from 0.5 to 2 ft and, if possible, from 2 to 4 ft. At RQLsd-018, for example, sampling of sediment was performed in all three depth intervals, and there was no refusal at 4 ft. At RQLsd-013, sediments were collected at 1.25 ft, and at RQLsd-023, 1.2 ft. RQLsd-015 was sampled from 0.0 to 0.5 ft and from 0.5 to 2 ft, refusing on unknown material. All other samples were collected from 0 to 0.5 ft or less.

2.2.4.1 Explosives

Explosives were present in very low concentrations in seven of the eight sediment sampling locations. A summary of these results is as follows:

- TNT was detected in three locations: RQLsd-012 at 0.021J mg/kg, and RQLsd-018 and RQLsd-019 at 0. 047J mg/kg.

- HMX was detected at five locations. RQLsd-012, -018, -019, -022, and -023 had detections of HMX in the 0.0 to 0.5-ft interval. In addition, the 0.5- to 2.0-ft and the 2- to 4-ft intervals in RQLsd-018 and the 0.5 to 2-ft interval in RQLsd-023 had small quantities of HMX. Concentrations ranged from 0.11J to 0.14mg/kg.

- 2,6-DNT was detected in RQLsd-012, RQLsd-022, and RQLsd-023, in concentrations of 0.076J, 0.064J, and 0.34J mg/kg, respectively.

- 2,4-DNT was detected in the 0.5- to 2-ft interval at RQLsd-023.

- 2-Nitrotoluene, 3-nitrotoluene, and 4-nitrotoluene were detected in low, estimated quantities in RQLsd-013, RQLsd-014, RQLsd-23, and RQLsd-012.

2.2.4.2 Propellants

Propellants were not present in sediments at concentrations above detection levels, with the exception of three occurrences of nitrocellulose. Nitrocellulose was detected at RQLsd-015 in the 0- to 0.5-ft sample at 4.3 mg/kg, and in the 0.5- to 2-ft sample at 2.3 mg/kg. Nitrocellulose occurred in the field duplicate sample of RQLsd-012 (0 to 0.5 ft) at 1.7J mg/kg.

2.2.4.3 TAL Metals and Cyanide

Of the 23 metals analyzed in pond sediments, antimony and silver were never detected above detection limits. Occurrences of selenium, thallium, and cadmium were limited to five or fewer of the eight sediment sampling locations. The remaining analytes were present above detection limits in nearly every sample. In general, where two or more depth intervals were sampled, concentrations of metals decreased with increasing depth. Sampling location RQLsd-022 had the greatest number (11) of maximum concentrations of the TAL metals. A summary of the metals results for sediments is shown in Table 2-5. Where multiple depth intervals were sampled, the depth interval of the maximum concentration is noted. Cyanide was detected at 2.8 mg/kg in one sediment sample, RQLsd-023, in the 0- to 0.5-ft interval.

Table 2-5. Summary of TAL Metals Results for RQL Pond Sediments (concentrations in mg/kg)

Analyte	No. of Detects	Minimum	Maximum	Location of Maximum
Arsenic	12	7.6	32.5	RQLsd-022
Barium	12	33J	145	RQLsd-022
Beryllium	9	0.33	0.65	RQLsd-018, 0.5- to 2 ft
Cadmium	4	1.4	6.4	RQLsd-018
Chromium	12	8.7	30.9	RQLsd-022
Cobalt	12	5J	33.6	RQLsd-022
Copper	12	19.5	134	RQLsd-022
Iron	12	13,700	54,500	RQLsd-018, 0.5- to 2 ft
Lead	12	21.1	87.2	RQLsd-022
Magnesium	12	1300J	58,000J	RQLsd-022
Manganese	12	189J	2590J	RQLsd-022
Mercury	12	0.033J	0.89J	RQLsd-012
Nickel	12	12.8	86.8	RQLsd-022
Selenium	5	0.6	2	RQLsd-013, 0- to 0.5 ft
Thallium	3	1.2	1.9	RQLsd-022
Vanadium	12	9J	40.7	RQLsd-013, 0- to 0.5 ft
Zinc	12	100	894	RQLsd-022

2.2.4.4 VOCs

VOCs were reported at concentrations near the laboratory detection levels in sediment. Acetone was detected in every sampling location except for RQLsd-019. Concentrations of acetone ranged from 3.7J to 26J µg/kg, with the highest concentration encountered at 0.5 to 2 ft in RQLsd-024. 2-Butanone was detected in RQLsd-013, -015, and -023 at concentrations ranging from 6.5J to 10J µg/kg. There was one occurrence of methylene chloride above detection levels, in RQLsd-019 at 0.73 µg/kg.

2.2.4.5 SVOCs

Polynuclear aromatic hydrocarbons (PAHs) were detected in five of the eight sampling locations. At RQLsd-012, -014, -015, -018, and -023, PAHs such as benzo(*a*)anthracene, fluoranthene, pyrene, and others were detected at concentrations ranging from 65J to 2000 µg/kg. This maximum value (for phenanthrene) was observed in the 0- to 0.5-ft sample at RQLsd-012. Some PAHs were also detected in the 0.5- to 2-ft intervals at RQLsd-015 and -023. PAHs were not detected in samples from RQLsd-013, -019, or -022.

2-Methylnaphthalene and acenaphthene were detected in the 0- to 0.5-ft sample at RQLsd-012, at 110J and 340J µg/kg, respectively.

2.2.5 Continuous Water Level Data Collection

In order to monitor water levels in RQL pond continuously until the completion of all groundwater and surface water sampling activities performed as a part of this Groundwater Investigation, a staff gauge with automated data collection capability was installed at the pond in July 1998. Figure 2-6 is a photograph of the completed platform and staff gauge.

The data logger collects and records water level data on a daily basis for the duration of sampling activities at RQL. The data will be downloaded to a notebook computer on site, at a minimum, during every groundwater sampling event or manual water level measurement event. Because the electronic pressure transducer used to automatically record data is submerged, it must be removed during the months in which the pond freezes. A visual gauge (scaled to 0.10 ft) installed on the platform can be used during winter months and is visible from the shore.

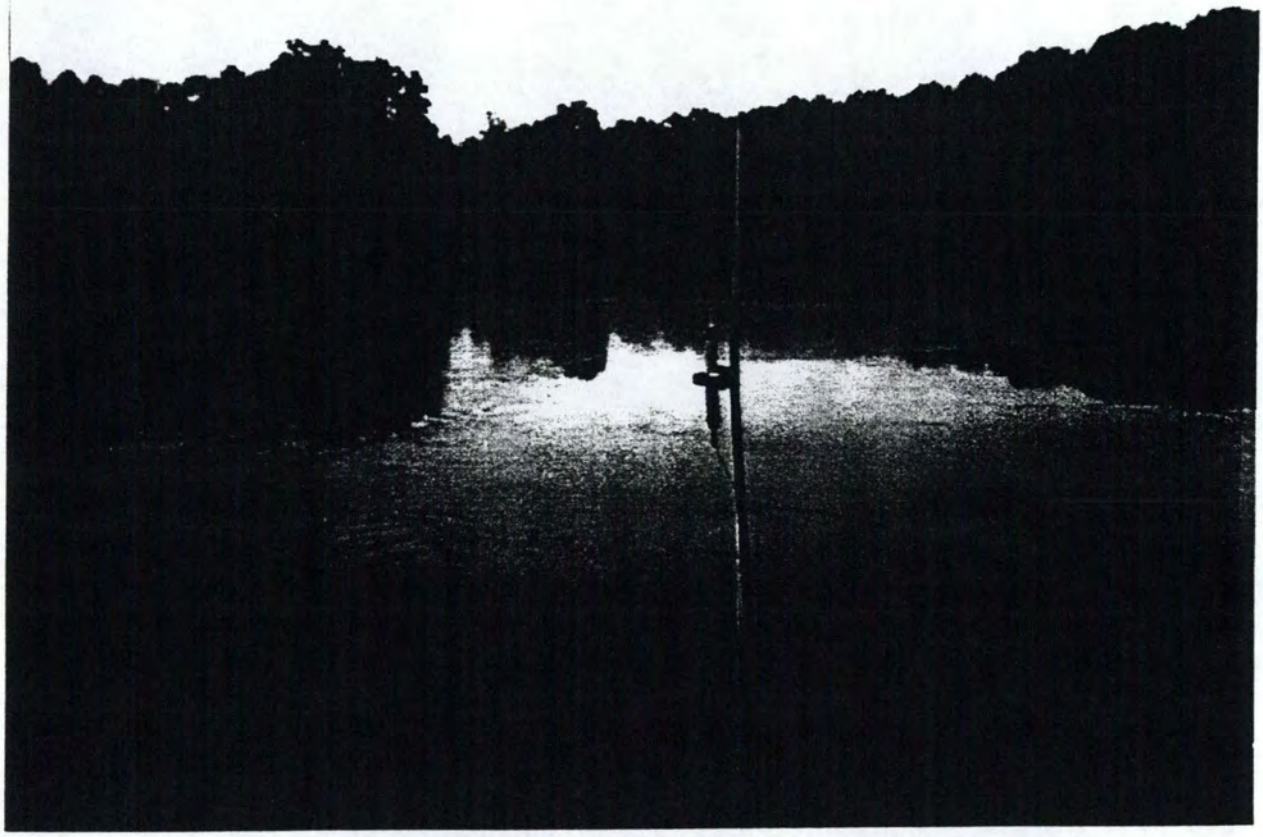

Figure 2-6. Photograph of Staff Gauge at Ramsdell Quarry Landfill Pond, Looking Southeastward from Northwest Corner of Pond

3.0 CONCLUSIONS

The results of the initial phase of sampling and measurements at RQL provide an assessment of summer conditions at the site. Follow-up work will provide information on temporal variations in groundwater and surface water chemistry, groundwater flow directions, and the degree of connectivity between RQL pond and the shallow groundwater system.

3.1 GROUNDWATER CONDITIONS AND QUALITY

- Groundwater flow is to the northeast across the site under a gentle (0.008) gradient.
- Shallow groundwater occurs within both primary and secondary porosity in the highly fractured, highly weathered Sharon sandstones.
- Groundwater in upgradient well RQLmw-006 contains low concentrations of the explosives RDX and 1,3-dinitrobenzene. These compounds also occur in one or more of the downgradient wells. The propellant nitroglycerine was found in the upgradient well, with the only other occurrence in RQLmw-008.
- Cobalt, nickel, and arsenic were identified in filtered samples from RQLmw-006 and five or more downgradient wells.
- SVOCs and VOCs were not present above detection levels in groundwater.
- Cyanide was not detected in groundwater.
- Vertical movement of groundwater and a substantial degree of interconnection may explain the similarities in water levels observed in the original wells, screened in deeper stratigraphic intervals, and the new wells, installed in shallow bedrock.

3.2 SURFACE WATER/SEDIMENT CONDITIONS AND QUALITY

- The elevation of the water surface in the pond during the initial sampling event was 958.48 ft amsl at the staff gauge. The staff gauge was set at the location where the pond is deepest.
- Surface water samples contained no explosives, propellants, VOCs, or SVOCs in concentrations above detection limits. Iron, magnesium, and manganese were the most frequently detected metals, with two or fewer occurrences each of arsenic, barium, and aluminum.
- Sediment samples exhibited the greatest amounts of explosives and other contaminants in the 0- to 0.5-ft interval. HMX was found in five of the eight locations, and at depths of 0.5 to 2 ft or greater in two of these. Nitrocellulose occurs in RQLsd-015, where no explosives were detected, and in RQLsd-012, in concentrations less than 5 mg/kg. PAHs were also present in five of the eight sampling locations and may reflect the former sites of open burning of wastes. These occurrences may result from either runoff or incipient contamination from historical operations on the quarry floor.

- Sediment has accumulated to a depth of 1.2 m (> 4 ft) at some locations in the pond. Water depth varies from 0 to 1m (0 to 3.18 ft). Thick sediment accumulations may diminish the amount of hydraulic communication between the pond and the shallow water-bearing zone.

- The potential connection between the pond and the shallow groundwater system cannot be discerned with only the initial data.

3.3 FOLLOW-UP INVESTIGATION

Five additional groundwater and surface water sampling events will follow the initial phase. These additional events began in September 1998. In addition, water level measurements will continue to be monitored daily in the six newly installed wells, monthly in the previously existing wells at RQL, and daily in RQL pond. As the data are assembled and analyzed, results will be reported to USACE each quarter. Upon completion of a full year of sampling of groundwater at RQL, an annual report will be prepared to integrate the observations made throughout a full year of water quality monitoring.

4.0 REFERENCES

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SUMMARY OF GROUNDWATER MONITORING RESULTS

RAMSDELL LANDFILL - MONITORING WELL 006

ANALYTE**, UNITS, METHOD NO.	1998			1999			
Sample Date	7/25/98	9/20/98	10/19/98	2/13/99	4/10/99	5/27/99	12/21/99
VOCs ug/l 8260							
Acetone	8.1	ND	ND	ND	ND	ND	2.3
Acrolein	ND	ND	ND	ND	ND	ND	ND
Acrylonitrile	ND	ND	ND	ND	ND	ND	ND
Benzene	0.52	ND	ND	ND	ND	ND	ND
Bromodichloromethane	ND	ND	ND	ND	ND	ND	ND
Bromomethane	ND	ND	ND	ND	ND	ND	ND
Bromoform	ND	ND	ND	ND	ND	ND	ND
Carbon Disulfide	2.4	ND	ND	ND	ND	ND	ND
Carbon tetrachloride	ND	ND	ND	ND	ND	ND	ND
Chlorobenzene	ND	ND	ND	ND	ND	ND	ND
Chlorodibromomethane	ND	ND	ND	ND	ND	ND	ND
Chloroform	ND	ND	ND	ND	ND	ND	ND
Chloroethane	ND	ND	ND	ND	ND	ND	ND
2-Chloroethyl vinyl ether	ND	ND	ND	ND	ND	ND	ND
Chloromethane	ND	ND	ND	ND	ND	ND	ND
Dichlorodifluoromethane	ND	ND	ND	ND	ND	ND	ND
1,1 Dichloroethene	ND	ND	ND	ND	ND	ND	ND
1,2 Dichloroethene	ND	ND	ND	ND	ND	ND	ND
1,1 Dichloroethane	ND	ND	ND	ND	ND	ND	ND
1,2 Dichloroethane	ND	ND	ND	ND	ND	ND	ND
1,2 Dichloropropane	ND	ND	ND	ND	ND	ND	ND
1,2,3-Trichloropropane	ND	ND	ND	ND	ND	ND	ND
cis-1,3-Dichloropropene	ND	ND	ND	ND	ND	ND	ND
trans-1,3-Dichloropropene	ND	ND	ND	ND	ND	ND	ND
Ethyl methacrylate	ND	ND	ND	ND	ND	ND	ND
Ehtylbenzene	ND	ND	ND	ND	ND	ND	ND
2-Hexanone	ND	ND	ND	ND	ND	ND	ND
4-Methyl-2-Pentanone	ND	ND	ND	ND	ND	ND	ND
Methylene chloride	ND	ND	0.63	5	ND	ND	ND
Methylethylketone (MEK)	ND	ND	ND	ND	ND	ND	ND
Styrene	ND	ND	ND	ND	ND	ND	ND
1,1,2,2-Tetrachloroethane	ND	ND	ND	ND	ND	ND	ND
Toluene	ND	0.54	ND	0.48	ND	ND	0.1
1,1,1, Trichloroethane	ND	ND	ND	ND	ND	ND	ND
1,1,2-Trichloroethane	ND	ND	ND	ND	ND	ND	ND
Trichloroethene	ND	ND	ND	ND	ND	ND	ND
Trichlorofluoromethane	ND	ND	ND	ND	ND	ND	ND
Vinyl acetate	ND	ND	ND	ND	ND	ND	ND
Vinyl chloride	ND	ND	ND	ND	ND	ND	ND
Xylenes (total)	ND	ND	ND	ND	ND	ND	ND
Explosives ug/l 8330							
Cyclotetramethylenetetranitramine (HMX)	ND	ND	ND	ND	ND	ND	ND
Cyclotrimethylenetrinitramine (RDX)	ND	ND	ND	ND	0.38	ND	ND
2,4 Dinitrotoluene	ND	ND	ND	0.22	0.033	0.033	ND
2,6 Dinitrotoluene	ND	ND	ND	ND	ND	ND	ND
2,4,6-Trinitrotoluene	ND	ND	ND	ND	ND	ND	ND
Metals ug/l							
Arsenic	9.9	28	21.8	35.5	24.5	25.8	19.4
Barium	29.7	34	31.8	25.7	18.9	26	17.9
Cadmium	ND	ND	ND	ND	ND	ND	ND
Calcium	94000	97300	10600	105000	101000	135000	99000
Chromium	ND	ND	9.4	ND	ND	ND	ND
Copper	ND	5400	ND	21.4	ND	ND	ND
Iron	1240	5520	6520	7480	6150	14100	4180
Lead	ND	ND	ND	ND	ND	ND	ND
Mercury	ND	ND	ND	ND	ND	ND	ND
Magnesium	37200	39000	420000	40800	39400	53900	40700
Manganese	5460	5440	5370	4180	4000	7720	3430
Nickel	945	823	599	348	334	1470	308
Phosphorus							ND
Potassium	2910	3240	2810	2220	2220	2830	1460
Selenium	ND	ND	ND	ND	ND	ND	ND
Silver	ND	ND	ND	ND	ND	ND	ND
Sodium	1900	2070	2030	1570	1440	1820	1570
Zinc	41.7	ND	ND	40.2	ND	1910	33.9
Non Metals mg/l							
Alkalinity				240	280	200	250
Ammonia Nitrogen				ND	ND	ND	ND
Chemical Oxygen Demand				ND	60	ND	ND
Chloride				2.1	2.4	2.1	2
Cyanide	ND		ND	ND	ND	ND	ND
Nitrate/Nitrite				ND	ND	ND	ND
pH (SU)				6.2	6.2	6	6.2
Phenols, Total				ND	ND	ND	ND
Specific Conductivity, Lab (umhos/cm)				760	670	1000	690
Sulfate				152	184	380	160
Total Dissolved Solids				510	550	770	470
Total Organic Carbon				3	7	4	3
Turbidity (Total Suspended Solids) NTU							10

** Preliminary data table to be confirmed. (April 30, 2001 Resample)

SUMMARY OF GROUNDWATER MONITORING RESULTS

RAMSDELL LANDFILL - MONITORING WELL 006

ANALYTE**, UNITS, METHOD NO.	2000						2001		
Sample Date	2/23/00	SSD	6/21/00	SSD	12/13/00	SSD	4/30/01	SSD	6/26/01 resample
VOCs ug/l: 8260									
Acetone	1.4 J		15		2.3J,B		8.5 J		
Acrolein	ND		ND		ND		ND		
Acrylonitrile	ND		ND		ND		ND		
Benzene	ND		0.42 J		ND		ND		
Bromodichloromethane	ND		ND		ND		ND		
Bromomethane	ND		ND		ND		ND		
Bromoform	ND		ND		ND		ND		
Carbon Disulfide	ND		ND		ND		ND		
Carbon tetrachloride	ND		ND		ND		ND		
Chlorobenzene	ND		ND		ND		ND		
Chlorodibromomethane	ND		ND		ND		ND		
Chloroform	ND		ND		ND		ND		
Chloroethane	ND		ND		ND		ND		
2-Chloroethyl vinyl ether	ND		ND		ND		ND		
Chloromethane	ND		ND		ND		ND		
Dichlorodifluoromethane	ND		ND		ND		ND		
1,1 Dichloroethene	ND		ND		ND		ND		
1,2 Dichloroethene	ND		ND		ND		ND		
1,1 Dichloroethane	ND		ND		ND		ND		
1,2 Dichloroethane	ND		ND		ND		ND		
1,2 Dichloropropane	ND		ND		ND		ND		
1,2,3-Trichloropropane	ND		ND		ND		ND		
cis-1,3-Dichloropropene	ND		ND		ND		ND		
trans-1,3-Dichloropropene	ND		ND		ND		ND		
Ethyl methacrylate	ND		ND		ND		ND		
Ehtylbenzene	ND		ND		ND		ND		
2-Hexanone	ND		ND		ND		ND		
4-Methyl-2-Pentanone	ND		ND		ND		ND		
Methylene chloride	ND		0.12 J,B		ND		ND		
Methylethylketone (MEK)	1.0 J		55		ND		92		
Styrene	ND		ND		ND		ND		
1,1,2,2-Tetrachloroethane	ND		ND		ND		ND		
Toluene	0.049 J,B		0.17 J		ND		ND		
1,1,1, Trichloroethane	ND		ND		ND		ND		
1,1,2-Trichloroethane	ND		ND		ND		ND		
Trichloroethene	ND		ND		ND		ND		
Trichlorofluoromethane	ND		ND		ND		ND		
Vinyl acetate	ND		ND		ND		ND		
Vinyl chloride	ND		ND		ND		ND		
Xylenes (total)	ND		ND		ND		ND		
Explosives ug/l: 8330									
Cyclotetramethylenetetranitramine (HMX)	ND		ND		ND		ND		
Cyclotrimethylenetrinitramine (RDX)	ND		ND		ND		ND		
2,4 Dinitrotoluene	ND		ND		ND		ND		
2,6 Dinitrotoluene	ND		ND		ND		ND		
2,4,6-Trinitrotoluene	ND		ND		ND		ND		
Metals ug/l									
Arsenic	13.9		26.6		32.4		31.7		
Barium	15.3 B		36.1 B		26.2		27.3 B		
Cadmium	ND		ND		ND		ND		
Calcium	96100		77500		101000		92300		
Chromium	ND		ND		ND		ND		
Copper	ND		ND		ND		ND		
Iron	3500 MBB		9260		9520		8940		
Lead	ND		ND		ND		ND		
Mercury	ND		ND		ND		ND		
Magnesium	39100		33900		42900		42100		
Manganese	3360 MBB		11000		4760		10300		
Nickel	222		217		120		332		
Phosphorus			ND		ND		0.1		
Potassium	1880		1600 B		1910 B		1430		
Selenium	ND		ND		ND		ND		
Silver	ND		ND		ND		ND		
Sodium	1600 B		2110		1560 B		1900 B		
Zinc	87.8 L		ND		ND		13.2 B		
Non Metals mg/l									
Alkalinity	280		240		270		310		
Ammonia Nitrogen	5.7		ND		ND		ND		
Chemical Oxygen Demand	19		ND		ND		52.4		
Chloride	1		2		2		4		
Cyanide	ND		ND		ND		ND		
Nitrate/Nitrite	ND		ND		ND		ND		
pH (SU)	6.3		6.3		6.4		7.6		
Phenols, Total	ND		ND		0.033		ND		
Specific Conductivity, Lab (umhos/cm)	670		680		760		720		
Sulfate	190		130		140		66		
Total Dissolved Solids	450		400		480		500		
Total Organic Carbon	3		6		4		13		
Turbidity (Total Suspended Solids) NTU	5.5		20		47		70		

** Preliminary data table to be confirmed. (April 30, 2001 Resample)

SUMMARY OF GROUNDWATER MONITORING RESULTS

RAMSDELL LANDFILL - MONITORING WELL 007

ANALYTE**, UNITS, METHOD NO.	1998			1999			
Sample Date	7/22/98	9/20/98	10/20/98	2/14/99	4/11/99	5/27/99	12/21/99
VOCs ug/l 8260							
Acetone	ND	ND	ND	ND	ND	ND	3.2
Acrolein	ND	ND	ND	ND	ND	ND	ND
Acrylonitrile	ND	ND	ND	ND	ND	ND	ND
Benzene	ND	ND	ND	ND	ND	ND	0.2
Bromodichloromethane	ND	ND	ND	ND	ND	ND	ND
Bromomethane	ND	ND	ND	ND	ND	ND	ND
Bromoform	ND	ND	ND	ND	ND	ND	ND
Carbon Disulfide	ND	ND	ND	ND	ND	ND	ND
Carbon tetrachloride	ND	ND	ND	ND	ND	ND	ND
Chlorobenzene	ND	ND	ND	ND	ND	ND	ND
Chlorodibromomethane	ND	ND	ND	ND	ND	ND	ND
Chloroform	ND	ND	ND	ND	ND	ND	ND
Chloroethane	ND	ND	ND	ND	ND	ND	ND
2-Chloroethyl vinyl ether	ND	ND	ND	ND	ND	ND	ND
Chloromethane	ND	ND	ND	ND	ND	ND	ND
Dichlorodifluoromethane	ND	ND	ND	ND	ND	ND	ND
1,1 Dichloroethene	ND	ND	ND	ND	ND	ND	ND
1,2 Dichloroethene	ND	ND	ND	ND	ND	ND	ND
1,1 Dichloroethane	ND	ND	ND	ND	ND	ND	ND
1,2 Dichloroethane	ND	ND	ND	ND	ND	ND	ND
1,2 Dichloropropane	ND	ND	ND	ND	ND	ND	ND
1,2,3-Trichloropropane	ND	ND	ND	ND	ND	ND	ND
cis-1,3-Dichloropropene	ND	ND	ND	ND	ND	ND	ND
trans-1,3-Dichloropropene	ND	ND	ND	ND	ND	ND	ND
Ethyl methacrylate	ND	ND	ND	ND	ND	ND	ND
Ehtylbenzene	ND	ND	ND	ND	ND	ND	ND
2-Hexanone	ND	ND	ND	ND	ND	ND	ND
4-Methyl-2-Pentanone	ND	ND	ND	ND	ND	ND	ND
Methylene chloride	ND	ND	3.7	5	ND	ND	0.17
Methylethylketone (MEK)	ND	ND	ND	ND	ND	ND	ND
Styrene	ND	ND	ND	ND	ND	ND	ND
1,1,2,2-Tetrachloroethane	ND	ND	ND	ND	ND	ND	ND
Toluene	ND	ND	ND	ND	ND	ND	0.12
1,1,1, Trichloroethane	ND	ND	ND	ND	ND	ND	ND
1,1,2-Trichloroethane	ND	ND	ND	ND	ND	ND	ND
Trichloroethene	ND	ND	ND	ND	ND	ND	ND
Trichlorofluoromethane	ND	ND	ND	ND	ND	ND	ND
Vinyl acetate	ND	ND	ND	ND	ND	ND	ND
Vinyl chloride	ND	ND	ND	ND	ND	ND	ND
Xylenes (total)	ND	ND	ND	ND	ND	ND	ND
Explosives ug/l 8330							
Cyclotetramethylenetetranitramine (HMX)	ND	ND	ND	ND	ND	ND	ND
Cyclotrimethylenetrinitramine (RDX)	ND	ND	ND	ND	0.49	ND	ND
2,4 Dinitrotoluene	ND	ND	ND	0.16	ND	0.11	ND
2,6 Dinitrotoluene	ND	ND	ND	ND	ND	ND	ND
2,4,6-Trinitrotoluene	ND	ND	ND	ND	ND	ND	ND
Metals ug/l							
Arsenic	59.4	50.2	54.3	8.9	23.1	38.5	47.6
Barium	58.3	56.5	42.4	23.8	31.8	53.4	32.1
Cadmium	ND	ND	ND	ND	ND	ND	ND
Calcium	159000	151000	129000	81600	88600	135000	116000
Chromium	ND	ND	ND	ND	ND	ND	ND
Copper	ND	ND	ND	3.4	ND	ND	ND
Iron	6560	82500	71400	5950	25500	70400	14400
Lead	ND	ND	ND	ND	ND	ND	ND
Mercury	0.082	ND	ND	ND	ND	ND	ND
Magnesium	67700	62000	57300	103000	115000	95900	181000
Manganese	4100	4570	4530	1330	1180	1420	1050
Nickel	39.4	49.5	56.2	18.9	18.2	18.2	23.5
Phosphorus							ND
Potassium	12000	11300	8820	5900	7330	10600	8740
Selenium	ND	ND	ND	ND	ND	ND	ND
Silver	ND	ND	ND	ND	0.84	ND	ND
Sodium	24000	25600	22700	7870	8420	17700	11100
Zinc	84	ND	261	48	55.2	103	70.9
Non Metals mg/l							
Alkalinity				710	170	580	770
Ammonia Nitrogen				ND	ND	ND	ND
Chemical Oxygen Demand				31	29	43	22
Chloride				3.4	3.7	5.6	7
Cyanide	ND		ND	ND	ND	ND	ND
Nitrate/Nitrite				ND	ND	ND	ND
pH (SU)				6.7	6.6	6.3	6.6
Phenols, Total				ND	ND	ND	ND
Specific Conductivity, Lab (umhos/cm)				1100	1000	1300	1500
Sulfate				118	128	168	290
Total Dissolved Solids				510	550	770	470
Total Organic Carbon				6	7	13	8
Turbidity (Total Suspended Solids) NTU							93

SUMMARY OF GROUNDWATER MONITORING RESULTS

RAMSDELL LANDFILL - MONITORING WELL 007

2000							2001			
2/23/00	SSD	6/21/00	SSD	12/13/00	SSD	2/6/01 re-sample	4/30/01	SSD	6/26/01 resample	Confirm SSD's
1.6 J		**ND**		**1.9 J,B**			**8.5 J**			
ND		ND		ND			ND			
ND		ND		ND			ND			
ND		**0.14 J**		ND			ND			
ND		ND		ND			ND			
ND		ND		ND			ND			
ND		ND		ND			ND			
ND		ND		ND			ND			
ND		ND		ND			ND			
ND		ND		ND			ND			
ND		ND		ND			ND			
ND		ND		ND			ND			
ND		ND		ND			ND			
ND		ND		ND			ND			
ND		ND		ND			ND			
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ND		ND		ND			ND			
ND		ND		ND			ND			
ND		ND		ND			ND			
ND		ND		ND			ND			
ND		ND		ND			ND			
ND		ND		ND			ND			
ND		**0.13 J,B**		ND			ND			
ND		**2.7 J**		ND			92			
ND		ND		ND			ND			
ND		ND		ND			ND			
ND		**0.14 J**		ND			ND			
ND		ND		ND			ND			
ND		ND		ND			ND			
ND		ND		ND			ND			
ND		ND		ND			ND			
ND		ND		ND			ND			
ND		ND		ND			ND			
ND		ND		ND			ND			
ND		ND		ND			ND			
ND		ND		ND			ND			
ND		ND		ND			ND			
ND		ND		ND			ND			
ND		ND		ND			ND			
13.7		**16.3**		**39.9**			**10.1**			
27.0 B		**42.9 B**		**32.9 B**			**30.7 B**			
ND		ND		ND			ND			
111000		**135000**		**110000**			**101000**			
ND		ND		ND			ND			
ND		ND		ND			ND			
020 MBB		**57700**		**25300**			**2670**			
ND		ND		ND			ND			
ND		ND		ND			ND			
140000		**122000**		**113000**			**176000**			
250 MBB		**1180**		**1650**			**1060**			
30.9 B		**24.9 B**		**22.4 B**			**18.4 B**			
		ND		ND			**0.1**			
8520		**9730**		**8830**			**8470**			
ND		ND		ND			ND			
ND		ND		ND			ND			
8640		**11000**		**10400**			**9170**			
76.5		**182**		**65.3**			**37**			
670		**240**		**600**			**860**			
ND		ND		ND			ND			
24		**20**		ND			**21.6**			
3		**5**		**5**			**4**			
ND		ND		ND			ND			
ND		ND		ND			ND			
7	YES	**6.71**	YES	**6.2**			**8**			
ND		ND		ND			ND			
82.2	YES	**1356**		**983**			**1132**	YES	178	NO
200		**180**		**160**			**180**			
780		**900**		**830**	YES	NO	**980**	YES	**1000**	YES
5		**11**		**8**	YES	NO	**7**			
125		**220**		**47**	310		**290**			

SUMMARY OF GROUNDWATER MONITORING RESULTS

RAMSDELL LANDFILL - MONITORING WELL 008

ANALYTE**, UNITS, METHOD NO.	1998			1999			
Sample Date:	7/22/98	9/19/98	10/20/98	2/14/99	4/11/99	5/28/99	12/14/99
VOCs ug/l: 8260							
Acetone	9	ND	ND	ND	ND	ND	3
Acrolein	ND	ND	ND	ND	ND	ND	ND
Acrylonitrile	ND	ND	ND	ND	ND	ND	ND
Benzene	ND	ND	ND	ND	ND	ND	0.087
Bromodichloromethane	ND	ND	ND	ND	ND	ND	ND
Bromomethane	ND	ND	ND	ND	ND	ND	ND
Bromoform	ND	ND	ND	ND	ND	ND	ND
Carbon Disulfide	ND	ND	ND	ND	ND	ND	ND
Carbon tetrachloride	ND	ND	ND	ND	ND	ND	ND
Chlorobenzene	ND	ND	ND	ND	ND	ND	ND
Chlorodibromomethane	ND	ND	ND	ND	ND	ND	ND
Chloroform	ND	ND	ND	ND	ND	ND	ND
Chloroethane	ND	ND	ND	ND	ND	ND	ND
2-Chloroethyl vinyl ether	ND	ND	ND	ND	ND	ND	ND
Chloromethane	ND	ND	ND	ND	ND	ND	ND
Dichlorodifluoromethane	ND	ND	ND	ND	ND	ND	ND
1,1 Dichloroethene	ND	ND	ND	ND	ND	ND	ND
1,2 Dichloroethene	ND	ND	ND	ND	ND	ND	ND
1,1 Dichloroethane	ND	ND	ND	ND	ND	ND	ND
1,2 Dichloroethane	ND	ND	ND	ND	ND	ND	ND
1,2 Dichloropropane	ND	ND	ND	ND	ND	ND	ND
1,2,3-Trichloropropane	ND	ND	ND	ND	ND	ND	ND
cis-1,3-Dichloropropene	ND	ND	ND	ND	ND	ND	ND
trans-1,3-Dichloropropene	ND	ND	ND	ND	ND	ND	ND
Ethyl methacrylate	ND	ND	ND	ND	ND	ND	ND
Ehtylbenzene	ND	ND	ND	ND	ND	ND	ND
2-Hexanone	ND	ND	ND	ND	ND	ND	ND
4-Methyl-2-Pentanone	ND	ND	ND	ND	ND	ND	ND
Methylene chloride	ND	ND	0.58	5	ND	ND	ND
Methylethylketone (MEK)	ND	ND	ND	ND	ND	ND	ND
Styrene	ND	ND	ND	ND	ND	ND	ND
1,1,2,2-Tetrachloroethane	ND	ND	ND	ND	ND	ND	ND
Toluene	ND	ND	ND	0.54	ND	ND	0.08
1,1,1, Trichloroethane	ND	ND	ND	ND	ND	ND	ND
1,1,2-Trichloroethane	ND	ND	ND	ND	ND	ND	ND
Trichloroethene	ND	ND	ND	ND	ND	ND	ND
Trichlorofluoromethane	ND	ND	ND	ND	ND	ND	ND
Vinyl acetate	ND	ND	ND	ND	ND	ND	ND
Vinyl chloride	ND	ND	ND	ND	ND	ND	ND
Xylenes (total)	ND	ND	ND	ND	ND	ND	ND
Explosives ug/l: 8330							
Cyclotetramethylenetetranitramine (HMX)	ND	ND	ND	ND	ND	ND	ND
Cyclotrimethylenetrinitramine (RDX)	ND	ND	ND	ND	ND	ND	ND
2,4 Dinitrotoluene	ND	ND	ND	0.35	0.076	0.069	ND
2,6 Dinitrotoluene	ND	ND	ND	ND	ND	ND	ND
2,4,6-Trinitrotoluene	ND	ND	ND	ND	ND	ND	ND
Metals ug/l:							
Arsenic	62.7	53.2	57.5	5.9	5.6	21.1	12.5
Barium	62.6	25.5	30	24.5	33.4	87.8	25.3
Cadmium	ND	ND	ND	ND	ND	ND	ND
Calcium	159000	137000	111000	34200	40400	83200	54100
Chromium	ND	ND	ND	ND	ND	ND	ND
Copper	ND	ND	6.9	ND	ND	ND	ND
Iron	65600	110000	124000	35400	50600	177000	44700
Lead	ND	ND	ND	ND	ND	ND	ND
Mercury	0.082	ND	ND	ND	ND	ND	ND
Magnesium	67700	61800	47500	69000	71800	49600	112000
Manganese	4100	6760	4520	674	660	1730	941
Nickel	39.4	220	94.1	ND	ND	16.8	35.3
Phosphorus							ND
Potassium	12000	6600	7400	4000	4920	9140	4920
Selenium	ND	ND	ND	ND	ND	ND	ND
Silver	ND	ND	ND	ND	1	0.7	ND
Sodium	24000	20600	16800	4680	4730	8430	6520
Zinc	84	941	197	19.1	19.5	16.1	52.6
Non-Metals mg/l:							
Alkalinity				430	410	470	590
Ammonia Nitrogen				ND	ND	2	ND
Chemical Oxygen Demand				26	19	61	42
Chloride				2.2	1.8	3.4	3
Cyanide	ND	ND	ND	ND	ND	ND	ND
Nitrate/Nitrite				ND	ND	ND	ND
pH (SU)				6.5	6.6	6.4	6.15
Phenols, Total				ND	ND	ND	0.048
Specific Conductivity, Lab (umhos/cm)				790	660	860	483
Sulfate				103	95.5	75.6	280
Total Dissolved Solids				520	440	700	340
Total Organic Carbon				5	6	13	5
Turbidity (Total Suspended Solids) NTU							150

SUMMARY OF GROUNDWATER MONITORING RESULTS

RAMSDELL LANDFILL - MONITORING WELL 008

ANALYTE**, UNITS, METHOD NO.	2000				2001					
Sample Date	2/23/00	SSD	6/21/00	SSD	12/14/00	SSD	4/30/01	SSD		
VOCs ug/l 8260										
Acetone	1.9 J		ND		3.1 J,B		ND			
Acrolein	ND		ND		ND		ND			
Acrylonitrile	ND		ND		ND		ND			
Benzene	ND		ND		ND		ND			
Bromodichloromethane	ND		ND		ND		ND			
Bromomethane	ND		ND		ND		ND			
Bromoform	ND		ND		ND		ND			
Carbon Disulfide	ND		ND		ND		ND			
Carbon tetrachloride	ND		ND		ND		ND			
Chlorobenzene	ND		ND		ND		ND			
Chlorodibromomethane	ND		ND		ND		ND			
Chloroform	ND		ND		ND		ND			
Chloroethane	ND		ND		ND		ND			
2-Chloroethyl vinyl ether	ND		ND		ND		ND			
Chloromethane	ND		ND		ND		ND			
Dichlorodifluoromethane	ND		ND		ND		ND			
1,1 Dichloroethene	ND		ND		ND		ND			
1,2 Dichloroethene	ND		ND		ND		ND			
1,1 Dichloroethane	ND		ND		ND		ND			
1,2 Dichloroethane	ND		ND		ND		ND			
1,2 Dichloropropane	ND		ND		ND		ND			
1,2,3-Trichloropropane	ND		ND		ND		ND			
cis-1,3-Dichloropropene	ND		ND		ND		ND			
trans-1,3-Dichloropropene	ND		ND		ND		ND			
Ethyl methacrylate	ND		ND		ND		ND			
Ehtylbenzene	ND		ND		ND		ND			
2-Hexanone	ND		ND		ND		ND			
4-Methyl-2-Pentanone	ND		ND		ND		ND			
Methylene chloride	ND		0.11 J,B		ND		ND			
Methylethylketone (MEK)	ND		ND		ND		ND			
Styrene	ND		ND		ND		ND			
1,1,2,2-Tetrachloroethane	ND		ND		ND		ND			
Toluene	0.069 J,B		0.14 J		ND		ND			
1,1,1, Trichloroethane	ND		ND		ND		ND			
1,1,2-Trichloroethane	ND		ND		ND		ND			
Trichloroethene	ND		ND		ND		ND			
Trichlorofluoromethane	ND		ND		ND		ND			
Vinyl acetate	ND		ND		ND		ND			
Vinyl chloride	ND		ND		ND		ND			
Xylenes (total)	ND		ND		ND		ND			
Explosives ug/l 8330										
Cyclotetramethylenetetranitramine (HMX)	ND		ND		ND		ND			
Cyclotrimethylenetrinitramine (RDX)	ND		ND		ND		ND			
2,4 Dinitrotoluene	ND		ND		ND		ND			
2,6 Dinitrotoluene	ND		ND		ND		ND			
2,4,6-Trinitrotoluene	ND		ND		ND		ND			
Metals ug/l										
Arsenic	ND		4.7 B		43.1		8			
Barium	18.6 B		31.5 B		39.1B		29.1 B			
Cadmium	ND		ND		ND		ND			
Calcium	46900		55800		59300		62500			
Chromium	ND		ND		ND		ND			
Copper	ND		ND		ND		ND			
Iron	11200MBB		38100		80400		66500			
Lead	ND		ND		ND		ND			
Mercury	ND		ND		ND		0.12 B			
Magnesium	61000		68400		56000		121000			
Manganese	691 MBB		829		1070		879			
Nickel	192		8.5 B		25.3 B		6.9 B			
Phosphorus	ND		ND		ND		0.2			
Potassium	3760		5510		6320		6900			
Selenium	ND		ND		ND		ND			
Silver	ND		ND		ND		ND			
Sodium	6740		5580		6470		6000			
Zinc	139		ND		44.6		13.7 B			
Non Metals mg/l										
Alkalinity	300		300		200		630			
Ammonia Nitrogen	1.3		ND		ND		ND			
Chemical Oxygen Demand	19		ND		ND		33.3			
Chloride	2		2		2		3			
Cyanide	ND		ND		ND		ND			
Nitrate/Nitrite	ND		ND		ND		ND			
pH (SU)	7.1	YES	7.22	YES	6.15		6.6			
Phenols, Total	ND		ND		0.03		ND			
Specific Conductivity, Lab (umhos/cm)	54.5		648		483		899			
Sulfate	180		120		110		68			
Total Dissolved Solids	440		460		340		670			
Total Organic Carbon	3		3		5		10			
Turbidity (Total Suspended Solids) NTU	126		25		200		1700			

SUMMARY OF GROUNDWATER MONITORING RESULTS

RAMSDELL LANDFILL - MONITORING WELL 009

ANALYTE**, UNITS, METHOD NO.	1998			1999			
Simple Date	7/17/98	9/19/98	10/20/98	2/14/99	4/11/99	5/28/99	12/21/99
VOCs ug/l: 8260							
Acetone	ND	ND	ND	ND	ND	ND	1.9
Acrolein	ND	ND	ND	ND	ND	ND	ND
Acrylonitrile	ND	ND	ND	ND	ND	ND	ND
Benzene	ND	ND	ND	ND	ND	ND	0.13
Bromodichloromethane	ND	ND	ND	ND	ND	ND	ND
Bromomethane	ND	ND	ND	ND	ND	ND	ND
Bromoform	ND	ND	ND	ND	ND	ND	ND
Carbon Disulfide	ND	ND	ND	ND	ND	ND	ND
Carbon tetrachloride	ND	ND	ND	ND	ND	ND	ND
Chlorobenzene	ND	ND	ND	ND	ND	ND	ND
Chlorodibromomethane	ND	ND	ND	ND	ND	ND	ND
Chloroform	ND	ND	ND	ND	ND	ND	ND
Chloroethane	ND	ND	ND	ND	ND	ND	ND
2-Chloroethyl vinyl ether	ND	ND	ND	ND	ND	ND	ND
Chloromethane	ND	ND	ND	ND	ND	ND	ND
Dichlorodifluoromethane	ND	ND	ND	ND	ND	ND	ND
1,1 Dichloroethene	ND	ND	ND	ND	ND	ND	ND
1,2 Dichloroethene	ND	ND	ND	ND	ND	ND	ND
1,1 Dichloroethane	ND	ND	ND	ND	ND	ND	ND
1,2 Dichloroethane	ND	ND	ND	ND	ND	ND	ND
1,2 Dichloropropane	ND	ND	ND	ND	ND	ND	ND
1,2,3-Trichloropropane	ND	ND	ND	ND	ND	ND	ND
cis-1,3-Dichloropropene	ND	ND	ND	ND	ND	ND	ND
trans-1,3-Dichloropropene	ND	ND	ND	ND	ND	ND	ND
Ethyl methacrylate	ND	ND	ND	ND	ND	ND	ND
Ehtylbenzene	ND	ND	ND	ND	ND	ND	ND
2-Hexanone	ND	ND	ND	ND	ND	ND	ND
4-Methyl-2-Pentanone	ND	ND	ND	ND	ND	ND	ND
Methylene chloride	ND	ND	0.67	5	ND	ND	ND
Methylethylketone (MEK)	ND	ND	ND	ND	ND	ND	ND
Styrene	ND	ND	ND	ND	ND	ND	ND
1,1,2,2-Tetrachloroethane	ND	ND	ND	ND	ND	ND	0.1
Toluene	ND	ND	ND	ND	ND	ND	0.097
1,1,1, Trichloroethane	ND	ND	ND	ND	ND	ND	ND
1,1,2-Trichloroethane	ND	ND	ND	ND	ND	ND	ND
Trichloroethene	ND	ND	ND	ND	ND	ND	ND
Trichlorofluoromethane	ND	ND	ND	ND	ND	ND	ND
Vinyl acetate	ND	ND	ND	ND	ND	ND	ND
Vinyl chloride	ND	ND	ND	ND	ND	ND	ND
Xylenes (total)	ND	ND	ND	ND	ND	ND	ND
Explosives ug/l: 8330							
Cyclotetramethylenetetranitramine (HMX)	ND	0.09	ND	ND	ND	ND	ND
Cyclotrimethylenetrinitramine (RDX)	ND	ND	ND	ND	ND	ND	ND
2,4 Dinitrotoluene	ND	ND	ND	ND	ND	ND	ND
2,6 Dinitrotoluene	ND	ND	ND	ND	ND	ND	ND
2,4,6-Trinitrotoluene	ND		ND	ND	ND	ND	ND
Metals ug/l:							
Arsenic	ND	10.7	3.9	ND	ND	3.2	ND
Barium	31.7	46.3	52.6	20.2	25	29	40.7
Cadmium	ND	ND	ND	ND	ND	ND	ND
Calcium	27800	37100	38200	18200	22100	22200	29000
Chromium	ND	ND	ND	ND	ND	ND	ND
Copper	ND	ND	ND	10.2	6.7	ND	ND
Iron	1630	18500	6670	278	453	1760	193
Lead	ND	ND	ND	ND	ND	ND	ND
Mercury	0.088	ND	ND	ND	ND	ND	ND
Magnesium	26500	45800	48800	9890	21200	28400	44100
Manganese	1130	3250	2040	53.9	409	936	138
Nickel	ND	15.5	ND	ND	ND	ND	ND
Phosphorus							ND
Potassium	3110	4470	3940	2400	3320	3440	3680
Selenium	ND	ND	ND	ND	ND	ND	8.2
Silver	ND	ND	ND	ND	1.2	ND	ND
Sodium	ND	6220	3340	2620	2620	2750	3550
Zinc	29.6	ND	ND	33.2	52.7	23.1	29.1
Non-Metals mg/l:							
Alkalinity				75	130	120	70
Ammonia Nitrogen				ND	ND	ND	ND
Chemical Oxygen Demand				11	190	ND	12
Chloride				1.3	1.3	2.1	3
Cyanide	ND	ND	ND	ND	ND	ND	ND
Nitrate/Nitrite				ND	ND	ND	0.4
pH (SU)				6.1	6.3	6.3	6.3
Phenols, Total				ND	ND	ND	ND
Specific Conductivity, Lab (umhos/cm)				210	250	360	480
Sulfate				29.9	31.1	63.8	190
Total Dissolved Solids				140	170	200	310
Total Organic Carbon				ND	5	6	4
Turbidity (Total Suspended Solids) NTU							3.3

SUMMARY OF GROUNDWATER MONITORING RESULTS

RAMSDELL LANDFILL - MONITORING WELL 009

ANALYTE**, UNITS, METHOD NO.	2000						2001			
Sample Date	2/23/00	SSD	6/21/00	SSD	12/14/00	SSD	4/30/01	SSD		
VOCs ug/l 8260										
Acetone	1.6 J		ND		1.3 J,B		ND			
Acrolein	ND		ND		ND		ND			
Acrylonitrile	ND		ND		ND		ND			
Benzene	ND		ND		ND		ND			
Bromodichloromethane	ND		ND		ND		ND			
Bromomethane	ND		ND		ND		ND			
Bromoform	ND		ND		ND		ND			
Carbon Disulfide	ND		ND		ND		ND			
Carbon tetrachloride	ND		ND		ND		ND			
Chlorobenzene	ND		ND		ND		ND			
Chlorodibromomethane	ND		ND		ND		ND			
Chloroform	ND		ND		ND		ND			
Chloroethane	ND		ND		ND		ND			
2-Chloroethyl vinyl ether	ND		ND		ND		ND			
Chloromethane	ND		ND		ND		ND			
Dichlorodifluoromethane	ND		ND		ND		ND			
1,1 Dichloroethene	ND		ND		ND		ND			
1,2 Dichloroethene	ND		ND		ND		ND			
1,1 Dichloroethane	ND		ND		ND		ND			
1,2 Dichloroethane	ND		ND		ND		ND			
1,2 Dichloropropane	ND		ND		ND		ND			
1,2,3-Trichloropropane	ND		ND		ND		ND			
cis-1,3-Dichloropropene	ND		ND		ND		ND			
trans-1,3-Dichloropropene	ND		ND		ND		ND			
Ethyl methacrylate	ND		ND		ND		ND			
Ehtylbenzene	ND		ND		ND		ND			
2-Hexanone	ND		ND		ND		ND			
4-Methyl-2-Pentanone	ND		ND		ND		ND			
Methylene chloride	ND		ND		ND		ND			
Methylethylketone (MEK)	ND		ND		ND		ND			
Styrene	ND		ND		ND		ND			
1,1,2,2-Tetrachloroethane	ND		ND		ND		ND			
Toluene	0.059 J,B		0.16 J		ND		ND			
1,1,1, Trichloroethane	ND		ND		ND		ND			
1,1,2-Trichloroethane	ND		ND		ND		ND			
Trichloroethene	ND		ND		ND		ND			
Trichlorofluoromethane	ND		ND		ND		ND			
Vinyl acetate	ND		ND		ND		ND			
Vinyl chloride	ND		ND		ND		ND			
Xylenes (total)	ND		ND		ND		ND			
Explosives ug/l 8330										
Cyclotetramethylenetetranitramine (HMX)	ND		ND		ND		ND			
Cyclotrimethylenetrinitramine (RDX)	ND		ND		ND		ND			
2,4 Dinitrotoluene	ND		ND		ND		ND			
2,6 Dinitrotoluene	ND		ND		ND		ND			
2,4,6-Trinitrotoluene	ND		ND		ND		ND			
Metals ug/l										
Arsenic	ND		ND		ND		ND			
Barium	18.9 B		30.2 B		25.2 B		21.6 B			
Cadmium	ND		ND		ND		ND			
Calcium	17100		27400		19000		20300			
Chromium	ND		ND		ND		ND			
Copper	5.4 B		ND		4.5 B		7.6 B			
Iron	597 MBD		544		185		422			
Lead	ND		ND		ND		ND			
Mercury	ND		ND		ND		0.13 B			
Magnesium	7880		14800		13800		18300			
Manganese	26.7		708		10.6 B		580			
Nickel	ND		2.9 B		ND		3.3 B			
Phosphorus	ND		ND		0.1		ND			
Potassium	3910 B		4420 B		4370 B		5280			
Selenium	ND		ND		ND		ND			
Silver	ND		ND		ND		ND			
Sodium	2580		2340 B		2090 B		2330 B			
Zinc	44.1		21.1		12.7 B		16.4 B			
Non Metals mg/l										
Alkalinity	59		51		62		100			
Ammonia Nitrogen	ND		ND		ND		ND			
Chemical Oxygen Demand	12		ND		11.4		23.6			
Chloride	4		2		4		3			
Cyanide	ND		ND		ND		ND			
Nitrate/Nitrite	0.1		ND		2.5		0.3			
pH (SU)	7.6		6.11		5.95		6.37			
Phenols, Total	ND		ND		ND		ND			
Specific Conductivity, Lab (umhos/cm)	16.3		201		223		204			
Sulfate	24		24		31		24			
Total Dissolved Solids	110		150		130		180			
Total Organic Carbon	5		2		3		7			
Turbidity (Total Suspended Solids) NTU	110		3.5		17		29			

SUMMARY OF GROUNDWATER MONITORING RESULTS

RAMSDELL LANDFILL - MONITORING WELL 010

ANALYTE**, UNITS, METHOD NO.	1998			1999			
Sample Date:	7/25/98	9/19/98	10/19/98	2/14/99	4/10/99	5/27/99	12/21/99
VOCs ug/l: 8260							
Acetone	ND	ND	ND	ND	ND	ND	1.1
Acrolein	ND	ND	ND	ND	ND	ND	ND
Acrylonitrile	ND	ND	ND	ND	ND	ND	ND
Benzene	ND	ND	ND	ND	ND	ND	0.14
Bromodichloromethane	ND	ND	ND	ND	ND	ND	ND
Bromomethane	ND	ND	ND	ND	ND	ND	ND
Bromoform	ND	ND	ND	ND	ND	ND	ND
Carbon Disulfide	ND	ND	ND	ND	ND	ND	ND
Carbon tetrachloride	ND	ND	ND	ND	ND	ND	ND
Chlorobenzene	ND	ND	ND	ND	ND	ND	ND
Chlorodibromomethane	ND	ND	ND	ND	ND	ND	ND
Chloroform	ND	ND	ND	ND	ND	ND	ND
Chloroethane	ND	ND	ND	ND	ND	ND	ND
2-Chloroethyl vinyl ether	ND	ND	ND	ND	ND	ND	ND
Chloromethane	ND	ND	ND	ND	ND	ND	ND
Dichlorodifluoromethane	ND	ND	ND	ND	ND	ND	ND
1,1 Dichloroethene	ND	ND	ND	ND	ND	ND	ND
1,2 Dichloroethene	ND	ND	ND	ND	ND	ND	ND
1,1 Dichloroethane	ND	ND	ND	ND	ND	ND	ND
1,2 Dichloroethane	ND	ND	ND	ND	ND	ND	ND
1,2 Dichloropropane	ND	ND	ND	ND	ND	ND	ND
1,2,3-Trichloropropane	ND	ND	ND	ND	ND	ND	ND
cis-1,3-Dichloropropene	ND	ND	ND	ND	ND	ND	ND
trans-1,3-Dichloropropene	ND	ND	ND	ND	ND	ND	ND
Ethyl methacrylate	ND	ND	ND	ND	ND	ND	ND
Ehtylbenzene	ND	ND	ND	ND	ND	ND	ND
2-Hexanone	ND	ND	ND	ND	ND	ND	ND
4-Methyl-2-Pentanone	ND	ND	ND	ND	ND	ND	ND
Methylene chloride	ND	ND	0.67	5	ND	ND	ND
Methylethylketone (MEK)	ND	ND	ND	ND	ND	ND	ND
Styrene	ND	ND	ND	ND	ND	ND	ND
1,1,2,2-Tetrachloroethane	ND	ND	ND	ND	ND	ND	ND
Toluene	0.72	ND	ND	ND	ND	ND	0.1
1,1,1, Trichloroethane	ND	ND	ND	ND	ND	ND	ND
1,1,2-Trichloroethane	ND	ND	ND	ND	ND	ND	ND
Trichloroethene	ND	ND	ND	ND	ND	ND	ND
Trichlorofluoromethane	ND	ND	ND	ND	ND	ND	ND
Vinyl acetate	ND	ND	ND	ND	ND	ND	ND
Vinyl chloride	ND	ND	ND	ND	ND	ND	ND
Xylenes (total)	ND	ND	ND	ND	ND	ND	ND
Explosives ug/l: 8330							
Cyclotetramethylenetetranitramine (HMX)	ND	ND	ND	ND	ND	ND	ND
Cyclotrimethylenetrinitramine (RDX)	ND	ND	ND	ND	ND	ND	ND
2,4 Dinitrotoluene	ND	ND	ND	ND	ND	ND	ND
2,6 Dinitrotoluene	ND	ND	ND	ND	ND	ND	ND
2,4,6-Trinitrotoluene	ND	ND	ND	ND	ND	ND	ND
Metals ug/l:							
Arsenic	ND	ND	ND	ND	ND	ND	ND
Barium	16.7	6.5	4	3.4	4	7.4	ND
Cadmium	ND	ND	ND	ND	ND	ND	ND
Calcium	66600	63500	63100	60400	60600	64300	70000
Chromium	ND	ND	ND	ND	ND	ND	ND
Copper	ND	ND	ND	ND	ND	ND	ND
Iron	93.5	86.3	139	ND	66.6	ND	ND
Lead	ND	ND	ND	ND	ND	ND	ND
Mercury	ND	ND	ND	ND	ND	ND	ND
Magnesium	26800	29000	24200	25400	26400	27600	29700
Manganese	3480	871	481	822	664	577	1220
Nickel	34.8	ND	17.2	ND	ND	25.2	10
Phosphorus							ND
Potassium	3570	3540	2920	2920	2880	3250	2710
Selenium	ND	ND	ND	ND	ND	ND	ND
Silver	ND	ND	ND	ND	ND	0.75	ND
Sodium	5490	3880	4520	5050	5640	7890	5260
Zinc	38.8	ND	ND	22.9	24.3	88.4	47.7
Non Metals mg/l:							
Alkalinity				150	130	100	130
Ammonia Nitrogen				ND	ND	ND	ND
Chemical Oxygen Demand				26	ND	ND	ND
Chloride				8.8	12.4	18.4	10
Cyanide	ND	ND	ND	ND	ND	ND	ND
Nitrate/Nitrite				0.3	0.3	0.1	0.1
pH (SU)				6.5	6.5	6.4	6.6
Phenols, Total				ND	ND	0.047	0.25
Specific Conductivity, Lab (umhos/cm)				340	480	610	550
Sulfate				151	165	184	180
Total Dissolved Solids				380	400	400	380
Total Organic Carbon				2	1	2	1
Turbidity (Total Suspended Solids) NTU							2.1

SUMMARY OF GROUNDWATER MONITORING RESULTS

RAMSDELL LANDFILL - MONITORING WELL 010

ANALYTE**, UNITS, METHOD NO.	2000						2001			
Sample Date	2/23/00	SSD	6/21/00	SSD	12/13/00	SSD	4/30/01	SSD		
VOCs ug/l 8260										
Acetone	0.92 J		ND		2.5 J,B		ND			
Acrolein	ND		ND		ND		ND			
Acrylonitrile	ND		ND		ND		ND			
Benzene	ND		ND		ND		ND			
Bromodichloromethane	ND		ND		ND		ND			
Bromomethane	ND		ND		ND		ND			
Bromoform	ND		ND		ND		ND			
Carbon Disulfide	ND		ND		ND		ND			
Carbon tetrachloride	ND		ND		ND		ND			
Chlorobenzene	ND		ND		ND		ND			
Chlorodibromomethane	ND		ND		ND		ND			
Chloroform	ND		0.12 J		ND		ND			
Chloroethane	ND		ND		ND		ND			
2-Chloroethyl vinyl ether	ND		ND		ND		ND			
Chloromethane	ND		ND		ND		ND			
Dichlorodifluoromethane	ND		ND		ND		ND			
1,1 Dichloroethene	ND		ND		ND		ND			
1,2 Dichloroethene	ND		ND		ND		ND			
1,1 Dichloroethane	ND		ND		ND		ND			
1,2 Dichloroethane	ND		ND		ND		ND			
1,2 Dichloropropane	ND		ND		ND		ND			
1,2,3-Trichloropropane	ND		ND		ND		ND			
cis-1,3-Dichloropropene	ND		ND		ND		ND			
trans-1,3-Dichloropropene	ND		ND		ND		ND			
Ethyl methacrylate	ND		ND		ND		ND			
Ehtylbenzene	ND		ND		ND		ND			
2-Hexanone	ND		ND		ND		ND			
4-Methyl-2-Pentanone	ND		ND		ND		ND			
Methylene chloride	ND		0.12 J,B		ND		ND			
Methylethylketone (MEK)	ND		ND		ND		ND			
Styrene	ND		ND		ND		ND			
1,1,2,2-Tetrachloroethane	ND		ND		ND		ND			
Toluene	0.074 J,B		0.16 J		ND		ND			
1,1,1, Trichloroethane	ND		ND		ND		ND			
1,1,2-Trichloroethane	ND		ND		ND		ND			
Trichloroethene	ND		ND		ND		ND			
Trichlorofluoromethane	ND		ND		ND		ND			
Vinyl acetate	ND		ND		ND		ND			
Vinyl chloride	ND		ND		ND		ND			
Xylenes (total)	ND		ND		ND		ND			
Explosives ug/l 8330										
Cyclotetramethylenetetranitramine (HMX)	ND		ND		ND		ND			
Cyclotrimethylenetrinitramine (RDX)	ND		ND		ND		ND			
2,4 Dinitrotoluene	ND		ND		ND		0.36			
2,6 Dinitrotoluene	ND		ND		ND		ND			
2,4,6-Trinitrotoluene	ND		ND		ND		ND			
Metals ug/l										
Arsenic	ND		ND		ND		ND			
Barium	ND		5.8 B		ND		23.1 B			
Cadmium	ND		ND		ND		ND			
Calcium	83400		80900		78700		15700			
Chromium	ND		ND		ND		ND			
Copper	23.5 B		10.1 B		ND		ND			
Iron	ND		ND		ND		4530			
Lead	ND		ND		ND		ND			
Mercury	ND		ND		ND		0.090 B			
Magnesium	38400		32300		51000		10200			
Manganese	1420 MBB		147		3170		1410			
Nickel	ND		13.0 B		11.8 B		75.3			
Phosphorus	ND		ND		ND		ND			
Potassium	3930 B		3450 B		4530 B		3980 B			
Selenium	ND		ND		ND		ND			
Silver	ND		ND		ND		ND			
Sodium	5680		12500		7300		2020 B			
Zinc	45.9		51.1		22.4		70.8			
Non Metals mg/l										
Alkalinity	150		100		160		ND			
Ammonia Nitrogen	1.3		ND		ND		ND			
Chemical Oxygen Demand	12		ND		ND		ND			
Chloride	10		31		12 J		3			
Cyanide	ND		ND		ND		ND			
Nitrate/Nitrite	ND		ND		ND		ND			
pH (SU)	7.1	YES	6.5	YES	6.8		5			
Phenols, Total	ND		ND		0.04		ND			
Specific Conductivity, Lab (umhos/cm)	75.5		655		680		220			
Sulfate	160		280		160		110			
Total Dissolved Solids	420		430		460		180			
Total Organic Carbon	2		ND		2		ND			
Turbidity (Total Suspended Solids) NTU	110		20		9.2		250			

SUMMARY OF GROUNDWATER MONITORING RESULTS

RAMSDELL LANDFILL - MONITORING WELL 011

ANALYTE**, UNITS, METHOD NO.	1998			1999			
Sample Date	7/27/98	9/19/98	10/19/98	2/13/99	4/10/99	5/27/99	12/21/99
VOCs ug/l: 8260							
Acetone	ND	ND	ND	ND	ND	ND	1.5
Acrolein	ND	ND	ND	ND	ND	ND	ND
Acrylonitrile	ND	ND	ND	ND	ND	ND	ND
Benzene	ND	ND	ND	ND	ND	ND	0.24
Bromodichloromethane	ND	ND	ND	ND	ND	ND	ND
Bromomethane	ND	ND	ND	ND	ND	ND	ND
Bromoform	ND	ND	ND	ND	ND	ND	ND
Carbon Disulfide	ND	ND	ND	ND	ND	ND	ND
Carbon tetrachloride	ND	ND	ND	ND	ND	ND	ND
Chlorobenzene	ND	ND	ND	ND	ND	ND	ND
Chlorodibromomethane	ND	ND	ND	ND	ND	ND	ND
Chloroform	ND	ND	ND	ND	ND	ND	ND
Chloroethane	ND	ND	ND	ND	ND	ND	ND
2-Chloroethyl vinyl ether	ND	ND	ND	ND	ND	ND	ND
Chloromethane	ND	ND	ND	ND	ND	ND	ND
Dichlorodifluoromethane	ND	ND	ND	ND	ND	ND	ND
1,1 Dichloroethene	ND	ND	ND	ND	ND	ND	ND
1,2 Dichloroethene	ND	ND	ND	ND	ND	ND	ND
1,1 Dichloroethane	ND	ND	ND	ND	ND	ND	ND
1,2 Dichloroethane	ND	ND	ND	ND	ND	ND	ND
1,2 Dichloropropane	ND	ND	ND	ND	ND	ND	ND
1,2,3-Trichloropropane	ND	ND	ND	ND	ND	ND	ND
cis-1,3-Dichloropropene	ND	ND	ND	ND	ND	ND	ND
trans-1,3-Dichloropropene	ND	ND	ND	ND	ND	ND	ND
Ethyl methacrylate	ND	ND	ND	ND	ND	ND	ND
Ehtylbenzene	ND	ND	ND	ND	ND	ND	ND
2-Hexanone	ND	ND	ND	ND	ND	ND	ND
4-Methyl-2-Pentanone	ND	ND	ND	ND	ND	ND	ND
Methylene chloride	ND	ND	0.74	5	ND	ND	ND
Methylethylketone (MEK)	ND	ND	ND	ND	ND	ND	ND
Styrene	ND	ND	ND	ND	ND	ND	ND
1,1,2,2-Tetrachloroethane	ND	ND	ND	ND	ND	ND	ND
Toluene	ND	ND	ND	0.46	ND	ND	0.097
1,1,1, Trichloroethane	ND	ND	ND	ND	ND	ND	ND
1,1,2-Trichloroethane	ND	ND	ND	ND	ND	ND	ND
Trichloroethene	ND	ND	ND	ND	ND	ND	ND
Trichlorofluoromethane	ND	ND	ND	ND	ND	ND	ND
Vinyl acetate	ND	ND	ND	ND	ND	ND	ND
Vinyl chloride	ND	ND	ND	ND	ND	ND	ND
Xylenes (total)	ND	ND	ND	ND	ND	ND	ND
Explosives ug/l: 8330							
Cyclotetramethylenetetranitramine (HMX)	0.067	ND	ND	ND	ND	ND	ND
Cyclotrimethylenetrinitramine (RDX)	ND	ND	ND	ND	ND	ND	ND
2,4 Dinitrotoluene	ND	ND	ND	ND	ND	ND	ND
2,6 Dinitrotoluene	ND	ND	ND	ND	ND	ND	ND
2,4,6-Trinitrotoluene	ND	ND	ND	ND	ND	ND	ND
Metals ug/l:							
Arsenic	11.3	ND	ND	ND	ND	ND	ND
Barium	38.2	32.8	28.4	33.6	29.6	32.1	23.5
Cadmium	ND	ND	ND	ND	ND	ND	ND
Calcium	15200	24100	26600	14800	12600	12000	57900
Chromium	ND	ND	ND	ND	ND	ND	ND
Copper	ND	ND	ND	5.7	ND	ND	6.8
Iron	5630	2470	1550	2450	1990	901	ND
Lead	ND	ND	ND	ND	ND	ND	ND
Mercury	0.1	ND	ND	ND	ND	ND	ND
Magnesium	9190	13600	14400	9480	8170	8390	26000
Manganese	1720	2620	3020	1750	1200	1270	3680
Nickel	158	150	118	124	105	104	84.9
Phosphorus							ND
Potassium	4960	5050	4080	4380	3930	4360	4000
Selenium	ND	ND	ND	ND	ND	ND	ND
Silver	ND	ND	ND	ND	0.8	ND	ND
Sodium	1780	2750	2850	2090	2060	2310	3130
Zinc	94.4	133	ND	165	ND	114	84.3
Non Metals mg/l:							
Alkalinity				14	ND	ND	70
Ammonia Nitrogen				ND	ND	ND	ND
Chemical Oxygen Demand				ND	ND	ND	ND
Chloride				2.4	3.2	3.1	7
Cyanide	ND	ND	ND	ND	ND	ND	ND
Nitrate/Nitrite				ND	ND	ND	ND
pH (SU)				4.7	4.6	4.4	6.2
Phenols, Total				ND	0.024	ND	ND
Specific Conductivity, Lab (umhos/cm)				210	180	220	350
Sulfate				78.3	89	90.1	150
Total Dissolved Solids				160	160	140	260
Total Organic Carbon				ND	ND	2	ND
Turbidity (Total Suspended Solids) NTU							0.8

SUMMARY OF GROUNDWATER MONITORING RESULTS

RAMSDELL LANDFILL - MONITORING WELL 011

ANALYTE**, UNITS, METHOD NO.	2000						2001			
Sample Date:	2/23/00	SSD	6/21/00	SSD	12/31/00	SSD	4/30/01			
VOCs ug/l: 8260										
Acetone	ND		ND		1.4 J,B		ND			
Acrolein	ND		ND		ND		ND			
Acrylonitrile	ND		ND		ND		ND			
Benzene	ND		ND		ND		ND			
Bromodichloromethane	ND		ND		ND		ND			
Bromomethane	ND		ND		ND		ND			
Bromoform	ND		ND		ND		ND			
Carbon Disulfide	ND		ND		ND		ND			
Carbon tetrachloride	ND		ND		ND		ND			
Chlorobenzene	ND		ND		ND		ND			
Chlorodibromomethane	ND		ND		ND		ND			
Chloroform	ND		ND		ND		ND			
Chloroethane	ND		ND		0.38 J		ND			
2-Chloroethyl vinyl ether	ND		ND		ND		ND			
Chloromethane	ND		ND		ND		ND			
Dichlorodifluoromethane	ND		ND		ND		ND			
1,1 Dichloroethene	ND		ND		ND		ND			
1,2 Dichloroethene	ND		ND		ND		ND			
1,1 Dichloroethane	ND		ND		ND		ND			
1,2 Dichloroethane	ND		ND		ND		ND			
1,2 Dichloropropane	ND		ND		ND		ND			
1,2,3-Trichloropropane	ND		ND		ND		ND			
cis-1,3-Dichloropropene	ND		ND		ND		ND			
trans-1,3-Dichloropropene	ND		ND		ND		ND			
Ethyl methacrylate	ND		ND		ND		ND			
Ehtylbenzene	ND		ND		ND		ND			
2-Hexanone	ND		ND		ND		ND			
4-Methyl-2-Pentanone	ND		ND		ND		ND			
Methylene chloride	ND		ND		0.19 J		ND			
Methylethylketone (MEK)	ND		ND		ND		ND			
Styrene	ND		ND		ND		ND			
1,1,2,2-Tetrachloroethane	ND		ND		ND		ND			
Toluene	ND		0.15 J		ND		ND			
1,1,1, Trichloroethane	ND		ND		ND		ND			
1,1,2-Trichloroethane	ND		ND		ND		ND			
Trichloroethene	ND		ND		ND		ND			
Trichlorofluoromethane	ND		ND		ND		ND			
Vinyl acetate	ND		ND		ND		ND			
Vinyl chloride	ND		ND		ND		ND			
Xylenes (total)	ND		ND		ND		ND			
Explosives ug/l: 8330										
Cyclotetramethylenetetranitramine (HMX)	ND		ND		ND		ND			
Cyclotrimethylenetrinitramine (RDX)	ND		ND		ND		ND			
2,4 Dinitrotoluene	ND		ND		ND		ND			
2,6 Dinitrotoluene	ND		ND		ND		ND			
2,4,6-Trinitrotoluene	ND		ND		ND		ND			
Metals ug/l:										
Arsenic	ND		ND		ND		ND			
Barium	34.5 B		33.4 B		15.8 B		ND			
Cadmium	ND		0.30 B		ND		ND			
Calcium	4470		17400		41100		81400			
Chromium	2.7		ND		ND		ND			
Copper	ND		ND		ND		ND			
Iron	86.7 B,MBE		797		ND		ND			
Lead	ND		ND		ND		ND			
Mercury	ND		ND		ND		ND			
Magnesium	18200		10300		20800		40800			
Manganese	3030 MBB		1440		3150		213			
Nickel	75		90.2		64		6.3 B			
Phosphorus	ND		ND		ND		ND			
Potassium	4040 B		4400 B		3420 B		3970 B			
Selenium	ND		ND		ND		ND			
Silver	ND		ND		ND		ND			
Sodium	2840 B		2140 B		3050 B		10300			
Zinc	106		99.2		36.1		14.2 B			
Non Metals mg/l										
Alkalinity	80		ND		97		120			
Ammonia Nitrogen	ND		ND		ND		ND			
Chemical Oxygen Demand	ND		ND		ND		ND			
Chloride	5		3		4		21			
Cyanide	ND		ND		ND		ND			
Nitrate/Nitrite	ND		ND		ND		ND			
pH (SU)	7.2		4.9		6.2		7.8			
Phenols, Total	ND		ND		ND		ND			
Specific Conductivity, Lab (umhos/cm)	237		184		440		660			
Sulfate	110		89		96		200			
Total Dissolved Solids	220		150		310		490			
Total Organic Carbon	ND		ND		1		ND			
Turbidity (Total Suspended Solids) NTU	ND		3.3		58		26			

RAMSDELL QUARRY LANDFILL

GROUNDWATER MONITORING PLAN

GENERAL HYDROGEOLOGY INFORMATION

The Ravenna Army Ammunition Plant is located in northeastern Ohio in Portage and Trumbull Counties. It is approximately 25 miles east of Akron and 5 miles east of Ravenna. The installation includes 21,419 acres in a tract 3.5 miles wide and 11 miles long. The Ramsdell Quarry Landfill is located in the northeast section of the installation tract.

Physiography

The RVAAP lies in the glaciated Allegheny Plateau section of the Appalachian Plateau Province. The western and northern portions of the installation display low hills and a dendritic surface drainage pattern. Eastern and southern portions are characterized by an undulating to moderately level land surface, with less stream dissection of the original glacially deposited surface.

Surface Waters

All of RVAAP is situated within the Ohio River Basin. The West Branch of the Mahoning River is the major surface stream in the area. This river flows in a southerly direction past the west end of the installation where it turns to the east and flows into the M.J. Kirwan Reservoir. From the reservoir, the west branch continues to flow in an easterly direction along the installation southern boundary until joining the Mahoning River east of the installation.

Ravenna's gently rolling terrain is marked with marshy areas and flowing and intermittent streams whose headwaters area is located in the installation's hills. Three primary water courses drain the installation: South Fork of Eagle Creek, Sand Creek, and Hinkley Creek. Sand Creek flows in an easterly to northeasterly direction through the central portion of the installation to its confluence with the South Fork of Eagle Creek. Most of Sand Creek's drainage area of 132.9 square mile is included within RVAAP's boundaries. The South Fork of Eagle Creek flows along the inside of the northern boundary of RVAAP. Hinkley Creek originates about 2 miles north of RVAAP and flows through the western portion of the installation in a southerly direction.

Approximately 45 ponds or small reservoirs are scattered throughout the installation. Many were built in natural drainage ways and incorporated into the plant operations as holding and settling ponds. Others were caused by beaver activity or resulted from glacial features. Most of the water bodies support an abundance of aquatic biota and are well stocked with fish.

Geology

The glacially deposited surface material of RVAAP consists of glacial till and sand and gravel. Till thickness in the major part of the central and eastern portion of the installation averages less than 45 feet. Till thickness in the western section of the installation is between 18 and 36 feet. Till thickness can vary to less than 3 feet in some locations.

In the central portion of the installation, and oriented in a southwest-northeast direction, is a buried glacial valley. Depths of unconsolidated sediments in the burial glacial valley range between 100 to 200 feet.

Bedrock formation underlying the glacial deposits consists of consolidated sediments of the Carboniferous age. These sediments dip gently to the southeast. Mississippian-aged shales and sandstones of the Cuyahoga group are the oldest formation to outcrop within the installation boundary. Most of the installation is underlain by Pennsylvanian-aged conglomerates, shales, and sandstones of the Pottsville formation.

HYDROGEOLOGIC CONDITIONS

The Ramsdell Quarry Landfill is located in an abandoned quarry which was excavated approximately 30 to 40 feet below the surrounding ground surface into the Sharon Member sandstone/conglomerate unit. The Sharon Member is the oldest member of the Pennsylvanian-age Pottsville Formation. Ground water occurs in the Sharon Member approximately 20 to 25 feet below the ground surface at the site. In addition to primary porosity, the Sharon Member contains secondary porosity joints and fractures at deeper levels. A small pond of water at the northern end of the quarry probably represents the aquifer potentiometric surface. The soils overlying the Sharon Member are thin, glacial till-derived loams which are not saturated. The Sharon Member is underlain unconformably by an aquiclude, the Meadville Shale member of the Mississippian-age Cuyahoga Group.

GENERAL MONITORING PROGRAM

The groundwater monitoring program for the Ramsdell Quarry Landfill includes five existing ground-water monitoring wells (MW-1, MW-2, MW-3, MW-4, and MW-5). The locations of the wells are shown in Figure 1. Well number MW-4 is the upgradient well for the site, but wells MW-2 and MW-1 may also be considered to be hydrologically upgradient. The first four wells were installed in June 1987 as open holes in the Sharon Member sandstone/conglomerate unit. In January 1988, the open holes were screened in the uppermost saturated zone and cased with 2-inch diameter polyvinyl chloride (PVC). Well MW-5 was installed in January 1988 to provide an additional downgradient well at the site.

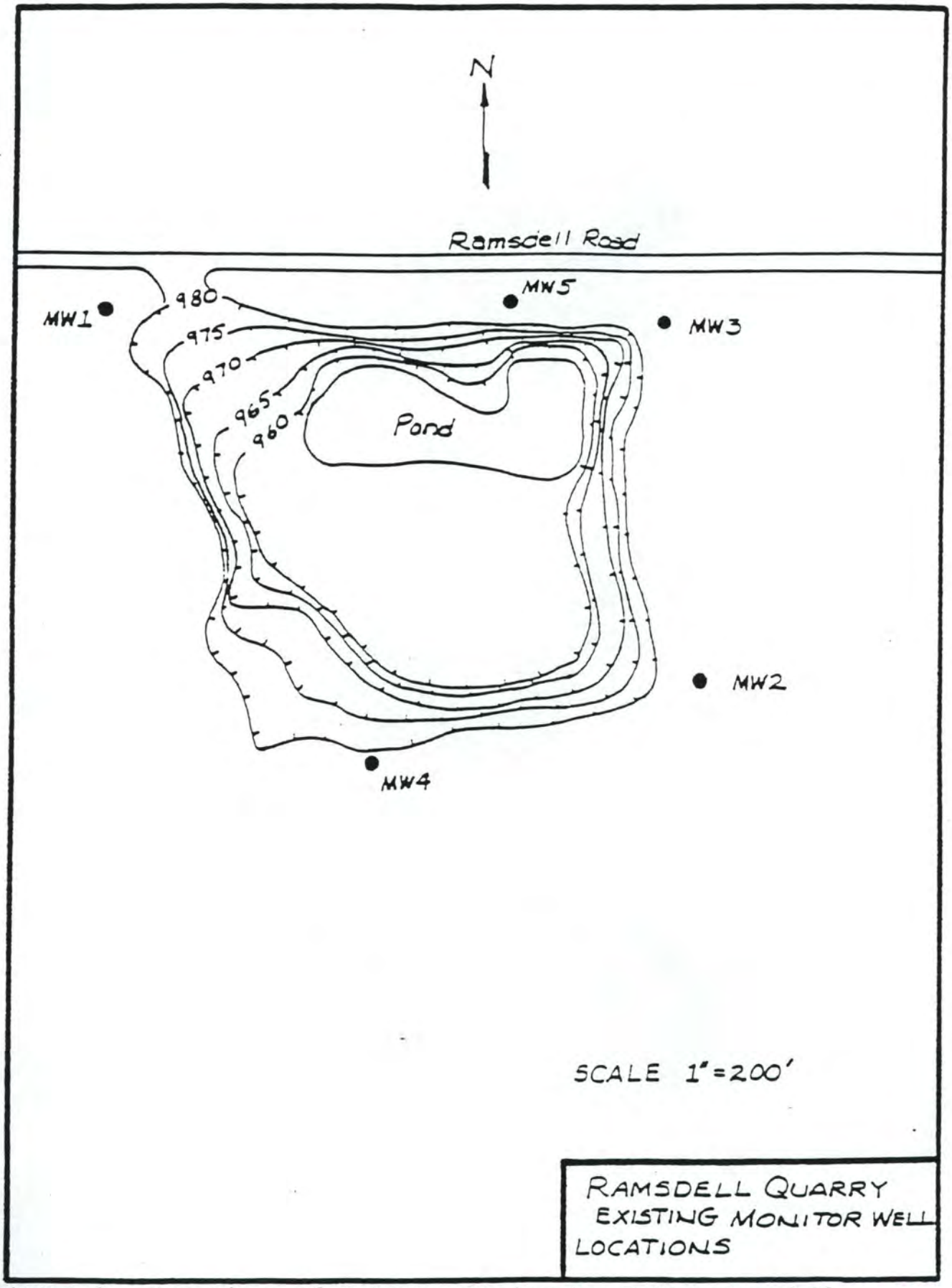

Figure 1. Locations of Existing Monitoring Wells, Ramsdell Quarry Landfill, Ravenna AAP

Each well is finished with an 8" diameter by 10 foot long steel locking cap firmly grouted into the bedrock for security. An illustration of the typical monitoring well installation for the Ramsdell Landfill Wells is shown in Figure 2.

THE GROUND WATER MONITORING PROGRAM SAMPLING AND ANALYTICAL PLAN

General

Water-quality sampling is conducted within the screened interval of each well. Sample collection is from all 5 wells. The samples are analyzed for total metals, explosive compounds, and the parameters listed in OEPA Solid Waste Disposal regulations. A list of the analytical parameters for RVAAP's Ramsdell Landfill water quality monitoring program is presented in Table 1.

The wells have been sampled semiannually from June 1987 through November 1991 and quarterly from June 1992 through February 1993. The wells will be sampled semiannually thereafter.

SAMPLE COLLECTION

Static Water Level Elevation Measurements

Prior to any well evacuation/purging or actual water sample acquisitions RVAAP personnel will take a static water level reading. Measurements will be taken with an electronic well tape. The level reading will be measured from the top of the monitoring well casing to the static water level within the well. A plumb depth measurement will be taken from the top of the well casing to the bottom of the screen to assure sediment has not impacted well recharging capabilities. Static water level and plumb depth measurement data shall be logged using the reporting format presented in Figure 3.

Well Evacuation

The purpose of well evacuation is to purge the well casing of stagnant/non-representative waters. The well evacuation process will be performed by knowledgeable in-house personnel. The purge method for all wells will be by use of a dedicated Teflon bottom discharge bailer. Three casing volumes will be purged from each well; unless the well is low yielding then it will be evacuated to dryness only one time. All volumes of water evacuated from the wells will be collected and quantities recorded on the Figure 3 form. Disposition status of collected purge waters will not be determined until after receipt of respective well analytical data. If collected waters are non-hazardous they will be deposited into the local sewer system; hazardous purge waters will either be treated by onsite NPDES carbon adsorption units or turned over to the U.S. Army Defense Reutilization Materials Office (DRMO) for proper disposal. Assigned personnel will

Figure 2. Typical Monitoring Well Installation

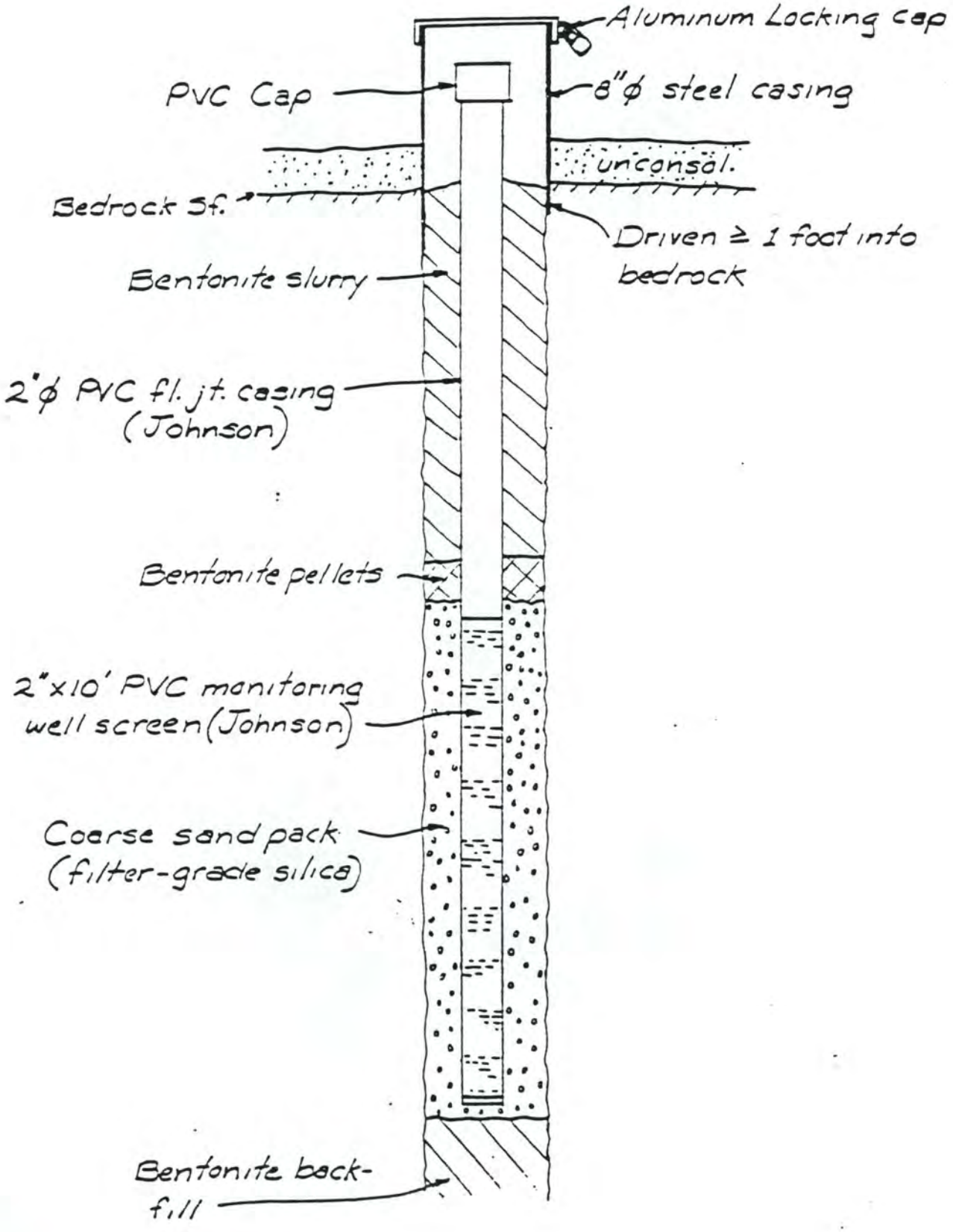

FIGURE 3

FIELD LOG DATA FOR RAMSDELL LANDFILL WELL PURGE

WELL NO. _____ DATE: _____

TIME START PURGE: _____ TIME END PURGE: _____

PLUMB DEPTH (Top of Casing)

START: _____ FINISH: _____

WATER LEVEL (Top of Casing)

START: _____ FINISH: _____

DEPTH OF WATER IN WELL: _____

(start plumb depth minus start water level)

PURGE MINIMUM IS THREE CASING VOLUMES PER WELL.

If well is low yielding and purge minimum cannot be achieved or well will not recharge within two hours; purge minimum will only be to well dryness one time. Plumb depth and water measurement will be recorded to 0.01 feet.

	1ST	2ND	3RD	TOTAL
GALLONS PURGED				
TEMPERATURE				
PH (END OF PURGE ONLY)				

Any decontamination procedure will consist of first washing in alcohol, then by a nonphosphate detergent scrub, then by a two rinse minimum of DI water or until all visible signs of a detergent are absent. All decontamination fluids generated will be disposed into the RVAAP sewage treatment plant.

assure well evacuation processes do not generate agitated well waters that would result in the loss of volatiles. To avoid volatile loss, attention must be paid to entry and removal of the bladder pump and during period of rapid drawdown that cause encompassing groundwaters to vigorously cascade down the sides of the screen.

Sampling Equipment

Each well will be sampled by a dedicated teflon bottom discharging bailer with dedicated attached retrieval cord. The specific bailer will be the same dedicated bailer mentioned in the WELL EVACUATION section of this part.

Sample Containers, Handling, and Preservation

All sample containers will be provided by a RVAAP contracted laboratory. The sample containers will be new or thoroughly cleaned based upon contracted laboratory's Quality Assurance/Quality Control (QA/QC) protocol policies. The sample containers will be sized, typed, and appropriate for their assigned analyte. Sample container and handling criteria are expressed in Table 2.

Sampling Procedures

Sampling from any monitoring well will not begin until the well has been adequately purged or evacuated.

Sample collection from the landfill groundwater monitoring wells will always begin with the upgradient well upon initiating the sampling, in order to preclude contamination from the downgradient wells.

Samples will be obtained according to their order in magnitude to the targeted analyte's volatile sensitivity. The landfill groundwater samples will be collected in the following preferred order:

TABLE 1

- Volatiles (VOCs)
- Total Organic Carbon (TOC)
- Explosives
- Total Metals
- Total Dissolved Solids
- Phenols
- Cyanide
- Sulfate and Chlorides
- Turbidity
- Ammonia Nitrogen (NH^3/N), Nitrite (NO_2), and Nitrate (NO_3).
- SPECIFIC CONDUCTIVITY

The sampling process will be performed in a manner that minimizes groundwater agitation during the entry and departure of the dedicated bailer. Sample transfer will be done in a way that assures minimal agitation, aeration, and contact with the atmosphere.

TABLE 2

SAMPLE COLLECTION REQUIREMENTS

ANALYSIS	MINIMUM REQUIREMENTS	CONTAINER	SPECIAL PREPARATION	PRESERVATION	HOLDING TIME
ORGANICS					
Volatiles or Trihalomethanes	40 ml. (x3)	G, Teflon-lined Cap	No Head Space	4 °, 1:1 HCL to pH<2	14 Days
Explosives	1,000 ml.	G, Teflon-lined Cap	Protect from Light	4°	>30 Days
METALS					
Total Metals	1,000 ml.	P	None	HNO_3 to pH <2	6 Months
Dissolved Metals	1,000 ml.	P	Filtration 0.45	HNO_3 to pH <2	6 Months
Total Hg	125 ml.	G, Teflon-lined Cap	None	4°, HNO_3 to pH <2, 0.05% Potassium Dichromate	15 Days
Dissolved Hg	125 ml.	G, Teflon-lined Cap	Filtration 0.45	4°, HNO_3 to pH <2, 0.05% Potassium Dichromate	15 Days
NONMETALS					
Acidity	250 ml.	G, P	None	4°	14 Days
Alkalinity	250 ml.	G, P	None	4°	14 Days 2 Days-NPDWR/USA
Ammonia	250 ml.	G, P	None	4°, H_2SO_4 to pH <2	28 Days

ANALYSIS	MINIMUM REQUIREMENTS	CONTAINER	SPECIAL PREPARATION	PRESERVATION	HOLDING TIME
Chemical Oxygen Demand (COD)	125 ml.	G, P	None	4°, H_2SO_4 to pH <2	28 Days
Chloride	250 ml.	G, P	None	Room Temperature	28 Days 7 Days-NSDWR
Cyanide	1,000 ml.	G, P	None	4°, NaOH to pH > 12	14 Days
Grease & Oil	1,000 ml.	G, Teflon-lined Cap	None	4°, H_2SO_4 to pH < 2	28 Days
Kjeldahl Nitrogen, Total	250 ml.	G, P	None	4°, H_2SO_4 to pH < 2	28 Days
Nitrate (NO_3)	125 ml.	G, P	None	4°	2 Days
Nitrate/Nitrite Nitrogen	125 ml.	G, P	None	4°, H_2SO_4 to pH < 2	28 Days
Nitrite (NO_2)	125 ml.	G, P	None	4°	2 Days
Organic Carbon Total (TOC)	125 ml.	G, P	None	4°, H_2SO_4 to pH < 2	28 Days
pH	150 ml.	G, P	None	4°	2 Days
Phenol, Total	1,000 ml.	G, Teflon-lined Cap	None	4°, H_2SO_4 to pH < 2	28 Days
Phosphate, Total (PO_4/P)	150 ml.	G, P	None	4°, H_2SO_4 to pH < 2	28 Days
Total Dissolved Solids (TDS)	250 ml.	G, P	None	4°	7 Days
Specific Conductivity	250 ml.	G, P	None	4°	28 Days
Sulfate	250 ml.	G, P	None	4°	28 Days 7 Days - NPDWR
TOC, Soluble	125 ml.	G, P	Filtration	4°, H_2SO_4 to pH < 2	28 Days
Turbidity	150 ml.	G, P	None	4°	2 Days
Temperature		G, P		None	Immediately
SOILS					
Total Metals	32 oz	Wide Mouth G	Soils & Sludges	Cool	6 Months

ANALYSIS	MINIMUM REQUIREMENTS	CONTAINER	SPECIAL PREPARATION	PRESERVATION	HOLDING TIME
Explosives	100 g	Wide Mouth G w/Teflon Lid	Protect from Sunlight		>30 Days
Kjeldahl Nitrogen, Total (TKN)	60 g soil	P or G, Wide Mouth		4°C	60 Days
Nitrite/Nitrate Nitrogen (NO_2NO_3)	60 g soil	P or G, Wide Mouth	Soils & Sludges	4°C	60 Days
Phosphorus, Available (PO_4/A)	60 g soil	P or G, Wide Mouth	Soils & Sludges	4°C	60 Days

NOTE:

P = polyethylene
G = glass

The dedicated sampling equipment should never be placed directly on the ground or come in contact with other contaminated surfaces during the sampling process. In the event contamination occurs RVAAP personnel will discontinue the sampling process until the dedicated bailer or sampling equipment is decontaminated. The decontamination procedure will consist of washing in alcohol (isopropyl), followed by a nonphosphate detergent scrub/scouring followed by a minimum of two rinses of distilled water or until all visible signs of detergent are removed. All fluids used in the decontamination process will be collected and disposed of in the RVAAP sewage treatment/collection system.

Field Analyses

RVAAP personnel will perform pH and temperature field measurements.

pH Field measurements will be performed both after well purging and after sampling of the respective monitoring well. To avoid contamination, all well pH measurements will be performed by extracting via the dedicated bailer a representative well sample and transferring to a suitable clean plastic container. The container will be gently rinsed at least twice with the well sample prior to filling the container and placement of the pH probe for measurement. Practical methodology used to transfer sample from bailer to container will be exercised; minimizing agitation and atmospheric contact. The pH probe will be standardized with known 4.0, 7.0, and 10.0 pH standard buffer solution. The probe will be thoroughly cleaned/rinsed with deionized (DI) water and aired to remove DI excess. Temperature compensation between probe and sample will be performed using an ASTM certified thermometer or a thermometer that has been evaluated and recalibrated against a certified thermometer. RVAAP's pH meter by choice will be an Orion 290-A model for field pH measurements.

A temperature reading will be taken of the well and sample congruous with the time the pH measurement is taken. The temperature reading will be taken by a thermometer that's either ASTM certified or one that's been evaluated and calibrated against the certified thermometer.

Due to the relative stability of a substance's specific conductivity (analogous to electrical resistance in micromhos) RVAAP elects that this analysis be performed at the contracted laboratory.

Field and Laboratory Quality Assurance/Quality Control (QA/QC)

Quality control in the field sampling methodology will be managed by trip blanks and duplicate samples.

Trip blank containers will be sourced from the contracted laboratory containing the appropriate quantity of preservative and Type II reagent grade water. The number of trip blanks will be determined by the number of sampling events. A sampling event will be qualified as

each day that sampling occurs. If the process requires two days to complete all sample acquisitions then two trip blanks will accompany the sampling barrage returning to the contracted laboratory. If sample acquisition is completed within one day then only one trip blank package will be processed for shipment to the laboratory.

Duplicate samples will follow the same scheme as the trip blanks per sampling event. The well site where duplicate samples are to be obtained will be randomly selected prior to entering the well field. Duplicate sample selection is to be identified by random drawing from one of the five wells within site. If it is determined that the sampling event will require two days to complete then another duplicate will be determined in the same manner mentioned. A duplicate sample's site will never be revisited until all five monitoring wells have been selected as a QC duplicate sample site.

Laboratory QC shall be administered via laboratory equipment blanks. These QC blanks shall be used to identify matrix interferences and equipment and reagent performance. The quantity of equipment blanks shall be generated as prescribed by the laboratory's QA/QC protocol.

Field Logbook - Field Data Recordkeeping

Figure 4 delineates the type of field data that is recorded by RVAAP personnel during a sampling period at a particular compliance monitoring point. The field data is kept for each well in a ring binder type notebook.

Chain of Custody

Properly labelled samples will be placed into the contracted laboratory's provided coolers and maintained by RVAAP personnel until completion of that day's sampling round. At the end of the day's sampling, the samples will be transported to a designated secure area. The secure area will be a locked refrigerated unit maintaining temperatures no greater than 4°C. At the point of samples and cooler transfer to the secured refrigeration unit a chain of custody will be documented with a sample tracking form titled as a Chain of Custody Record (CCR); an example of which is provided as Figure 5. All internal and external custody exchanges of the samples and cooler will be documented on the CCR until there is final receipt by the contracted laboratory. The laboratory will administer their own CCR once they assume custody of RVAAP's samples. To finalize the chain of custody process data generated from the appropriate laboratory analyses will be compiled into a formal report. The contracted laboratory's final formal report shall identify test description, results, the analytical processes detection limits, units of expression, date analyzed, and analyst; which also will include the same for all field, lab, and equipment blanks as QA/QC data.

FIGURE 4

FIELD DATA LOGBOOK SHEET

RAMSDELL LANDFILL GROUNDWATER MONITORING

1. Well Identification No. _____

2. Well Depth: _____ (From top of casing to screen bottom)

3. Static Water Level Depth: _____

   Measurement Technique: _____

4. Presence of Immiscible Layers (Y or N): _____

   Detection Method: _____

5. Well Yield - High or Low: _____

6. Well Purge Procedure/Equipment: _____

   _____

7. Date and Time Well Purged: Date: _____

   Time: _____

8. Purge Volume: _____

   Purge Pumping Rate: _____

9. Collection Method of Immiscible Layers (If item #4 is "Y"): _____

   _____

   Sample I.D. NOs for Immiscible Layers: _____

10. Personnel Performing Purge: (For this well report)

    _____

    _____

11. Sample Withdrawal Procedure/Equipment: _____

    _____

12. Date and Time of Sample Collection: Date: _____

    Time: _____

FIELD DATA LOGBOOK SHEET
PAGE 2
WELL NO. _____

13. Sample Container Data:

TYPE (P, G)	SAMPLE I.D.	PRESERVATIVE(S)	ANALYTICAL PARAMETER

FIELD DATA LOGBOOK SHEET
PAGE 3
WELL NO. _____

14. Field Analysis Data and Method:

pH After Purge: _____ Method: _____

pH At Sampling: _____ Method: _____

Water Sample Temperature: _____ °C

15. Sample Distribution and Transporter:

Point of Destination: _____

Mode of Transportation: _____

Agent of Transport: _____

16. Personnel Performing Sampling: (For this well report)

_____

_____

17. Field Observations During Sampling Event: _____

_____

_____

18. Climatic Conditions: _____

_____

_____

Air Temperature: _____ °C

19. Internal Temperature of Field (refrigerated) Container:

_____ °C

20. Internal Temperature of Shipping (refrigerated) Container:

_____ °C

FIELD DATA LOGBOOK SHEET
PAGE 4
WELL NO. _____

21. Well Sampling Sequence:

MW-1: _____ Date: _____

MW-2: _____ Date: _____

MW-3: _____ Date: _____

MW-4: _____ Date: _____

MW-5: _____ Date: _____

FIGURE 5 - CHAIN OF CUSTODY RECORD

PROJECT	SAMPLERS (Signature)

CLIENT ID	SAMPLE NUMBER	DATE	TIME	ANALYSIS REQUIRED

Relinquished by: (Signature)	Received by: (Signature)	Date	Time
Relinquished by: (Signature)	Received by: (Signature)	Date	Time
Relinquished by: (Signature)	Received by: (Signature)	Date	Time
Relinquished by: (Signature)	Received by: (Signature)	Date	Time

Name and Address of Laboratory:

STATISTICAL METHODOLOGY DETERMINING THE PRESENCE OF SIGNIFICANT IMPACT VIA THE USE OF ANALYTICAL DATASETS

RVAAP will perform statistical investigation utilizing USEPA's Ground Water Information Tracking System/Statistical Analysis System (GRITS/STAT). GRITS/STAT is a comprehensive ground water computerized database system that is designed to store, analyze, and report data generated during the ground water monitoring period. GRITS/STAT 4.12 is the current version available with RVAAP's database system. RVAAP will continue to upgrade this system as newer GRITS/STAT versions become available through USEPA.

The established datasets from previous groundwater sampling at the landfill, and future datasets generated will be applied to GRITS/STAT's in-line statistical method. Based upon a preliminary selection process and USEPA's experience, RVAAP has chosen the parametric Analysis Of Variance (ANOVA). The GRITS/STAT's parametric ANOVA program tests to determine whether differences between background well means and compliance well means are statistically significant. The regulator and reader are being made aware of the potential that parametric ANOVA may not be a suitable choice for the RVAAP data. The GRITS/STAT system has a built-in Methods - Normality (M-N) compatibility program. The M-N makes a program analysis of the dataset to determine if there exists a statistical non-normality applicable to the use of parametric ANOVA. If statistical evidence delineates non-normality then another method must be selected other than parametric ANOVA. The GRITS/STAT system has the availability of several built-in alternate statistical methods. It will be a matter of applying the RVAAP dataset to a method that M-N determines to have statistical evidence of normality. Based upon EPA's historical recommendation of parametric ANOVA, RVAAP has to assume statistical non-normality will not be an issue.

If, at any of the monitoring wells it is determined that there has been a statistically significant change from background values for any of the measured parameters, RVAAP will follow the procedures specified in OAC 3745-27-10 (D)(8). If a significant change is confirmed, the procedures specified in OAC 3745-27-10 E will be followed.

GROUNDWATER QUALITY ASSESSMENT PROGRAM REPORT FOR THE RAMSDELL QUARRY LANDFILL

RAVENNA ARMY AMMUNITION PLANT
RAVENNA, OHIO 44266

Prepared for

OPERATIONS SUPPORT COMMAND
Rock Island, IL 61299-6000

Prepared by

MKM ENGINEERS, INC
4153 BLUEBONNET DRIVE
STAFFORD, TEXAS 77477

And

NEAL ENVIRONMENTAL SERVICES, LLC

Received
11/16/01
at RVAAP
Ohio EPA

NOVEMBER 2001

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MKM

MKM Engineers, Inc.

Geotechnical, Environmental and Remediation Services

November 16, 2001

Christopher Jones, Director
Ohio Environmental Protection Agency
Lazarus Government Center
P.O. Box 1049
Columbus, Ohio 43216-1049

Re: Initial Sampling Event, Ramsdell Quarry Landfill
9/11/01 Groundwater Assessment Plan
Ravenna Army Ammunition Plant's (RVAAP)

Dear Director Jones:

On behalf of the US Army's Operation Support Command at the Ravenna Army Ammunition Plant, MKM Engineers, Inc. and Neal Environmental Services is providing this summary report in compliance with the Groundwater Assessment Plan (GAP), dated September 7, 2001, for the closed solid waste landfill known as Ramsdell Quarry Landfill. The GAP was submitted in accordance with O.A.C. 3745-27-10, effective March 1, 1990, (hereafter referred to as O.A.C. 3745-27-10). In accordance with O.A.C. 3745-27-10 the GAP called for the sampling and analysis of wells RQL MW-006 (upgradient) and RQL MW-007 (impacted downgradient) for all parameters listed in Appendix II to O.A.C. 3745-27-10 as well as a list of specific explosive materials and propellants. Further, the GAP and O.A.C. 3745-27-10, required that the sampling be conducted by September 25, 2001 and that the analytical results be submitted to you not more that 60 days after the sampling event and not more than 15 days after receiving the results of the analysis.

On September 20, 2001, the RVAAP sampled RQL MW-006 and RQL MW-007. On September 25, 2001, MKM was notified that due to laboratory handling difficulties, the cyanide analyte would require resampling. The OEPA NEDO was immediately notified of this situation by email. The two monitoring wells were resampled on September 26, 2001 and submitted for analysis. On November 5, 2001, the RVAAP received all of the analytical results from this initial sampling event. Today, via this letter and attachments the RVAAP is submitting these analytical results to you in accordance with O.A.C. 3745-27-10.

Attached to this summary report are copies of the analytical results obtained from the September 20, 2001, sampling of RQL MW-006 and RQL MW-007 including the duplicate and field blank results (Appendix A), the data validation report in Appendix B and the field sampling forms in Appendix C.

Ravenna Army Ammunition Plant, Building 1038, St. Rt. 5, Ravenna, OH 44266
Phone: (330) 358-2920 Fax: (330) 358-2924

The GAP and O.A.C. 3745-27-10 requires the evaluation of the sample results from RQL MW-006 and RQL MW-007, to determine if leachate or leachate derived constituents were identified as being numerically higher in RQL MW-007 (the down gradient well) than in RQL MW-006 (the above gradient well). The analytical results were validated and tabulated for ease of review. Those data which reflected an increase in concentration in the downgradient well, RQL MW-007, are presented in Table 1.

Table 1

RQL MW-007 Analytical Results that were Numerically Higher than RQL MW-006 Analytical Results

Parameter	RQL MW-006 Analytical Result	RQL MW-007 Analytical Result
Arsenic	0.019 mg/L	0.053 mg/L
Barium	0.021 mg/L	0.039 mg/L
Iron	8.3 mg/L	39.0 mg/L
Potassium	Not Detected	9.1 mg/L
Magnesium	45.0 mg/L	140.0 mg/L
Sodium	Not Detected	14.8 mg/L
Zinc	Not Detected	0.056 mg/L
Chloromethane	Not Detected	0.030 J ug/L
Chloride	1.9 mg/L	7.0 mg/L
Sulfate	224.0 mg/L	267.0 mg/L

A review of this data was completed in comparison to the data validation report and the RVAAP Facility-wide Background concentrations. Based upon this review the results indicate that some of these parameters do not represent leachate or leachate derived constituents. Chloromethane was reported as a J value of 0.30 ug/L. The laboratory reporting limit for Chloromethane was 1.0 ug/L. The J qualifier indicates that the value is estimated given that it has been reported below the required laboratory reporting limit. Thus, while the laboratory reported detecting Chloromethane in the sample from RQL MW-007 the amount reported must be viewed as suspect. In addition, Chloromethane was also detected in the field blank with a reported J value of 0.15 ug/L. Additionally, Chloromethane is routinely analyzed quarterly as part of the Ramsdell Quarry Landfill detection monitoring program. Over a period of 2 years and 11 sampling events Chloromethane has never been detected in a sample from RQL MW-007. Thus, it

is believed that any Chloromethane reported as detected in the RQL MW-007 sample was due to laboratory contamination. Several of the parameters noted in Table 1 above exhibit numerically higher concentrations in RQL MW-007 yet are actually lower than the established RVAAP Bedrock Ground Water Facility-wide Background Data concentrations, (see Table 2). This background data for RVAAP were developed during the Phase II Remedial Investigation (RI) for the Winklepeck Burning Grounds (USACE 1999b).

Table 2

RQL MW-007 Analytical Results that were Numerically Higher than RQL MW-006 but Lower than RVAAP Bedrock Ground Water Facility-wide Back Ground

Parameter	RQL MW-007 Analytical Result	RVAAP Bedrock Ground Water Facility-wide Background Concentration
Barium	0.039 mg/L	0.241 mg/L
Sodium	14.80 mg/L	49.70 mg/L
Zinc	0.056 mg/L	0.193 mg/L

Thus, the RVAAP does not believe that these parameters constitute leachate or leachate derived constituents found to be above background for the purposes of O.A.C. 3745-27-10.

Based upon the above data, the assessment plan and O.A.C. 3745-27-10 the RVAAP will, upon the concurrence of the Ohio EPA, develop a schedule for sampling RQL MW-008 and RQL MW-009 for Arsenic, Iron, Potassium, Magnesium, Chloride and Sulfate.

Upon review of the analytical from this and prior sampling events several points come to light that should also be noted. While the RVAAP believes it is appropriate at this time to sample RQL MW-008 and RQL MW-009 for the above listed parameters, at the same time the RVAAP does not believe that the existing data support a theory that these parameters constitute leachate derived constituents that are impacting the groundwater. For example, the turbidity in RQL MW-007 during the recent sampling event was very high when compared to RQL MW-006 (see Appendix C). This can result in the detection of elevated metals. Slight variations in sampling techniques can produce very different turbidity results. In addition, historically it has been the RVAAP's position

that Iron, Potassium and Magnesium more commonly considered essential nutrient compounds and are not leachate-derived constituents related to the Ramsdell Quarry Landfill. Finally, the results for the parameters that were numerically higher in RQL MW-007 than in RQL MW-006 in this sampling event were generally consistent with the numerical historical results obtained in RQL MW-007. A more thorough analysis of these results may well show that they too do not actually represent values that are above background. The RVAAP believes a more appropriate time to address these issues and other issues more fully is following the sampling of RQL MW-008 and RQL MW-009 and the analysis of those samples. Upon concurrence by the OEPA the RVAAP will proceed with the sampling of monitoring wells RQL MW-008 and RQL MW-009 for the parameters designated above.

Sincerely,

Richard Callahan
Environmental Program Manager
MKM Engineers, Inc.

Attachment

cc: Jarnal Singh, (Ohio EPA, NEDO)
Eileen Mohr / Todd Fisher, (Ohio EPA, NEDO)
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Bill Ingold, (OSC, Rock Island)
Mark Patterson, (OSC, RVAAP)
Jim Mcgee, (Toltest, Oper. Contrtactor RVAAP)
Ernie Neal, (NES)

MKM

MKM Engineers, Inc.

Geotechnical, Environmental and Remediation Services

November 16, 2001

Christopher Jones, Director
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Jim Mcgee, (Toltest, Oper. Contrtactor RVAAP)
Ernie Neal, (NES)

MKM ENGINEERS INC

Client Sample ID: RQLMW-06

GC/MS Volatiles

Lot-Sample #...: A1I210297-001 **Work Order #...:** EKW2Q1AP **Matrix.....:** WG
Date Sampled...: 09/20/01 09:15 **Date Received..:** 09/20/01
Prep Date.....: 10/01/01 **Analysis Date..:** 10/01/01
Prep Batch #...: 1274204
Dilution Factor: 1 **Method.....:** SW846 8260B

PARAMETER	RESULT	REPORTING LIMIT	UNITS
Dichlorodifluoromethane	ND	1.0	ug/L
Acetonitrile	ND	20	ug/L
Acrolein	ND	20	ug/L
Allyl chloride	ND	2.0	ug/L
1,3-Dichloropropane	ND	1.0	ug/L
2,2-Dichloropropane	ND	1.0	ug/L
1,1-Dichloropropene	ND	1.0	ug/L
Ethyl methacrylate	ND	1.0	ug/L
Isobutyl alcohol	ND	50	ug/L
Methyl methacrylate	ND	2.0	ug/L
Propionitrile	ND	4.0	ug/L
4-Methyl-2-pentanone (MIBK)	ND	10	ug/L
Acetone	**1.9 J**	**10**	**ug/L**
Acrylonitrile	ND	20	ug/L
Benzene	ND	1.0	ug/L
Bromochloromethane	ND	1.0	ug/L
Bromodichloromethane	ND	1.0	ug/L
Bromoform	ND	1.0	ug/L
Bromomethane	ND	1.0	ug/L
2-Butanone	ND	10	ug/L
Carbon disulfide	ND	1.0	ug/L
Carbon tetrachloride	ND	1.0	ug/L
Chlorobenzene	ND	1.0	ug/L
Dibromochloromethane	ND	1.0	ug/L
1,2-Dibromo-3-chloro-propane	ND	7.0	ug/L
Chloroethane	ND	1.0	ug/L
Chloroform	ND	1.0	ug/L
Chloromethane	ND	1.0	ug/L
1,2-Dibromoethane	ND	1.0	ug/L
Dibromomethane	ND	1.0	ug/L
1,2-Dichlorobenzene	ND	1.0	ug/L
1,4-Dichlorobenzene	ND	1.0	ug/L
trans-1,4-Dichloro-2-butene	ND	1.0	ug/L
1,1-Dichloroethane	ND	1.0	ug/L
1,2-Dichloroethane	ND	1.0	ug/L
1,1-Dichloroethene	ND	1.0	ug/L

(Continued on next page)

MKM ENGINEERS INC

Client Sample ID: RQLMW-06

GC/MS Volatiles

Lot-Sample #...: A1I210297-001 Work Order #...: EKW2Q1AP Matrix.....: WG

PARAMETER	RESULT	REPORTING LIMIT	UNITS
cis-1,2-Dichloroethene	ND	1.0	ug/L
trans-1,2-Dichloroethene	ND	1.0	ug/L
1,2-Dichloropropane	ND	1.0	ug/L
cis-1,3-Dichloropropene	ND	1.0	ug/L
trans-1,3-Dichloropropene	ND	1.0	ug/L
Ethylbenzene	ND	1.0	ug/L
Trichlorofluoromethane	ND	1.0	ug/L
2-Hexanone	ND	10	ug/L
Iodomethane	ND	1.0	ug/L
Methylene chloride	**1.1 B**	**1.0**	**ug/L**
Styrene	ND	1.0	ug/L
1,1,1,2-Tetrachloroethane	ND	1.0	ug/L
1,1,2,2-Tetrachloroethane	ND	1.0	ug/L
Tetrachloroethene	ND	1.0	ug/L
Toluene	ND	1.0	ug/L
1,1,1-Trichloroethane	ND	1.0	ug/L
1,1,2-Trichloroethane	ND	1.0	ug/L
Trichloroethene	ND	1.0	ug/L
1,2,3-Trichloropropane	ND	1.0	ug/L
Vinyl acetate	ND	10	ug/L
Vinyl chloride	ND	1.0	ug/L
Xylenes (total)	ND	1.0	ug/L
Chloroprene	ND	2.0	ug/L
1,3-Dichlorobenzene	ND	1.0	ug/L
Methacrylonitrile	ND	2.0	ug/L

SURROGATE	PERCENT RECOVERY	RECOVERY LIMITS
Dibromofluoromethane	106	(73 - 122)
1,2-Dichloroethane-d4	105	(61 - 128)
Toluene-d8	96	(76 - 110)
4-Bromofluorobenzene	88	(74 - 116)

NOTE(S):

J Estimated result. Result is less than RL.

B Method blank contamination. The associated method blank contains the target analyte at a reportable level.

MKM ENGINEERS INC

Client Sample ID: RQLMW-06

TOTAL Metals

Lot-Sample #...: A1I210297-001 **Matrix.....:** WG
Date Sampled...: 09/20/01 09:15 **Date Received..:** 09/20/01

PARAMETER	RESULT	REPORTING LIMIT	UNITS	METHOD	PREPARATION-ANALYSIS DATE	WORK ORDER #
Prep Batch #...: 1267112						
Zinc	ND	0.050	mg/L	SW846 6010B	09/24-09/25/01	EKW2Q1A6
		Dilution Factor: 1				
Silver	ND	0.010	mg/L	SW846 6010B	09/24-09/25/01	EKW2Q1A3
		Dilution Factor: 1				
Arsenic	**0.019**	**0.0050**	**mg/L**	**SW846 6010B**	**09/24-09/25/01**	**EKW2Q1AQ**
		Dilution Factor: 1				
Barium	**0.021**	**0.010**	**mg/L**	**SW846 6010B**	**09/24-09/25/01**	**EKW2Q1AV**
		Dilution Factor: 1				
Beryllium	ND	0.0040	mg/L	SW846 6010B	09/24-09/25/01	EKW2Q1AW
		Dilution Factor: 1				
Calcium	**111**	**5.0**	**mg/L**	**SW846 6010B**	**09/24-09/25/01**	**EKW2Q1A8**
		Dilution Factor: 1				
Cadmium	ND	0.0050	mg/L	SW846 6010B	09/24-09/25/01	EKW2Q1AX
		Dilution Factor: 1				
Cobalt	ND	0.050	mg/L	SW846 6010B	09/24-09/25/01	EKW2Q1A0
		Dilution Factor: 1				
Chromium	ND	0.010	mg/L	SW846 6010B	09/24-09/25/01	EKW2Q1A7
		Dilution Factor: 1				
Copper	ND	0.010	mg/L	SW846 6010B	09/24-09/25/01	EKW2Q1A1
		Dilution Factor: 1				
Iron	**8.3**	**0.10**	**mg/L**	**SW846 6010B**	**09/24-09/25/01**	**EKW2Q1A9**
		Dilution Factor: 1				
Potassium	ND	5.0	mg/L	SW846 6010B	09/24-09/25/01	EKW2Q1CA
		Dilution Factor: 1				
Magnesium	**45.0**	**5.0**	**mg/L**	**SW846 6010B**	**09/24-09/25/01**	**EKW2Q1CC**
		Dilution Factor: 1				
Manganese	**5.1**	**0.015**	**mg/L**	**SW846 6010B**	**09/24-09/25/01**	**EKW2Q1CD**
		Dilution Factor: 1				

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MKM ENGINEERS INC

Client Sample ID: RQLMW-06

TOTAL Metals

Lot-Sample #...: A1I210297-001 Matrix.....: WG

PARAMETER	RESULT	REPORTING LIMIT	UNITS	METHOD	PREPARATION-ANALYSIS DATE	WORK ORDER #
Sodium	ND	5.0	mg/L	SW846 6010B	09/24-09/25/01	EKW2Q1A4
		Dilution Factor: 1				
Nickel	**0.25**	**0.040**	**mg/L**	**SW846 6010B**	**09/24-09/25/01**	**EKW2Q1A2**
		Dilution Factor: 1				
Lead	ND	0.0030	mg/L	SW846 6010B	09/24-09/25/01	EKW2Q1AR
		Dilution Factor: 1				
Antimony	ND	0.060	mg/L	SW846 6010B	09/24-09/25/01	EKW2Q1AU
		Dilution Factor: 1				
Selenium	ND	0.0050	mg/L	SW846 6010B	09/24-09/25/01	EKW2Q1AT
		Dilution Factor: 1				
Tin	ND	0.10	mg/L	SW846 6010B	09/24-09/25/01	EKW2Q1CE
		Dilution Factor: 1				
Thallium	ND Wa	0.0020	mg/L	SW846 7841	09/24-09/25/01	EKW2Q1CF
		Dilution Factor: 1				
Vanadium	ND	0.050	mg/L	SW846 6010B	09/24-09/25/01	EKW2Q1A5
		Dilution Factor: 1				
Mercury	ND	0.00020	mg/L	SW846 7470A	09/24-09/25/01	EKW2Q1CG
		Dilution Factor: 1				

NOTE(S):

Wa Post digestion spike recovery fell between 40-85% due to matrix interference.

MKM ENGINEERS INC

Client Sample ID: RQLMW-06

General Chemistry

Lot-Sample #...: A1I210297-001 Work Order #...: EKW2Q Matrix.....: WG
Date Sampled...: 09/20/01 09:15 Date Received..: 09/20/01

PARAMETER	RESULT	RL	UNITS	METHOD	PREPARATION-ANALYSIS DATE	PREP BATCH #
pH (liquid)	8.0		No Units	MCAWW 150.1	09/22/01	1267393
		Dilution Factor: 1				
Chloride	1.9	1.0	mg/L	MCAWW 300.0A	09/25/01	1269389
		Dilution Factor: 1				
Hexavalent Chromium	ND	0.02	mg/L	SW846 7196A	09/21/01	1268450
		Dilution Factor: 1				
Nitrate-Nitrite	ND	0.1	mg/L	MCAWW 353.2	09/24/01	1268415
		Dilution Factor: 1				
Nitrocellulose	ND	0.50	mg/L	MCAWW 353.2	09/29-10/04/01	1274466
		Dilution Factor: 1				
Nitrogen, as Ammonia	0.3	0.2	mg/L	MCAWW 350.3	10/01/01	1275093
		Dilution Factor: 1				
Sulfate	224	2.0	mg/L	MCAWW 300.0A	09/25/01	1269392
		Dilution Factor: 2				
Total phosphorus	ND	0.1	mg/L	MCAWW 365.2	09/26/01	1269443
		Dilution Factor: 1				
Total Alkalinity	260	5.0	mg/L	MCAWW 310.1	09/22/01	1267433
		Dilution Factor: 1				
Total Dissolved Solids	540	10	mg/L	MCAWW 160.1	09/25-09/26/01	1268169
		Dilution Factor: 1				
Total Organic Carbon	11	1	mg/L	SW846 9060	09/24/01	1268207
		Dilution Factor: 1				
Total Phenols	ND	0.040	mg/L	SW846 9065	10/03/01	1276408
		Dilution Factor: 1				
Total Sulfide	ND	1.0	mg/L	MCAWW 376.1	09/24/01	1268591
		Dilution Factor: 1				

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MKM ENGINEERS INC

Client Sample ID: RQLMW-06

General Chemistry

Lot-Sample #...: A1I210297-001 Work Order #...: EKW2Q Matrix.....: WG

PARAMETER	RESULT	RL	UNITS	METHOD	PREPARATION-ANALYSIS DATE	PREP BATCH #
Turbidity	24	0.5	NTU	MCAWW 180.1	09/21/01	1264521

Dilution Factor: 1

MKM ENGINEERS INC

Client Sample ID: RQLMW-06

General Chemistry

Lot-Sample #...: A1I280133-001 **Work Order #...:** EK9ET **Matrix.....:** WG
Date Sampled...: 09/26/01 13:55 **Date Received..:** 09/27/01

PARAMETER	RESULT	RL	UNITS	METHOD	PREPARATION-ANALYSIS DATE	PREP BATCH #
Total Cyanide	ND	0.010	mg/L	MCAWW 335.2	10/02/01	1275384

Dilution Factor: 1

MKM ENGINEERS INC

Client Sample ID: RQLMW-06

GC/MS Semivolatiles

Lot-Sample #...: A1I210297-001 **Work Order #...:** EKW2Q1AJ **Matrix.....:** WG
Date Sampled...: 09/20/01 09:15 **Date Received..:** 09/20/01
Prep Date.....: 09/24/01 **Analysis Date..:** 09/30/01
Prep Batch #...: 1267101
Dilution Factor: 1 **Method.....:** SW846 8270C

PARAMETER	RESULT	REPORTING LIMIT	UNITS
Acenaphthene	ND	10	ug/L
Acenaphthylene	ND	10	ug/L
Acetophenone	ND	10	ug/L
2-Acetylaminofluorene	ND	100	ug/L
4-Aminobiphenyl	ND	50	ug/L
Anthracene	ND	10	ug/L
Benzo(a)anthracene	ND	10	ug/L
Benzo(b)fluoranthene	ND	10	ug/L
Benzo(k)fluoranthene	ND	10	ug/L
Benzo(ghi)perylene	ND	10	ug/L
Benzo(a)pyrene	ND	10	ug/L
Benzyl alcohol	ND	10	ug/L
bis(2-Chloroethoxy) methane	ND	10	ug/L
bis(2-Chloroethyl)-ether	ND	10	ug/L
bis(2-Chloro-1-methylethyl) ether	ND	10	ug/L
bis(2-Ethylhexyl) phthalate	ND	10	ug/L
4-Bromophenyl phenyl ether	ND	10	ug/L
Butyl benzyl phthalate	ND	10	ug/L
p-Chloroaniline	ND	10	ug/L
4-Chloro-3-methylphenol	ND	10	ug/L
2-Chloronaphthalene	ND	10	ug/L
2-Chlorophenol	ND	10	ug/L
4-Chlorophenyl phenyl ether	ND	10	ug/L
Chrysene	ND	10	ug/L
Diallate	ND	20	ug/L
Dibenz(a,h)anthracene	ND	10	ug/L
Dibenzofuran	ND	10	ug/L
Di-n-butyl phthalate	ND	10	ug/L
3,3'-Dichlorobenzidine	ND	50	ug/L
2,4-Dichlorophenol	ND	10	ug/L
2,6-Dichlorophenol	ND	10	ug/L
Diethyl phthalate	ND	10	ug/L
Thionazin	ND	50	ug/L

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MKM ENGINEERS INC

Client Sample ID: RQLMW-06

GC/MS Semivolatiles

Lot-Sample #...: A1I210297-001 Work Order #...: EKW2Q1AJ Matrix.....: WG

PARAMETER	RESULT	REPORTING LIMIT	UNITS
Dimethoate	ND	20	ug/L
p-Dimethylaminoazobenzene	ND	20	ug/L
7,12-Dimethylbenz(a)-anthracene	ND	20	ug/L
3,3'-Dimethylbenzidine	ND	50	ug/L
2,4-Dimethylphenol	ND	10	ug/L
Dimethyl phthalate	ND	10	ug/L
Di-n-octyl phthalate	ND	10	ug/L
1,3-Dinitrobenzene	ND	10	ug/L
4,6-Dinitro-2-methylphenol	ND	50	ug/L
2,4-Dinitrophenol	ND	50	ug/L
2,4-Dinitrotoluene	ND	10	ug/L
2,6-Dinitrotoluene	ND	10	ug/L
Diphenylamine	ND	10	ug/L
Disulfoton	ND	50	ug/L
Ethyl methanesulfonate	ND	10	ug/L
Famphur	ND	100	ug/L
Fluoranthene	ND	10	ug/L
Fluorene	ND	10	ug/L
Hexachlorobenzene	ND	10	ug/L
Hexachlorobutadiene	ND	10	ug/L
Hexachlorocyclopentadiene	ND	50	ug/L
Hexachloroethane	ND	10	ug/L
Hexachloropropene	ND	100	ug/L
Indeno(1,2,3-cd)pyrene	ND	10	ug/L
Isophorone	ND	10	ug/L
Isosafrole	ND	20	ug/L
Methapyrilene	ND	50	ug/L
o-Toluidine	ND	20	ug/L
3-Methylcholanthrene	ND	20	ug/L
Methyl methanesulfonate	ND	10	ug/L
2-Methylnaphthalene	ND	10	ug/L
2-Methylphenol	ND	10	ug/L
3-Methylphenol	ND	10	ug/L
4-Methylphenol	ND	10	ug/L
Naphthalene	ND	10	ug/L
1,4-Naphthoquinone	ND	50	ug/L
1-Naphthylamine	ND	10	ug/L
2-Naphthylamine	ND	10	ug/L
2-Nitroaniline	ND	50	ug/L
3-Nitroaniline	ND	50	ug/L

(Continued on next page)

MKM ENGINEERS INC

Client Sample ID: RQLMW-06

GC/MS Semivolatiles

Lot-Sample #...: A1I210297-001 Work Order #...: EKW2Q1AJ Matrix.....: WG

PARAMETER	RESULT	REPORTING LIMIT	UNITS
4-Nitroaniline	ND	50	ug/L
Nitrobenzene	ND	10	ug/L
2-Nitrophenol	ND	10	ug/L
4-Nitrophenol	ND	50	ug/L
N-Nitrosodi-n-butylamine	ND	10	ug/L
N-Nitrosodiethylamine	ND	10	ug/L
N-Nitrosodimethylamine	ND	10	ug/L
N-Nitrosodi-n-propyl-amine	ND	10	ug/L
N-Nitrosodiphenylamine	ND	10	ug/L
N-Nitrosomethylethylamine	ND	10	ug/L
N-Nitrosopiperidine	ND	10	ug/L
N-Nitrosopyrrolidine	ND	10	ug/L
5-Nitro-o-toluidine	ND	20	ug/L
Pentachlorobenzene	ND	10	ug/L
Pentachloronitrobenzene	ND	50	ug/L
Pentachlorophenol	ND	10	ug/L
Phenacetin	ND	20	ug/L
Phenanthrene	ND	10	ug/L
Phenol	ND	10	ug/L
p-Phenylene diamine	ND	100	ug/L
Phorate	ND	50	ug/L
Pronamide	ND	20	ug/L
Pyrene	ND	10	ug/L
Safrole	ND	20	ug/L
1,2,4,5-Tetrachloro-benzene	ND	10	ug/L
2,3,4,6-Tetrachlorophenol	ND	50	ug/L
1,2,4-Trichloro-benzene	ND	10	ug/L
2,4,5-Trichloro-phenol	ND	10	ug/L
2,4,6-Trichloro-phenol	ND	10	ug/L
O,O,O-Triethylphosphoro-thioate	ND	50	ug/L
1,3,5-Trinitrobenzene	ND	50	ug/L
Chlorobenzilate	ND	10	ug/L

(Continued on next page)

MKM ENGINEERS INC

Client Sample ID: RQLMW-06

GC/MS Semivolatiles

Lot-Sample #...: A1I210297-001 Work Order #...: EKW2Q1AJ Matrix.....: WG

SURROGATE	PERCENT RECOVERY	RECOVERY LIMITS
Nitrobenzene-d5	70	(32 - 112)
2-Fluorobiphenyl	68	(30 - 110)
Terphenyl-d14	72	(10 - 144)
Phenol-d5	12	(10 - 113)
2-Fluorophenol	5.5 *	(13 - 110)
2,4,6-Tribromophenol	8.6 *	(21 - 122)

NOTE(S):

* Surrogate recovery is outside stated control limits.

MKM ENGINEERS INC

Client Sample ID: RQLMW-06

GC/MS Semivolatiles

Lot-Sample #...: A1I210297-001 **Work Order #...:** EKW2Q2AJ **Matrix.....:** WG
Date Sampled...: 09/20/01 09:15 **Date Received..:** 09/20/01
Prep Date.....: 10/02/01 **Analysis Date..:** 10/06/01
Prep Batch #...: 1275109
Dilution Factor: 1 **Method.....:** SW846 8270C

PARAMETER	RESULT	REPORTING LIMIT	UNITS
Acenaphthene	ND	10	ug/L
Acenaphthylene	ND	10	ug/L
Acetophenone	ND	10	ug/L
2-Acetylaminofluorene	ND	100	ug/L
4-Aminobiphenyl	ND	50	ug/L
Anthracene	ND	10	ug/L
Benzo(a)anthracene	ND	10	ug/L
Benzo(b)fluoranthene	ND	10	ug/L
Benzo(k)fluoranthene	ND	10	ug/L
Benzo(ghi)perylene	ND	10	ug/L
Benzo(a)pyrene	ND	10	ug/L
Benzyl alcohol	ND	10	ug/L
bis(2-Chloroethoxy) methane	ND	10	ug/L
bis(2-Chloroethyl)-ether	ND	10	ug/L
bis(2-Chloro-1-methylethyl) ether	ND	10	ug/L
bis(2-Ethylhexyl) phthalate	ND	10	ug/L
4-Bromophenyl phenyl ether	ND	10	ug/L
Butyl benzyl phthalate	ND	10	ug/L
p-Chloroaniline	ND	10	ug/L
4-Chloro-3-methylphenol	ND	10	ug/L
2-Chloronaphthalene	ND	10	ug/L
2-Chlorophenol	ND	10	ug/L
4-Chlorophenyl phenyl ether	ND	10	ug/L
Chrysene	ND	10	ug/L
Diallate	ND	20	ug/L
Dibenz(a,h)anthracene	ND	10	ug/L
Dibenzofuran	ND	10	ug/L
Di-n-butyl phthalate	ND	10	ug/L
3,3'-Dichlorobenzidine	ND	50	ug/L
2,4-Dichlorophenol	ND	10	ug/L
2,6-Dichlorophenol	ND	10	ug/L
Diethyl phthalate	ND	10	ug/L
Thionazin	ND	50	ug/L

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MKM ENGINEERS INC

Client Sample ID: RQLMW-06

GC/MS Semivolatiles

Lot-Sample #...: A1I210297-001 Work Order #...: EKW2Q2AJ Matrix.....: WG

PARAMETER	RESULT	REPORTING LIMIT	UNITS
Dimethoate	ND	20	ug/L
p-Dimethylaminoazobenzene	ND	20	ug/L
7,12-Dimethylbenz(a)-anthracene	ND	20	ug/L
3,3'-Dimethylbenzidine	ND	50	ug/L
2,4-Dimethylphenol	ND	10	ug/L
Dimethyl phthalate	ND	10	ug/L
Di-n-octyl phthalate	ND	10	ug/L
1,3-Dinitrobenzene	ND	10	ug/L
4,6-Dinitro-2-methylphenol	ND	50	ug/L
2,4-Dinitrophenol	ND	50	ug/L
2,4-Dinitrotoluene	ND	10	ug/L
2,6-Dinitrotoluene	ND	10	ug/L
Diphenylamine	ND	10	ug/L
Disulfoton	ND	50	ug/L
Ethyl methanesulfonate	ND	10	ug/L
Famphur	ND	100	ug/L
Fluoranthene	ND	10	ug/L
Fluorene	ND	10	ug/L
Hexachlorobenzene	ND	10	ug/L
Hexachlorobutadiene	ND	10	ug/L
Hexachlorocyclopentadiene	ND	50	ug/L
Hexachloroethane	ND	10	ug/L
Hexachloropropene	ND	100	ug/L
Indeno(1,2,3-cd)pyrene	ND	10	ug/L
Isophorone	ND	10	ug/L
Isosafrole	ND	20	ug/L
Methapyrilene	ND	50	ug/L
o-Toluidine	ND	20	ug/L
3-Methylcholanthrene	ND	20	ug/L
Methyl methanesulfonate	ND	10	ug/L
2-Methylnaphthalene	ND	10	ug/L
2-Methylphenol	ND	10	ug/L
3-Methylphenol	ND	10	ug/L
4-Methylphenol	ND	10	ug/L
Naphthalene	ND	10	ug/L
1,4-Naphthoquinone	ND	50	ug/L
1-Naphthylamine	ND	10	ug/L
2-Naphthylamine	ND	10	ug/L
2-Nitroaniline	ND	50	ug/L
3-Nitroaniline	ND	50	ug/L

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MKM ENGINEERS INC

Client Sample ID: RQLMW-06

GC/MS Semivolatiles

Lot-Sample #...: A1I210297-001 Work Order #...: EKW2Q2AJ Matrix.....: WG

PARAMETER	RESULT	REPORTING LIMIT	UNITS
4-Nitroaniline	ND	50	ug/L
Nitrobenzene	ND	10	ug/L
2-Nitrophenol	ND	10	ug/L
4-Nitrophenol	ND	50	ug/L
N-Nitrosodi-n-butylamine	ND	10	ug/L
N-Nitrosodiethylamine	ND	10	ug/L
N-Nitrosodimethylamine	ND	10	ug/L
N-Nitrosodi-n-propyl-amine	ND	10	ug/L
N-Nitrosodiphenylamine	ND	10	ug/L
N-Nitrosomethylethylamine	ND	10	ug/L
N-Nitrosopiperidine	ND	10	ug/L
N-Nitrosopyrrolidine	ND	10	ug/L
5-Nitro-o-toluidine	ND	20	ug/L
Pentachlorobenzene	ND	10	ug/L
Pentachloronitrobenzene	ND	50	ug/L
Pentachlorophenol	ND	10	ug/L
Phenacetin	ND	20	ug/L
Phenanthrene	ND	10	ug/L
Phenol	ND	10	ug/L
p-Phenylene diamine	ND	100	ug/L
Phorate	ND	50	ug/L
Pronamide	ND	20	ug/L
Pyrene	ND	10	ug/L
Safrole	ND	20	ug/L
1,2,4,5-Tetrachloro-benzene	ND	10	ug/L
2,3,4,6-Tetrachlorophenol	ND	50	ug/L
1,2,4-Trichloro-benzene	ND	10	ug/L
2,4,5-Trichloro-phenol	ND	10	ug/L
2,4,6-Trichloro-phenol	ND	10	ug/L
O,O,O-Triethylphosphoro-thioate	ND	50	ug/L
1,3,5-Trinitrobenzene	ND	50	ug/L
Chlorobenzilate	ND	10	ug/L

(Continued on next page)

MKM ENGINEERS INC

Client Sample ID: RQLMW-06

GC/MS Semivolatiles

Lot-Sample #...: A1I210297-001 **Work Order #...:** EKW2Q2AJ **Matrix.....:** WG

SURROGATE	PERCENT RECOVERY	RECOVERY LIMITS
Nitrobenzene-d5	89	(32 - 112)
2-Fluorobiphenyl	75	(30 - 110)
Terphenyl-d14	64	(10 - 144)
Phenol-d5	16	(10 - 113)
2-Fluorophenol	7.6 *	(13 - 110)
2,4,6-Tribromophenol	11 *	(21 - 122)

NOTE(S):

* Surrogate recovery is outside stated control limits.

MKM ENGINEERS INC

Client Sample ID: RQLMW-06

GC Semivolatiles

Lot-Sample #...: A1I210297-001 **Work Order #...:** EKW2Q1AL **Matrix.....:** WG
Date Sampled...: 09/20/01 09:15 **Date Received..:** 09/20/01
Prep Date.....: 09/24/01 **Analysis Date..:** 09/30/01
Prep Batch #...: 1267178
Dilution Factor: 1 **Method.....:** SW846 8081A

PARAMETER	RESULT	REPORTING LIMIT	UNITS
Endosulfan sulfate	ND	0.050	ug/L
Endrin	ND	0.050	ug/L
Endrin aldehyde	ND	0.050	ug/L
Heptachlor	ND	0.050	ug/L
Heptachlor epoxide	ND	0.050	ug/L
Isodrin	ND	0.10	ug/L
Kepone	ND	1.0	ug/L
Methoxychlor	ND	0.10	ug/L
Toxaphene	ND	2.0	ug/L
Aldrin	ND	0.050	ug/L
alpha-BHC	ND	0.050	ug/L
beta-BHC	ND	0.050	ug/L
delta-BHC	ND	0.050	ug/L
gamma-BHC (Lindane)	ND	0.050	ug/L
Chlordane (technical)	ND	0.50	ug/L
4,4'-DDD	ND	0.050	ug/L
4,4'-DDE	ND	0.050	ug/L
4,4'-DDT	ND	0.050	ug/L
Dieldrin	ND	0.050	ug/L
Endosulfan I	ND	0.050	ug/L
Endosulfan II	ND	0.050	ug/L

SURROGATE	PERCENT RECOVERY	RECOVERY LIMITS
Tetrachloro-m-xylene	56	(39 - 130)
Decachlorobiphenyl	26	(10 - 147)

MKM ENGINEERS INC

Client Sample ID: RQLMW-06

GC Semivolatiles

Lot-Sample #...: A1I210297-001 **Work Order #...:** EKW2Q1AM **Matrix.....:** WG
Date Sampled...: 09/20/01 09:15 **Date Received..:** 09/20/01
Prep Date.....: 09/24/01 **Analysis Date..:** 09/30/01
Prep Batch #...: 1267179
Dilution Factor: 1 **Method.....:** SW846 8082

PARAMETER	RESULT	REPORTING LIMIT	UNITS
Aroclor 1016	ND	1.0	ug/L
Aroclor 1221	ND	1.0	ug/L
Aroclor 1232	ND	1.0	ug/L
Aroclor 1242	ND	1.0	ug/L
Aroclor 1248	ND	1.0	ug/L
Aroclor 1254	ND	1.0	ug/L
Aroclor 1260	ND	1.0	ug/L

SURROGATE	PERCENT RECOVERY	RECOVERY LIMITS
Tetrachloro-m-xylene	69	(45 - 120)
Decachlorobiphenyl	28	(24 - 128)

MKM ENGINEERS INC

Client Sample ID: RQLMW-06

GC Semivolatiles

Lot-Sample #...: A1I210297-001 **Work Order #...:** EKW2Q1AC **Matrix.....:** WG
Date Sampled...: 09/20/01 09:15 **Date Received..:** 09/20/01
Prep Date.....: 09/26/01 **Analysis Date..:** 10/14/01
Prep Batch #...: 1269103
Dilution Factor: 1 **Method.....:** SW846 8141A

PARAMETER	RESULT	REPORTING LIMIT	UNITS
Methyl parathion	ND	1.0	ug/L
Parathion	ND	1.0	ug/L

SURROGATE	PERCENT RECOVERY	RECOVERY LIMITS
Triphenyl phosphate	93	(41 - 155)

MKM ENGINEERS INC

Client Sample ID: RQLMW-06

Dissolved Trace Level Organic Compounds

Lot-Sample #...: A1I210297-001 **Work Order #...:** EKW2Q1CT **Matrix.....:** WG
Date Sampled...: 09/20/01 09:15 **Date Received..:** 09/20/01
Prep Date.....: 09/27/01 **Analysis Date..:** 10/04/01
Prep Batch #...: 1270314
Dilution Factor: 1 **Method.....:** NONE UV/HPLC per

PARAMETER	RESULT	REPORTING LIMIT	UNITS
Nitroguanidine	ND	20	ug/L

MKM ENGINEERS INC

Client Sample ID: RQLMW-06

GC Semivolatiles

Lot-Sample #...: A1I210297-001 **Work Order #...:** EKW2Q1AK **Matrix.....:** WG
Date Sampled...: 09/20/01 09:15 **Date Received..:** 09/20/01
Prep Date.....: 09/24/01 **Analysis Date..:** 10/05/01
Prep Batch #...: 1267107
Dilution Factor: 1 **Method.....:** SW846 8151A

PARAMETER	RESULT	REPORTING LIMIT	UNITS
2,4-D	ND	4.0	ug/L
Dinoseb	ND	0.70	ug/L
2,4,5-TP (Silvex)	ND	1.0	ug/L
2,4,5-T	ND	1.0	ug/L

SURROGATE	PERCENT RECOVERY	RECOVERY LIMITS
2,4-Dichlorophenylacetic acid	83	(43 - 111)

MKM ENGINEERS INC

Client Sample ID: RQLMW-06

HPLC

Lot-Sample #...: A1I210297-001 **Work Order #...:** EKW2Q1CQ **Matrix.....:** WG
Date Sampled...: 09/20/01 09:15 **Date Received..:** 09/20/01
Prep Date.....: 09/25/01 **Analysis Date..:** 09/27/01
Prep Batch #...: 1268126
Dilution Factor: 1 **Method.....:** SW846 8330

PARAMETER	RESULT	REPORTING LIMIT	UNITS
1,3-Dinitrobenzene	ND	0.20	ug/L
2,4-Dinitrotoluene	ND	0.13	ug/L
2,6-Dinitrotoluene	ND	0.13	ug/L
Nitrobenzene	ND	0.20	ug/L
Nitroglycerin	ND	2.5	ug/L
1,3,5-Trinitrobenzene	ND	0.20	ug/L
2,4,6-Trinitrotoluene	ND	0.20	ug/L
HMX	ND	0.50	ug/L
RDX	ND	0.50	ug/L
Tetryl	ND	0.20	ug/L
2-Nitrotoluene	ND	0.20	ug/L
3-Nitrotoluene	ND	0.20	ug/L
4-Nitrotoluene	ND	0.20	ug/L
4-Amino-2,6-dinitrotoluene	ND	0.20	ug/L
2-Amino-4,6-dinitrotoluene	ND	0.20	ug/L

SURROGATE	PERCENT RECOVERY	RECOVERY LIMITS
1-Chloro-3-nitrobenzene	53	(53 - 133)

MKM ENGINEERS INC

Client Sample ID: RQLMW-07

GC/MS Volatiles

Lot-Sample #...: A1I210297-002 **Work Order #...:** EKW3G1DH **Matrix.....:** WG

PARAMETER	RESULT	REPORTING LIMIT	UNITS
cis-1,2-Dichloroethene	ND	1.0	ug/L
trans-1,2-Dichloroethene	ND	1.0	ug/L
1,2-Dichloropropane	ND	1.0	ug/L
cis-1,3-Dichloropropene	ND	1.0	ug/L
trans-1,3-Dichloropropene	ND	1.0	ug/L
Ethylbenzene	ND	1.0	ug/L
Trichlorofluoromethane	ND	1.0	ug/L
2-Hexanone	ND	10	ug/L
Iodomethane	ND	1.0	ug/L
Methylene chloride	**0.49 J,B**	**1.0**	**ug/L**
Styrene	ND	1.0	ug/L
1,1,1,2-Tetrachloroethane	ND	1.0	ug/L
1,1,2,2-Tetrachloroethane	ND	1.0	ug/L
Tetrachloroethene	ND	1.0	ug/L
Toluene	ND	1.0	ug/L
1,1,1-Trichloroethane	ND	1.0	ug/L
1,1,2-Trichloroethane	ND	1.0	ug/L
Trichloroethene	ND	1.0	ug/L
1,2,3-Trichloropropane	ND	1.0	ug/L
Vinyl acetate	ND	10	ug/L
Vinyl chloride	ND	1.0	ug/L
Xylenes (total)	ND	1.0	ug/L
Chloroprene	ND	2.0	ug/L
1,3-Dichlorobenzene	ND	1.0	ug/L
Methacrylonitrile	ND	2.0	ug/L

SURROGATE	PERCENT RECOVERY	RECOVERY LIMITS
Dibromofluoromethane	103	(73 - 122)
1,2-Dichloroethane-d4	102	(61 - 128)
Toluene-d8	96	(76 - 110)
4-Bromofluorobenzene	88	(74 - 116)

NOTE(S):

J Estimated result. Result is less than RL.

B Method blank contamination. The associated method blank contains the target analyte at a reportable level.

MKM ENGINEERS INC

Client Sample ID: RQLMW-07

GC/MS Semivolatiles

Lot-Sample #...: A1I210297-002 **Work Order #...:** EKW3G1C1 **Matrix.....:** WG
Date Sampled...: 09/20/01 10:10 **Date Received..:** 09/20/01
Prep Date.....: 09/24/01 **Analysis Date..:** 09/30/01
Prep Batch #...: 1267101
Dilution Factor: 1 **Method.....:** SW846 8270C

PARAMETER	RESULT	REPORTING LIMIT	UNITS
Acenaphthene	ND	10	ug/L
Acenaphthylene	ND	10	ug/L
Acetophenone	ND	10	ug/L
2-Acetylaminofluorene	ND	100	ug/L
4-Aminobiphenyl	ND	50	ug/L
Anthracene	ND	10	ug/L
Benzo(a)anthracene	ND	10	ug/L
Benzo(b)fluoranthene	ND	10	ug/L
Benzo(k)fluoranthene	ND	10	ug/L
Benzo(ghi)perylene	ND	10	ug/L
Benzo(a)pyrene	ND	10	ug/L
Benzyl alcohol	ND	10	ug/L
bis(2-Chloroethoxy) methane	ND	10	ug/L
bis(2-Chloroethyl)-ether	ND	10	ug/L
bis(2-Chloro-1-methylethyl) ether	ND	10	ug/L
bis(2-Ethylhexyl) phthalate	ND	10	ug/L
4-Bromophenyl phenyl ether	ND	10	ug/L
Butyl benzyl phthalate	ND	10	ug/L
p-Chloroaniline	ND	10	ug/L
4-Chloro-3-methylphenol	ND	10	ug/L
2-Chloronaphthalene	ND	10	ug/L
2-Chlorophenol	ND	10	ug/L
4-Chlorophenyl phenyl ether	ND	10	ug/L
Chrysene	ND	10	ug/L
Diallate	ND	20	ug/L
Dibenz(a,h)anthracene	ND	10	ug/L
Dibenzofuran	ND	10	ug/L
Di-n-butyl phthalate	ND	10	ug/L
3,3'-Dichlorobenzidine	ND	50	ug/L
2,4-Dichlorophenol	ND	10	ug/L
2,6-Dichlorophenol	ND	10	ug/L
Diethyl phthalate	ND	10	ug/L
Thionazin	ND	50	ug/L

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MKM ENGINEERS INC

Client Sample ID: RQLMW-07

GC/MS Volatiles

Lot-Sample #...: A1I210297-002 **Work Order #...:** EKW3G1DH **Matrix.....:** WG
Date Sampled...: 09/20/01 10:10 **Date Received..:** 09/20/01
Prep Date.....: 10/01/01 **Analysis Date..:** 10/01/01
Prep Batch #...: 1274204
Dilution Factor: 1 **Method.....:** SW846 8260B

PARAMETER	RESULT	REPORTING LIMIT	UNITS
Dichlorodifluoromethane	ND	1.0	ug/L
Acetonitrile	ND	20	ug/L
Acrolein	ND	20	ug/L
Allyl chloride	ND	2.0	ug/L
1,3-Dichloropropane	ND	1.0	ug/L
2,2-Dichloropropane	ND	1.0	ug/L
1,1-Dichloropropene	ND	1.0	ug/L
Ethyl methacrylate	ND	1.0	ug/L
Isobutyl alcohol	ND	50	ug/L
Methyl methacrylate	ND	2.0	ug/L
Propionitrile	ND	4.0	ug/L
4-Methyl-2-pentanone (MIBK)	ND	10	ug/L
Acetone	**1.8 J**	**10**	**ug/L**
Acrylonitrile	ND	20	ug/L
Benzene	ND	1.0	ug/L
Bromochloromethane	ND	1.0	ug/L
Bromodichloromethane	ND	1.0	ug/L
Bromoform	ND	1.0	ug/L
Bromomethane	ND	1.0	ug/L
2-Butanone	ND	10	ug/L
Carbon disulfide	ND	1.0	ug/L
Carbon tetrachloride	ND	1.0	ug/L
Chlorobenzene	ND	1.0	ug/L
Dibromochloromethane	ND	1.0	ug/L
1,2-Dibromo-3-chloro-propane	ND	7.0	ug/L
Chloroethane	ND	1.0	ug/L
Chloroform	ND	1.0	ug/L
Chloromethane	**0.30 J**	**1.0**	**ug/L**
1,2-Dibromoethane	ND	1.0	ug/L
Dibromomethane	ND	1.0	ug/L
1,2-Dichlorobenzene	ND	1.0	ug/L
1,4-Dichlorobenzene	ND	1.0	ug/L
trans-1,4-Dichloro-2-butene	ND	1.0	ug/L
1,1-Dichloroethane	ND	1.0	ug/L
1,2-Dichloroethane	ND	1.0	ug/L
1,1-Dichloroethene	ND	1.0	ug/L

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MKM ENGINEERS INC

Client Sample ID: RQLMW-07

GC/MS Semivolatiles

Lot-Sample #...: A1I210297-002 **Work Order #...:** EKW3G1C1 **Matrix.....:** WG

PARAMETER	RESULT	REPORTING LIMIT	UNITS
Dimethoate	ND	20	ug/L
p-Dimethylaminoazobenzene	ND	20	ug/L
7,12-Dimethylbenz(a)-anthracene	ND	20	ug/L
3,3'-Dimethylbenzidine	ND	50	ug/L
2,4-Dimethylphenol	ND	10	ug/L
Dimethyl phthalate	ND	10	ug/L
Di-n-octyl phthalate	ND	10	ug/L
1,3-Dinitrobenzene	ND	10	ug/L
4,6-Dinitro-2-methylphenol	ND	50	ug/L
2,4-Dinitrophenol	ND	50	ug/L
2,4-Dinitrotoluene	ND	10	ug/L
2,6-Dinitrotoluene	ND	10	ug/L
Diphenylamine	ND	10	ug/L
Disulfoton	ND	50	ug/L
Ethyl methanesulfonate	ND	10	ug/L
Famphur	ND	100	ug/L
Fluoranthene	ND	10	ug/L
Fluorene	ND	10	ug/L
Hexachlorobenzene	ND	10	ug/L
Hexachlorobutadiene	ND	10	ug/L
Hexachlorocyclopentadiene	ND	50	ug/L
Hexachloroethane	ND	10	ug/L
Hexachloropropene	ND	100	ug/L
Indeno(1,2,3-cd)pyrene	ND	10	ug/L
Isophorone	ND	10	ug/L
Isosafrole	ND	20	ug/L
Methapyrilene	ND	50	ug/L
o-Toluidine	ND	20	ug/L
3-Methylcholanthrene	ND	20	ug/L
Methyl methanesulfonate	ND	10	ug/L
2-Methylnaphthalene	ND	10	ug/L
2-Methylphenol	ND	10	ug/L
3-Methylphenol	ND	10	ug/L
4-Methylphenol	ND	10	ug/L
Naphthalene	ND	10	ug/L
1,4-Naphthoquinone	ND	50	ug/L
1-Naphthylamine	ND	10	ug/L
2-Naphthylamine	ND	10	ug/L
2-Nitroaniline	ND	50	ug/L
3-Nitroaniline	ND	50	ug/L

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MKM ENGINEERS INC

Client Sample ID: RQLMW-07

GC/MS Semivolatiles

Lot-Sample #...: A1I210297-002 **Work Order #...:** EKW3G1C1 **Matrix.....:** WG

PARAMETER	RESULT	REPORTING LIMIT	UNITS
4-Nitroaniline	ND	50	ug/L
Nitrobenzene	ND	10	ug/L
2-Nitrophenol	ND	10	ug/L
4-Nitrophenol	ND	50	ug/L
N-Nitrosodi-n-butylamine	ND	10	ug/L
N-Nitrosodiethylamine	ND	10	ug/L
N-Nitrosodimethylamine	ND	10	ug/L
N-Nitrosodi-n-propyl-amine	ND	10	ug/L
N-Nitrosodiphenylamine	ND	10	ug/L
N-Nitrosomethylethylamine	ND	10	ug/L
N-Nitrosopiperidine	ND	10	ug/L
N-Nitrosopyrrolidine	ND	10	ug/L
5-Nitro-o-toluidine	ND	20	ug/L
Pentachlorobenzene	ND	10	ug/L
Pentachloronitrobenzene	ND	50	ug/L
Pentachlorophenol	ND	10	ug/L
Phenacetin	ND	20	ug/L
Phenanthrene	ND	10	ug/L
Phenol	ND	10	ug/L
p-Phenylene diamine	ND	100	ug/L
Phorate	ND	50	ug/L
Pronamide	ND	20	ug/L
Pyrene	ND	10	ug/L
Safrole	ND	20	ug/L
1,2,4,5-Tetrachloro-benzene	ND	10	ug/L
2,3,4,6-Tetrachlorophenol	ND	50	ug/L
1,2,4-Trichloro-benzene	ND	10	ug/L
2,4,5-Trichloro-phenol	ND	10	ug/L
2,4,6-Trichloro-phenol	ND	10	ug/L
O,O,O-Triethylphosphoro-thioate	ND	50	ug/L
1,3,5-Trinitrobenzene	ND	50	ug/L
Chlorobenzilate	ND	10	ug/L

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MKM ENGINEERS INC

Client Sample ID: RQLMW-07

GC/MS Semivolatiles

Lot-Sample #...: A1I210297-002 **Work Order #...:** EKW3G1C1 **Matrix.....:** WG

SURROGATE	PERCENT RECOVERY	RECOVERY LIMITS
Nitrobenzene-d5	73	(32 - 112)
2-Fluorobiphenyl	69	(30 - 110)
Terphenyl-d14	76	(10 - 144)
Phenol-d5	53	(10 - 113)
2-Fluorophenol	40	(13 - 110)
2,4,6-Tribromophenol	47	(21 - 122)

MKM ENGINEERS INC

Client Sample ID: RQLMW-07

GC Semivolatiles

Lot-Sample #...: A1I210297-002 **Work Order #...:** EKW3G1C7 **Matrix.....:** WG
Date Sampled...: 09/20/01 10:10 **Date Received..:** 09/20/01
Prep Date.....: 09/24/01 **Analysis Date..:** 09/30/01
Prep Batch #...: 1267178
Dilution Factor: 1 **Method.....:** SW846 8081A

PARAMETER	RESULT	REPORTING LIMIT	UNITS
Aldrin	ND	0.050	ug/L
alpha-BHC	ND	0.050	ug/L
beta-BHC	ND	0.050	ug/L
delta-BHC	ND	0.050	ug/L
gamma-BHC (Lindane)	ND	0.050	ug/L
Chlordane (technical)	ND	0.50	ug/L
4,4'-DDD	ND	0.050	ug/L
4,4'-DDE	ND	0.050	ug/L
4,4'-DDT	ND	0.050	ug/L
Dieldrin	ND	0.050	ug/L
Endosulfan I	ND	0.050	ug/L
Endosulfan II	ND	0.050	ug/L
Endosulfan sulfate	ND	0.050	ug/L
Endrin	ND	0.050	ug/L
Endrin aldehyde	ND	0.050	ug/L
Heptachlor	ND	0.050	ug/L
Heptachlor epoxide	ND	0.050	ug/L
Isodrin	ND	0.10	ug/L
Kepone	ND	1.0	ug/L
Methoxychlor	ND	0.10	ug/L
Toxaphene	ND	2.0	ug/L

SURROGATE	PERCENT RECOVERY	RECOVERY LIMITS
Tetrachloro-m-xylene	74	(39 - 130)
Decachlorobiphenyl	56	(10 - 147)

MKM ENGINEERS INC

Client Sample ID: RQLMW-07

GC Semivolatiles

Lot-Sample #...: A1I210297-002 **Work Order #...:** EKW3G1DA **Matrix.....:** WG
Date Sampled...: 09/20/01 10:10 **Date Received..:** 09/20/01
Prep Date.....: 09/24/01 **Analysis Date..:** 10/01/01
Prep Batch #...: 1267179
Dilution Factor: 1 **Method.....:** SW846 8082

PARAMETER	RESULT	REPORTING LIMIT	UNITS
Aroclor 1016	ND	1.0	ug/L
Aroclor 1221	ND	1.0	ug/L
Aroclor 1232	ND	1.0	ug/L
Aroclor 1242	ND	1.0	ug/L
Aroclor 1248	ND	1.0	ug/L
Aroclor 1254	ND	1.0	ug/L
Aroclor 1260	ND	1.0	ug/L

SURROGATE	PERCENT RECOVERY	RECOVERY LIMITS
Tetrachloro-m-xylene	98	(45 - 120)
Decachlorobiphenyl	59	(24 - 128)

MKM ENGINEERS INC

Client Sample ID: RQLMW-07

GC Semivolatiles

Lot-Sample #...: A1I210297-002 **Work Order #...:** EKW3G1CE **Matrix.....:** WG
Date Sampled...: 09/20/01 10:10 **Date Received..:** 09/20/01
Prep Date.....: 09/24/01 **Analysis Date..:** 09/25/01
Prep Batch #...: 1267188
Dilution Factor: 1 **Method.....:** SW846 8141A

PARAMETER	RESULT	REPORTING LIMIT	UNITS
Methyl parathion	ND	1.0	ug/L
Parathion	ND	1.0	ug/L

SURROGATE	PERCENT RECOVERY	RECOVERY LIMITS
Triphenyl phosphate	129	(41 - 155)

MKM ENGINEERS INC

Client Sample ID: RQLMW-07

GC Semivolatiles

Lot-Sample #...: A1I210297-002 **Work Order #...:** EKW3G1C4 **Matrix.....:** WG
Date Sampled...: 09/20/01 10:10 **Date Received..:** 09/20/01
Prep Date.....: 09/24/01 **Analysis Date..:** 10/05/01
Prep Batch #...: 1267107
Dilution Factor: 1 **Method.....:** SW846 8151A

PARAMETER	RESULT	REPORTING LIMIT	UNITS
2,4-D	ND	4.0	ug/L
Dinoseb	ND	0.70	ug/L
2,4,5-TP (Silvex)	ND	1.0	ug/L
2,4,5-T	ND	1.0	ug/L

SURROGATE	PERCENT RECOVERY	RECOVERY LIMITS
2,4-Dichlorophenylacetic acid	67	(43 - 111)

MKM ENGINEERS INC

Client Sample ID: RQLMW-07

Dissolved Trace Level Organic Compounds

Lot-Sample #...: A1I210297-002	**Work Order #...:** EKW3G1FT	**Matrix.....:** WG	
Date Sampled...: 09/20/01 10:10	**Date Received..:** 09/20/01		
Prep Date.....: 09/27/01	**Analysis Date..:** 10/05/01		
Prep Batch #...: 1270314			
Dilution Factor: 1	**Method.....:** NONE UV/HPLC per		

PARAMETER	RESULT	REPORTING LIMIT	UNITS
Nitroguanidine	ND	20	ug/L

MKM ENGINEERS INC

Client Sample ID: RQLMW-07

HPLC

Lot-Sample #...: A1I210297-002 **Work Order #...:** EKW3G1FL **Matrix.....:** WG
Date Sampled...: 09/20/01 10:10 **Date Received..:** 09/20/01
Prep Date.....: 09/25/01 **Analysis Date..:** 09/27/01
Prep Batch #...: 1268126
Dilution Factor: 1 **Method.....:** SW846 8330

PARAMETER	RESULT	REPORTING LIMIT	UNITS
1,3-Dinitrobenzene	ND	0.20	ug/L
2,4-Dinitrotoluene	ND	0.13	ug/L
2,6-Dinitrotoluene	ND	0.13	ug/L
Nitrobenzene	ND	0.20	ug/L
Nitroglycerin	ND	2.5	ug/L
1,3,5-Trinitrobenzene	ND	0.20	ug/L
2,4,6-Trinitrotoluene	ND	0.20	ug/L
HMX	ND	0.50	ug/L
RDX	ND	0.50	ug/L
Tetryl	ND	0.20	ug/L
2-Nitrotoluene	ND	0.20	ug/L
3-Nitrotoluene	ND	0.20	ug/L
4-Nitrotoluene	ND	0.20	ug/L
4-Amino-2,6-dinitrotoluene	ND	0.20	ug/L
2-Amino-4,6-dinitrotoluene	ND	0.20	ug/L

SURROGATE	PERCENT RECOVERY	RECOVERY LIMITS
1-Chloro-3-nitrobenzene	57	(53 - 133)

MKM ENGINEERS INC

Client Sample ID: RQLMW-07

TOTAL Metals

Lot-Sample #...: A1I210297-002 **Matrix.....:** WG
Date Sampled...: 09/20/01 10:10 **Date Received..:** 09/20/01

PARAMETER	RESULT	REPORTING LIMIT	UNITS	METHOD	PREPARATION-ANALYSIS DATE	WORK ORDER #
Prep Batch #...: 1267112						
Silver	ND	0.010	mg/L	SW846 6010B	09/24-09/25/01	EKW3G1AL
		Dilution Factor: 1				
Arsenic	**0.053**	**0.0050**	**mg/L**	**SW846 6010B**	**09/24-09/25/01**	**EKW3G1DL**
		Dilution Factor: 1				
Barium	**0.039**	**0.010**	**mg/L**	**SW846 6010B**	**09/24-09/25/01**	**EKW3G1D1**
		Dilution Factor: 1				
Beryllium	ND	0.0040	mg/L	SW846 6010B	09/24-09/25/01	EKW3G1D4
		Dilution Factor: 1				
Calcium	**109**	**5.0**	**mg/L**	**SW846 6010B**	**09/24-09/25/01**	**EKW3G1A4**
		Dilution Factor: 1				
Cadmium	ND	0.0050	mg/L	SW846 6010B	09/24-09/25/01	EKW3G1D7
		Dilution Factor: 1				
Cobalt	ND	0.050	mg/L	SW846 6010B	09/24-09/25/01	EKW3G1AA
		Dilution Factor: 1				
Chromium	ND	0.010	mg/L	SW846 6010B	09/24-09/25/01	EKW3G1A1
		Dilution Factor: 1				
Copper	ND	0.010	mg/L	SW846 6010B	09/24-09/25/01	EKW3G1AE
		Dilution Factor: 1				
Iron	**39.0**	**0.10**	**mg/L**	**SW846 6010B**	**09/24-09/25/01**	**EKW3G1A7**
		Dilution Factor: 1				
Potassium	**9.1**	**5.0**	**mg/L**	**SW846 6010B**	**09/24-09/25/01**	**EKW3G1EA**
		Dilution Factor: 1				
Magnesium	**140**	**5.0**	**mg/L**	**SW846 6010B**	**09/24-09/25/01**	**EKW3G1EE**
		Dilution Factor: 1				
Manganese	**1.3**	**0.015**	**mg/L**	**SW846 6010B**	**09/24-09/25/01**	**EKW3G1EH**
		Dilution Factor: 1				
Sodium	**14.8**	**5.0**	**mg/L**	**SW846 6010B**	**09/24-09/25/01**	**EKW3G1AP**
		Dilution Factor: 1				

(Continued on next page)

MKM ENGINEERS INC

Client Sample ID: RQLMW-07

TOTAL Metals

Lot-Sample #...: A1I210297-002 **Matrix.....:** WG

PARAMETER	RESULT	REPORTING LIMIT	UNITS	METHOD	PREPARATION-ANALYSIS DATE	WORK ORDER #
Nickel	ND	0.040	mg/L	SW846 6010B	09/24-09/25/01	EKW3G1AH
		Dilution Factor: 1				
Lead	ND	0.0030	mg/L	SW846 6010B	09/24-09/25/01	EKW3G1DP
		Dilution Factor: 1				
Antimony	ND	0.060	mg/L	SW846 6010B	09/24-09/25/01	EKW3G1DW
		Dilution Factor: 1				
Selenium	ND	0.0050	mg/L	SW846 6010B	09/24-09/25/01	EKW3G1DT
		Dilution Factor: 1				
Tin	ND	0.10	mg/L	SW846 6010B	09/24-09/25/01	EKW3G1EL
		Dilution Factor: 1				
Thallium	ND Wa	0.0020	mg/L	SW846 7841	09/24-09/25/01	EKW3G1EP
		Dilution Factor: 1				
anadium	ND	0.050	mg/L	SW846 6010B	09/24-09/25/01	EKW3G1AT
		Dilution Factor: 1				
Zinc	**0.056**	**0.050**	**mg/L**	**SW846 6010B**	**09/24-09/25/01**	**EKW3G1AW**
		Dilution Factor: 1				
Mercury	ND	0.00020	mg/L	SW846 7470A	09/24-09/25/01	EKW3G1ET
		Dilution Factor: 1				

NOTE(S):

Wa Post digestion spike recovery fell between 40-85% due to matrix interference.

MKM ENGINEERS INC

Client Sample ID: RQLMW-07

General Chemistry

Lot-Sample #...: A1I210297-002 Work Order #...: EKW3G Matrix.....: WG
Date Sampled...: 09/20/01 10:10 Date Received..: 09/20/01

PARAMETER	RESULT	RL	UNITS	METHOD	PREPARATION-ANALYSIS DATE	PREP BATCH #
pH (liquid)	8.1		No Units	MCAWW 150.1	09/22/01	1267393
		Dilution Factor: 1				
Chloride	7.0	1.0	mg/L	MCAWW 300.0A	09/25/01	1269389
		Dilution Factor: 1				
Hexavalent Chromium	ND	0.02	mg/L	SW846 7196A	09/21/01	1268450
		Dilution Factor: 1				
Nitrate-Nitrite	ND	0.1	mg/L	MCAWW 353.2	09/24/01	1268415
		Dilution Factor: 1				
Nitrocellulose	ND	0.50	mg/L	MCAWW 353.2	09/29-10/04/01	1274466
		Dilution Factor: 1				
Nitrogen, as Ammonia	0.9	0.2	mg/L	MCAWW 350.3	10/01/01	1275093
		Dilution Factor: 1				
Sulfate	267	5.0	mg/L	MCAWW 300.0A	09/25/01	1269392
		Dilution Factor: 5				
Total phosphorus	ND	0.1	mg/L	MCAWW 365.2	09/26/01	1269443
		Dilution Factor: 1				
Total Alkalinity	730	5.0	mg/L	MCAWW 310.1	09/22/01	1267433
		Dilution Factor: 1				
Total Cyanide	ND	0.010	mg/L	MCAWW 335.2	10/02/01	1275384
		Dilution Factor: 1				
Total Dissolved Solids	1000	10	mg/L	MCAWW 160.1	09/25-09/26/01	1268169
		Dilution Factor: 1				
Total Organic Carbon	10	1	mg/L	SW846 9060	09/24/01	1268207
		Dilution Factor: 1				
Total Phenols	ND	0.040	mg/L	SW846 9065	10/03/01	1276408
		Dilution Factor: 1				

(Continued on next page)

MKM ENGINEERS INC

Client Sample ID: RQLMW-07

General Chemistry

Lot-Sample #...: A1I210297-002 Work Order #...: EKW3G Matrix.....: WG

PARAMETER	RESULT	RL	UNITS	METHOD	PREPARATION-ANALYSIS DATE	PREP BATCH #
Total Sulfide	ND	1.0	mg/L	MCAWW 376.1	09/24/01	1268591
	Dilution Factor: 1					
Turbidity	**690**	**10**	**NTU**	**MCAWW 180.1**	**09/21/01**	**1264521**
	Dilution Factor: 20					

MKM ENGINEERS INC

Client Sample ID: DUPLICATE

GC/MS Volatiles

Lot-Sample #...: A1I210297-003 **Work Order #...:** EKW3P1A2 **Matrix.....:** WG
Date Sampled...: 09/20/01 10:20 **Date Received..:** 09/20/01
Prep Date.....: 10/01/01 **Analysis Date..:** 10/01/01
Prep Batch #...: 1274204
Dilution Factor: 1 **Method.....:** SW846 8260B

PARAMETER	RESULT	REPORTING LIMIT	UNITS
Dichlorodifluoromethane	ND	1.0	ug/L
Acetonitrile	ND	20	ug/L
Acrolein	ND	20	ug/L
Allyl chloride	ND	2.0	ug/L
1,3-Dichloropropane	ND	1.0	ug/L
2,2-Dichloropropane	ND	1.0	ug/L
1,1-Dichloropropene	ND	1.0	ug/L
Ethyl methacrylate	ND	1.0	ug/L
Isobutyl alcohol	ND	50	ug/L
Methyl methacrylate	ND	2.0	ug/L
Propionitrile	ND	4.0	ug/L
4-Methyl-2-pentanone (MIBK)	ND	10	ug/L
Acetone	ND	10	ug/L
Acrylonitrile	ND	20	ug/L
Benzene	ND	1.0	ug/L
Bromochloromethane	ND	1.0	ug/L
Bromodichloromethane	ND	1.0	ug/L
Bromoform	ND	1.0	ug/L
Bromomethane	ND	1.0	ug/L
2-Butanone	ND	10	ug/L
Carbon disulfide	ND	1.0	ug/L
Carbon tetrachloride	ND	1.0	ug/L
Chlorobenzene	ND	1.0	ug/L
Dibromochloromethane	ND	1.0	ug/L
1,2-Dibromo-3-chloro-propane	ND	7.0	ug/L
Chloroethane	ND	1.0	ug/L
Chloroform	**0.19 J**	**1.0**	**ug/L**
Chloromethane	**0.14 J**	**1.0**	**ug/L**
1,2-Dibromoethane	ND	1.0	ug/L
Dibromomethane	ND	1.0	ug/L
1,2-Dichlorobenzene	ND	1.0	ug/L
1,4-Dichlorobenzene	ND	1.0	ug/L
trans-1,4-Dichloro-2-butene	ND	1.0	ug/L
1,1-Dichloroethane	ND	1.0	ug/L
1,2-Dichloroethane	ND	1.0	ug/L
1,1-Dichloroethene	ND	1.0	ug/L

(Continued on next page)

MKM ENGINEERS INC

Client Sample ID: DUPLICATE

GC/MS Volatiles

Lot-Sample #...: A1I210297-003 Work Order #...: EKW3P1A2 Matrix.....: WG

PARAMETER	RESULT	REPORTING LIMIT	UNITS
cis-1,2-Dichloroethene	ND	1.0	ug/L
trans-1,2-Dichloroethene	ND	1.0	ug/L
1,2-Dichloropropane	ND	1.0	ug/L
cis-1,3-Dichloropropene	ND	1.0	ug/L
trans-1,3-Dichloropropene	ND	1.0	ug/L
Ethylbenzene	ND	1.0	ug/L
Trichlorofluoromethane	ND	1.0	ug/L
2-Hexanone	ND	10	ug/L
Iodomethane	ND	1.0	ug/L
Methylene chloride	**0.43 J,B**	**1.0**	**ug/L**
Styrene	ND	1.0	ug/L
1,1,1,2-Tetrachloroethane	ND	1.0	ug/L
1,1,2,2-Tetrachloroethane	ND	1.0	ug/L
Tetrachloroethene	ND	1.0	ug/L
Toluene	ND	1.0	ug/L
1,1,1-Trichloroethane	ND	1.0	ug/L
1,1,2-Trichloroethane	ND	1.0	ug/L
Trichloroethene	ND	1.0	ug/L
1,2,3-Trichloropropane	ND	1.0	ug/L
Vinyl acetate	ND	10	ug/L
Vinyl chloride	ND	1.0	ug/L
Xylenes (total)	ND	1.0	ug/L
Chloroprene	ND	2.0	ug/L
1,3-Dichlorobenzene	ND	1.0	ug/L
Methacrylonitrile	ND	2.0	ug/L

SURROGATE	PERCENT RECOVERY	RECOVERY LIMITS
Dibromofluoromethane	108	(73 - 122)
1,2-Dichloroethane-d4	103	(61 - 128)
Toluene-d8	91	(76 - 110)
4-Bromofluorobenzene	89	(74 - 116)

NOTE(S):

J Estimated result. Result is less than RL.

B Method blank contamination. The associated method blank contains the target analyte at a reportable level.

MKM ENGINEERS INC

Client Sample ID: DUPLICATE

GC/MS Semivolatiles

Lot-Sample #...: A1I210297-003 **Work Order #...:** EKW3P1AV **Matrix.....:** WG
Date Sampled...: 09/20/01 10:20 **Date Received..:** 09/20/01
Prep Date.....: 09/24/01 **Analysis Date..:** 09/30/01
Prep Batch #...: 1267101
Dilution Factor: 1 **Method.....:** SW846 8270C

PARAMETER	RESULT	REPORTING LIMIT	UNITS
4-Nitroaniline	ND	50	ug/L
Nitrobenzene	ND	10	ug/L
2-Nitrophenol	ND	10	ug/L
4-Nitrophenol	ND	50	ug/L
N-Nitrosodi-n-butylamine	ND	10	ug/L
N-Nitrosodiethylamine	ND	10	ug/L
N-Nitrosodimethylamine	ND	10	ug/L
N-Nitrosodi-n-propyl-amine	ND	10	ug/L
N-Nitrosodiphenylamine	ND	10	ug/L
N-Nitrosomethylethylamine	ND	10	ug/L
N-Nitrosopiperidine	ND	10	ug/L
N-Nitrosopyrrolidine	ND	10	ug/L
5-Nitro-o-toluidine	ND	20	ug/L
Pentachlorobenzene	ND	10	ug/L
Pentachloronitrobenzene	ND	50	ug/L
Pentachlorophenol	ND	10	ug/L
Phenacetin	ND	20	ug/L
Phenanthrene	ND	10	ug/L
Phenol	ND	10	ug/L
p-Phenylene diamine	ND	100	ug/L
Phorate	ND	50	ug/L
Pronamide	ND	20	ug/L
Pyrene	ND	10	ug/L
Safrole	ND	20	ug/L
1,2,4,5-Tetrachloro-benzene	ND	10	ug/L
2,3,4,6-Tetrachlorophenol	ND	50	ug/L
1,2,4-Trichloro-benzene	ND	10	ug/L
2,4,5-Trichloro-phenol	ND	10	ug/L
2,4,6-Trichloro-phenol	ND	10	ug/L
O,O,O-Triethylphosphoro-thioate	ND	50	ug/L
1,3,5-Trinitrobenzene	ND	50	ug/L
Chlorobenzilate	ND	10	ug/L
Acenaphthene	ND	10	ug/L

(Continued on next page)

MKM ENGINEERS INC

Client Sample ID: DUPLICATE

GC/MS Semivolatiles

Lot-Sample #...: A1I210297-003 **Work Order #...:** EKW3P1AV **Matrix.....:** WG

PARAMETER	RESULT	REPORTING LIMIT	UNITS
Acenaphthylene	ND	10	ug/L
Acetophenone	ND	10	ug/L
2-Acetylaminofluorene	ND	100	ug/L
4-Aminobiphenyl	ND	50	ug/L
Anthracene	ND	10	ug/L
Benzo(a)anthracene	ND	10	ug/L
Benzo(b)fluoranthene	ND	10	ug/L
Benzo(k)fluoranthene	ND	10	ug/L
Benzo(ghi)perylene	ND	10	ug/L
Benzo(a)pyrene	ND	10	ug/L
Benzyl alcohol	ND	10	ug/L
bis(2-Chloroethoxy) methane	ND	10	ug/L
bis(2-Chloroethyl)-ether	ND	10	ug/L
bis(2-Chloro-1-methylethyl) ether	ND	10	ug/L
bis(2-Ethylhexyl) phthalate	ND	10	ug/L
4-Bromophenyl phenyl ether	ND	10	ug/L
Butyl benzyl phthalate	ND	10	ug/L
p-Chloroaniline	ND	10	ug/L
4-Chloro-3-methylphenol	ND	10	ug/L
2-Chloronaphthalene	ND	10	ug/L
2-Chlorophenol	ND	10	ug/L
4-Chlorophenyl phenyl ether	ND	10	ug/L
Chrysene	ND	10	ug/L
Diallate	ND	20	ug/L
Dibenz(a,h)anthracene	ND	10	ug/L
Dibenzofuran	ND	10	ug/L
Di-n-butyl phthalate	ND	10	ug/L
3,3'-Dichlorobenzidine	ND	50	ug/L
2,4-Dichlorophenol	ND	10	ug/L
2,6-Dichlorophenol	ND	10	ug/L
Diethyl phthalate	ND	10	ug/L
Thionazin	ND	50	ug/L
Dimethoate	ND	20	ug/L
p-Dimethylaminoazobenzene	ND	20	ug/L
7,12-Dimethylbenz(a)-anthracene	ND	20	ug/L
3,3'-Dimethylbenzidine	ND	50	ug/L

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MKM ENGINEERS INC

Client Sample ID: DUPLICATE

GC/MS Semivolatiles

Lot-Sample #...: A1I210297-003 Work Order #...: EKW3P1AV Matrix.....: WG

PARAMETER	RESULT	REPORTING LIMIT	UNITS
2,4-Dimethylphenol	ND	10	ug/L
Dimethyl phthalate	ND	10	ug/L
Di-n-octyl phthalate	ND	10	ug/L
1,3-Dinitrobenzene	ND	10	ug/L
4,6-Dinitro-2-methylphenol	ND	50	ug/L
2,4-Dinitrophenol	ND	50	ug/L
2,4-Dinitrotoluene	ND	10	ug/L
2,6-Dinitrotoluene	ND	10	ug/L
Diphenylamine	ND	10	ug/L
Disulfoton	ND	50	ug/L
Ethyl methanesulfonate	ND	10	ug/L
Famphur	ND	100	ug/L
Fluoranthene	ND	10	ug/L
Fluorene	ND	10	ug/L
Hexachlorobenzene	ND	10	ug/L
Hexachlorobutadiene	ND	10	ug/L
Hexachlorocyclopentadiene	ND	50	ug/L
Hexachloroethane	ND	10	ug/L
Hexachloropropene	ND	100	ug/L
Indeno(1,2,3-cd)pyrene	ND	10	ug/L
Isophorone	ND	10	ug/L
Isosafrole	ND	20	ug/L
Methapyrilene	ND	50	ug/L
o-Toluidine	ND	20	ug/L
3-Methylcholanthrene	ND	20	ug/L
Methyl methanesulfonate	ND	10	ug/L
2-Methylnaphthalene	ND	10	ug/L
2-Methylphenol	ND	10	ug/L
3-Methylphenol	ND	10	ug/L
4-Methylphenol	ND	10	ug/L
Naphthalene	ND	10	ug/L
1,4-Naphthoquinone	ND	50	ug/L
1-Naphthylamine	ND	10	ug/L
2-Naphthylamine	ND	10	ug/L
2-Nitroaniline	ND	50	ug/L
3-Nitroaniline	ND	50	ug/L

(Continued on next page)

MKM ENGINEERS INC

Client Sample ID: DUPLICATE

GC/MS Semivolatiles

Lot-Sample #...: A1I210297-003 **Work Order #...:** EKW3P1AV **Matrix.....:** WG

SURROGATE	PERCENT RECOVERY	RECOVERY LIMITS
Nitrobenzene-d5	75	(32 - 112)
2-Fluorobiphenyl	72	(30 - 110)
Terphenyl-d14	82	(10 - 144)
Phenol-d5	52	(10 - 113)
2-Fluorophenol	33	(13 - 110)
2,4,6-Tribromophenol	40	(21 - 122)

MKM ENGINEERS INC

Client Sample ID: DUPLICATE

GC Semivolatiles

Lot-Sample #...: A1I210297-003 **Work Order #...:** EKW3P1AX **Matrix.....:** WG
Date Sampled...: 09/20/01 10:20 **Date Received..:** 09/20/01
Prep Date.....: 09/24/01 **Analysis Date..:** 09/30/01
Prep Batch #...: 1267178
Dilution Factor: 1 **Method.....:** SW846 8081A

PARAMETER	RESULT	REPORTING LIMIT	UNITS
Aldrin	ND	0.050	ug/L
alpha-BHC	ND	0.050	ug/L
beta-BHC	ND	0.050	ug/L
delta-BHC	ND	0.050	ug/L
gamma-BHC (Lindane)	ND	0.050	ug/L
Chlordane (technical)	ND	0.50	ug/L
4,4'-DDD	ND	0.050	ug/L
4,4'-DDE	ND	0.050	ug/L
4,4'-DDT	ND	0.050	ug/L
Dieldrin	ND	0.050	ug/L
Endosulfan I	ND	0.050	ug/L
Endosulfan II	ND	0.050	ug/L
Endosulfan sulfate	ND	0.050	ug/L
Endrin	ND	0.050	ug/L
Endrin aldehyde	ND	0.050	ug/L
Heptachlor	ND	0.050	ug/L
Heptachlor epoxide	ND	0.050	ug/L
Isodrin	ND	0.10	ug/L
Kepone	ND	1.0	ug/L
Methoxychlor	ND	0.10	ug/L
Toxaphene	ND	2.0	ug/L

SURROGATE	PERCENT RECOVERY	RECOVERY LIMITS
Tetrachloro-m-xylene	76	(39 - 130)
Decachlorobiphenyl	47	(10 - 147)

MKM ENGINEERS INC

Client Sample ID: DUPLICATE

GC Semivolatiles

Lot-Sample #...: A1I210297-003 **Work Order #...:** EKW3P1A0 **Matrix.....:** WG
Date Sampled...: 09/20/01 10:20 **Date Received..:** 09/20/01
Prep Date.....: 09/24/01 **Analysis Date..:** 09/30/01
Prep Batch #...: 1267179
Dilution Factor: 1 **Method.....:** SW846 8082

PARAMETER	RESULT	REPORTING LIMIT	UNITS
Aroclor 1016	ND	1.0	ug/L
Aroclor 1221	ND	1.0	ug/L
Aroclor 1232	ND	1.0	ug/L
Aroclor 1242	ND	1.0	ug/L
Aroclor 1248	ND	1.0	ug/L
Aroclor 1254	ND	1.0	ug/L
Aroclor 1260	ND	1.0	ug/L

SURROGATE	PERCENT RECOVERY	RECOVERY LIMITS
Tetrachloro-m-xylene	95	(45 - 120)
Decachlorobiphenyl	51	(24 - 128)

MKM ENGINEERS INC

Client Sample ID: DUPLICATE

GC Semivolatiles

Lot-Sample #...: A1I210297-003 **Work Order #...:** EKW3P1AN **Matrix.....:** WG
Date Sampled...: 09/20/01 10:20 **Date Received..:** 09/20/01
Prep Date.....: 09/24/01 **Analysis Date..:** 09/25/01
Prep Batch #...: 1267188
Dilution Factor: 1 **Method.....:** SW846 8141A

PARAMETER	RESULT	REPORTING LIMIT	UNITS
Methyl parathion	ND	1.0	ug/L
Parathion	ND	1.0	ug/L

SURROGATE	PERCENT RECOVERY	RECOVERY LIMITS
Triphenyl phosphate	129	(41 - 155)

MKM ENGINEERS INC

Client Sample ID: DUPLICATE

GC Semivolatiles

Lot-Sample #...: A1I210297-003 **Work Order #...:** EKW3P1AW **Matrix.....:** WG
Date Sampled...: 09/20/01 10:20 **Date Received..:** 09/20/01
Prep Date.....: 09/24/01 **Analysis Date..:** 10/05/01
Prep Batch #...: 1267107
Dilution Factor: 1 **Method.....:** SW846 8151A

PARAMETER	RESULT	REPORTING LIMIT	UNITS
2,4-D	ND	4.0	ug/L
Dinoseb	ND	0.70	ug/L
2,4,5-TP (Silvex)	ND	1.0	ug/L
2,4,5-T	ND	1.0	ug/L

SURROGATE	PERCENT RECOVERY	RECOVERY LIMITS
2,4-Dichlorophenylacetic acid	71	(43 - 111)

MKM ENGINEERS INC

Client Sample ID: DUPLICATE

Dissolved Trace Level Organic Compounds

Lot-Sample #...: A1I210297-003 **Work Order #...:** EKW3P1CT **Matrix.....:** WG
Date Sampled...: 09/20/01 10:20 **Date Received..:** 09/20/01
Prep Date.....: 09/27/01 **Analysis Date..:** 10/05/01
Prep Batch #...: 1270314
Dilution Factor: 1 **Method.....:** NONE UV/HPLC per

PARAMETER	RESULT	REPORTING LIMIT	UNITS
Nitroguanidine	ND	20	ug/L

MKM ENGINEERS INC

Client Sample ID: DUPLICATE

HPLC

Lot-Sample #...: A1I210297-003 **Work Order #...:** EKW3P2CQ **Matrix.....:** WG
Date Sampled...: 09/20/01 10:20 **Date Received..:** 09/20/01
Prep Date.....: 09/27/01 **Analysis Date..:** 10/02/01
Prep Batch #...: 1270302
Dilution Factor: 5 **Method.....:** SW846 8330

PARAMETER	RESULT	REPORTING LIMIT	UNITS
1,3-Dinitrobenzene	ND	1.0	ug/L
2,4-Dinitrotoluene	ND	1.0	ug/L
2,6-Dinitrotoluene	ND	1.0	ug/L
Nitrobenzene	ND	1.0	ug/L
Nitroglycerin	ND	12	ug/L
1,3,5-Trinitrobenzene	ND	1.0	ug/L
2,4,6-Trinitrotoluene	ND	1.0	ug/L
HMX	ND	2.5	ug/L
RDX	ND	2.5	ug/L
Tetryl	ND	1.0	ug/L
2-Nitrotoluene	ND	1.0	ug/L
3-Nitrotoluene	ND	1.0	ug/L
4-Nitrotoluene	ND	1.0	ug/L
4-Amino-2,6-dinitrotoluene	ND	1.0	ug/L
2-Amino-4,6-dinitrotoluene	ND	1.0	ug/L

SURROGATE	PERCENT RECOVERY	RECOVERY LIMITS
1-Chloro-3-nitrobenzene	90	(53 - 133)

MKM ENGINEERS INC

Client Sample ID: DUPLICATE

TOTAL Metals

Lot-Sample #...: A1I210297-003 Matrix.....: WG
Date Sampled...: 09/20/01 10:20 Date Received..: 09/20/01

PARAMETER	RESULT	REPORTING LIMIT	UNITS	METHOD	PREPARATION-ANALYSIS DATE	WORK ORDER #
Prep Batch #...: 1267112						
Zinc	0.061	0.050	mg/L	SW846 6010B	09/24-09/25/01	EKW3P1AH
		Dilution Factor: 1				
Silver	ND	0.010	mg/L	SW846 6010B	09/24-09/25/01	EKW3P1AE
		Dilution Factor: 1				
Arsenic	0.057	0.0050	mg/L	SW846 6010B	09/24-09/25/01	EKW3P1A3
		Dilution Factor: 1				
Barium	0.045	0.010	mg/L	SW846 6010B	09/24-09/25/01	EKW3P1A7
		Dilution Factor: 1				
Beryllium	ND	0.0040	mg/L	SW846 6010B	09/24-09/25/01	EKW3P1A8
		Dilution Factor: 1				
Calcium	127	5.0	mg/L	SW846 6010B	09/24-09/25/01	EKW3P1AK
		Dilution Factor: 1				
Cadmium	ND	0.0050	mg/L	SW846 6010B	09/24-09/25/01	EKW3P1A9
		Dilution Factor: 1				
Cobalt	ND	0.050	mg/L	SW846 6010B	09/24-09/25/01	EKW3P1AA
		Dilution Factor: 1				
Chromium	ND	0.010	mg/L	SW846 6010B	09/24-09/25/01	EKW3P1AJ
		Dilution Factor: 1				
Copper	ND	0.010	mg/L	SW846 6010B	09/24-09/25/01	EKW3P1AC
		Dilution Factor: 1				
Iron	44.2	0.10	mg/L	SW846 6010B	09/24-09/25/01	EKW3P1AL
		Dilution Factor: 1				
Potassium	10.6	5.0	mg/L	SW846 6010B	09/24-09/25/01	EKW3P1CA
		Dilution Factor: 1				
Magnesium	163	5.0	mg/L	SW846 6010B	09/24-09/25/01	EKW3P1CC
		Dilution Factor: 1				
Manganese	1.5	0.015	mg/L	SW846 6010B	09/24-09/25/01	EKW3P1CD
		Dilution Factor: 1				

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MKM ENGINEERS INC

Client Sample ID: DUPLICATE

TOTAL Metals

Lot-Sample #...: A1I210297-003 **Matrix.....:** WG

PARAMETER	RESULT	REPORTING LIMIT	UNITS	METHOD	PREPARATION-ANALYSIS DATE	WORK ORDER #
Sodium	**16.8**	**5.0**	**mg/L**	**SW846 6010B**	**09/24-09/25/01**	**EKW3P1AF**
		Dilution Factor: 1				
Nickel	ND	0.040	mg/L	SW846 6010B	09/24-09/25/01	EKW3P1AD
		Dilution Factor: 1				
Lead	ND	0.0030	mg/L	SW846 6010B	09/24-09/25/01	EKW3P1A4
		Dilution Factor: 1				
Antimony	ND	0.060	mg/L	SW846 6010B	09/24-09/25/01	EKW3P1A6
		Dilution Factor: 1				
Selenium	ND	0.0050	mg/L	SW846 6010B	09/24-09/25/01	EKW3P1A5
		Dilution Factor: 1				
Tin	ND	0.10	mg/L	SW846 6010B	09/24-09/25/01	EKW3P1CE
		Dilution Factor: 1				
Thallium	ND Wa	0.0020	mg/L	SW846 7841	09/24-09/25/01	EKW3P1CF
		Dilution Factor: 1				
Vanadium	ND	0.050	mg/L	SW846 6010B	09/24-09/25/01	EKW3P1AG
		Dilution Factor: 1				
Mercury	ND	0.00020	mg/L	SW846 7470A	09/24-09/25/01	EKW3P1CG
		Dilution Factor: 1				

NOTE(S):

Wa Post digestion spike recovery fell between 40-85% due to matrix interference.

MKM ENGINEERS INC

Client Sample ID: DUPLICATE

General Chemistry

Lot-Sample #...: A1I210297-003 Work Order #...: EKW3P Matrix.....: WG
Date Sampled...: 09/20/01 10:20 Date Received..: 09/20/01

PARAMETER	RESULT	RL	UNITS	METHOD	PREPARATION-ANALYSIS DATE	PREP BATCH #
pH (liquid)	8.0		No Units	MCAWW 150.1	09/22/01	1267393
	Dilution Factor: 1					
Chloride	6.9	1.0	mg/L	MCAWW 300.0A	09/25/01	1269389
	Dilution Factor: 1					
Hexavalent Chromium	ND	0.02	mg/L	SW846 7196A	09/21/01	1268450
	Dilution Factor: 1					
Nitrate-Nitrite	ND	0.1	mg/L	MCAWW 353.2	09/24/01	1268415
	Dilution Factor: 1					
Nitrocellulose	ND	0.50	mg/L	MCAWW 353.2	09/29-10/04/01	1274466
	Dilution Factor: 1					
itrogen, as Ammonia	1.2	0.2	mg/L	MCAWW 350.3	10/01/01	1275093
	Dilution Factor: 1					
Sulfate	269	5.0	mg/L	MCAWW 300.0A	09/25/01	1269392
	Dilution Factor: 5					
Total phosphorus	0.1	0.1	mg/L	MCAWW 365.2	09/26/01	1269445
	Dilution Factor: 1					
Total Alkalinity	730	5.0	mg/L	MCAWW 310.1	09/22/01	1267433
	Dilution Factor: 1					
Total Dissolved Solids	1000	10	mg/L	MCAWW 160.1	09/25-09/26/01	1268169
	Dilution Factor: 1					
Total Organic Carbon	10	1	mg/L	SW846 9060	09/24/01	1268207
	Dilution Factor: 1					
Total Phenols	0.067	0.040	mg/L	SW846 9065	10/03/01	1276408
	Dilution Factor: 1					
Total Sulfide	1.7	1.0	mg/L	MCAWW 376.1	09/24/01	1268591
	Dilution Factor: 1					

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MKM ENGINEERS INC

Client Sample ID: DUPLICATE

General Chemistry

Lot-Sample #...: A1I210297-003 Work Order #...: EKW3P Matrix.....: WG

PARAMETER	RESULT	RL	UNITS	METHOD	PREPARATION-ANALYSIS DATE	PREP BATCH #
Turbidity	500	10	NTU	MCAWW 180.1	09/21/01	1264521

Dilution Factor: 20

MKM ENGINEERS INC

Client Sample ID: DUPLICATE

General Chemistry

Lot-Sample #...: A1I280133-002 **Work Order #...:** EK9E1 **Matrix.....:** WG
Date Sampled...: 09/26/01 13:27 **Date Received..:** 09/27/01

PARAMETER	RESULT	RL	UNITS	METHOD	PREPARATION-ANALYSIS DATE	PREP BATCH #
Total Cyanide	ND	0.010	mg/L	MCAWW 335.2	10/02/01	1275384

Dilution Factor: 1

MKM ENGINEERS INC

Client Sample ID: FIELD BLANK

GC/MS Volatiles

Lot-Sample #...: A1I210297-004 **Work Order #...:** EKW3T1A2 **Matrix.....:** WQ
Date Sampled...: 09/20/01 08:05 **Date Received..:** 09/20/01
Prep Date.....: 10/01/01 **Analysis Date..:** 10/01/01
Prep Batch #...: 1274204
Dilution Factor: 1 **Method.....:** SW846 8260B

PARAMETER	RESULT	REPORTING LIMIT	UNITS
1,2-Dibromo-3-chloro-propane	ND	7.0	ug/L
Chloroethane	ND	1.0	ug/L
Chloroform	ND	1.0	ug/L
Dichlorodifluoromethane	ND	1.0	ug/L
Acetonitrile	ND	20	ug/L
Acrolein	ND	20	ug/L
Allyl chloride	ND	2.0	ug/L
1,3-Dichloropropane	ND	1.0	ug/L
2,2-Dichloropropane	ND	1.0	ug/L
Chloromethane	**0.15 J**	**1.0**	**ug/L**
1,2-Dibromoethane	ND	1.0	ug/L
1,1-Dichloropropene	ND	1.0	ug/L
Ethyl methacrylate	ND	1.0	ug/L
Isobutyl alcohol	ND	50	ug/L
Dibromomethane	ND	1.0	ug/L
1,2-Dichlorobenzene	ND	1.0	ug/L
1,4-Dichlorobenzene	ND	1.0	ug/L
Methyl methacrylate	ND	2.0	ug/L
Propionitrile	ND	4.0	ug/L
4-Methyl-2-pentanone (MIBK)	ND	10	ug/L
Acetone	**2.3 J**	**10**	**ug/L**
Acrylonitrile	ND	20	ug/L
Benzene	ND	1.0	ug/L
Bromochloromethane	ND	1.0	ug/L
Bromodichloromethane	ND	1.0	ug/L
Bromoform	ND	1.0	ug/L
Bromomethane	ND	1.0	ug/L
2-Butanone	**0.43 J**	**10**	**ug/L**
Carbon disulfide	ND	1.0	ug/L
Carbon tetrachloride	ND	1.0	ug/L
Chlorobenzene	ND	1.0	ug/L
Dibromochloromethane	ND	1.0	ug/L
trans-1,4-Dichloro-2-butene	ND	1.0	ug/L
1,1-Dichloroethane	ND	1.0	ug/L
1,2-Dichloroethane	ND	1.0	ug/L
1,1-Dichloroethene	ND	1.0	ug/L

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MKM ENGINEERS INC

Client Sample ID: FIELD BLANK

GC/MS Volatiles

Lot-Sample #...: A1I210297-004 **Work Order #...:** EKW3T1A2 **Matrix.....:** WQ

PARAMETER	RESULT	REPORTING LIMIT	UNITS
cis-1,2-Dichloroethene	ND	1.0	ug/L
trans-1,2-Dichloroethene	ND	1.0	ug/L
1,2-Dichloropropane	ND	1.0	ug/L
cis-1,3-Dichloropropene	ND	1.0	ug/L
trans-1,3-Dichloropropene	ND	1.0	ug/L
Ethylbenzene	ND	1.0	ug/L
Trichlorofluoromethane	ND	1.0	ug/L
2-Hexanone	ND	10	ug/L
Iodomethane	ND	1.0	ug/L
Methylene chloride	**0.43 J,B**	**1.0**	**ug/L**
Styrene	ND	1.0	ug/L
1,1,1,2-Tetrachloroethane	ND	1.0	ug/L
1,1,2,2-Tetrachloroethane	ND	1.0	ug/L
Tetrachloroethene	ND	1.0	ug/L
Toluene	ND	1.0	ug/L
1,1,1-Trichloroethane	ND	1.0	ug/L
1,1,2-Trichloroethane	ND	1.0	ug/L
Trichloroethene	ND	1.0	ug/L
1,2,3-Trichloropropane	ND	1.0	ug/L
Vinyl acetate	ND	10	ug/L
Vinyl chloride	ND	1.0	ug/L
Xylenes (total)	ND	1.0	ug/L
Chloroprene	ND	2.0	ug/L
1,3-Dichlorobenzene	ND	1.0	ug/L
Methacrylonitrile	ND	2.0	ug/L

SURROGATE	PERCENT RECOVERY	RECOVERY LIMITS
Dibromofluoromethane	106	(73 - 122)
1,2-Dichloroethane-d4	105	(61 - 128)
Toluene-d8	93	(76 - 110)
4-Bromofluorobenzene	88	(74 - 116)

NOTE(S):

J Estimated result. Result is less than RL.

B Method blank contamination. The associated method blank contains the target analyte at a reportable level.

MKM ENGINEERS INC

Client Sample ID: FIELD BLANK

GC/MS Semivolatiles

Lot-Sample #...: A1I210297-004 **Work Order #...:** EKW3T1AV **Matrix.....:** WQ
Date Sampled...: 09/20/01 08:05 **Date Received..:** 09/20/01
Prep Date.....: 09/24/01 **Analysis Date..:** 09/30/01
Prep Batch #...: 1267101
Dilution Factor: 1 **Method.....:** SW846 8270C

PARAMETER	RESULT	REPORTING LIMIT	UNITS
Acenaphthene	ND	10	ug/L
Acenaphthylene	ND	10	ug/L
Acetophenone	ND	10	ug/L
2-Acetylaminofluorene	ND	100	ug/L
4-Aminobiphenyl	ND	50	ug/L
Anthracene	ND	10	ug/L
Benzo(a)anthracene	ND	10	ug/L
Benzo(b)fluoranthene	ND	10	ug/L
Benzo(k)fluoranthene	ND	10	ug/L
Benzo(ghi)perylene	ND	10	ug/L
Benzo(a)pyrene	ND	10	ug/L
Benzyl alcohol	ND	10	ug/L
bis(2-Chloroethoxy) methane	ND	10	ug/L
bis(2-Chloroethyl)-ether	ND	10	ug/L
bis(2-Chloro-1-methylethyl) ether	ND	10	ug/L
bis(2-Ethylhexyl) phthalate	ND	10	ug/L
4-Bromophenyl phenyl ether	ND	10	ug/L
Butyl benzyl phthalate	ND	10	ug/L
p-Chloroaniline	ND	10	ug/L
4-Chloro-3-methylphenol	ND	10	ug/L
2-Chloronaphthalene	ND	10	ug/L
2-Chlorophenol	ND	10	ug/L
4-Chlorophenyl phenyl ether	ND	10	ug/L
Chrysene	ND	10	ug/L
Diallate	ND	20	ug/L
Dibenz(a,h)anthracene	ND	10	ug/L
Dibenzofuran	ND	10	ug/L
Di-n-butyl phthalate	ND	10	ug/L
3,3'-Dichlorobenzidine	ND	50	ug/L
2,4-Dichlorophenol	ND	10	ug/L
2;6-Dichlorophenol	ND	10	ug/L
Diethyl phthalate	ND	10	ug/L
Thionazin	ND	50	ug/L

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MKM ENGINEERS INC

Client Sample ID: FIELD BLANK

GC/MS Semivolatiles

Lot-Sample #...: A1I210297-004 **Work Order #...:** EKW3T1AV **Matrix.....:** WQ

PARAMETER	RESULT	REPORTING LIMIT	UNITS
Dimethoate	ND	20	ug/L
p-Dimethylaminoazobenzene	ND	20	ug/L
7,12-Dimethylbenz(a)-anthracene	ND	20	ug/L
3,3'-Dimethylbenzidine	ND	50	ug/L
2,4-Dimethylphenol	ND	10	ug/L
Dimethyl phthalate	ND	10	ug/L
Di-n-octyl phthalate	ND	10	ug/L
1,3-Dinitrobenzene	ND	10	ug/L
4,6-Dinitro-2-methylphenol	ND	50	ug/L
2,4-Dinitrophenol	ND	50	ug/L
2,4-Dinitrotoluene	ND	10	ug/L
2,6-Dinitrotoluene	ND	10	ug/L
Diphenylamine	ND	10	ug/L
Disulfoton	ND	50	ug/L
Ethyl methanesulfonate	ND	10	ug/L
Famphur	ND	100	ug/L
Fluoranthene	ND	10	ug/L
Fluorene	ND	10	ug/L
Hexachlorobenzene	ND	10	ug/L
Hexachlorobutadiene	ND	10	ug/L
Hexachlorocyclopentadiene	ND	50	ug/L
Hexachloroethane	ND	10	ug/L
Hexachloropropene	ND	100	ug/L
Indeno(1,2,3-cd)pyrene	ND	10	ug/L
Isophorone	ND	10	ug/L
Isosafrole	ND	20	ug/L
Methapyrilene	ND	50	ug/L
o-Toluidine	ND	20	ug/L
3-Methylcholanthrene	ND	20	ug/L
Methyl methanesulfonate	ND	10	ug/L
2-Methylnaphthalene	ND	10	ug/L
2-Methylphenol	ND	10	ug/L
3-Methylphenol	ND	10	ug/L
4-Methylphenol	ND	10	ug/L
Naphthalene	ND	10	ug/L
1,4-Naphthoquinone	ND	50	ug/L
1-Naphthylamine	ND	10	ug/L
2-Naphthylamine	ND	10	ug/L
2-Nitroaniline	ND	50	ug/L
3-Nitroaniline	ND	50	ug/L

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MKM ENGINEERS INC

Client Sample ID: FIELD BLANK

GC/MS Semivolatiles

Lot-Sample #...: A1I210297-004 **Work Order #...:** EKW3T1AV **Matrix.....:** WQ

PARAMETER	RESULT	REPORTING LIMIT	UNITS
4-Nitroaniline	ND	50	ug/L
Nitrobenzene	ND	10	ug/L
2-Nitrophenol	ND	10	ug/L
4-Nitrophenol	ND	50	ug/L
N-Nitrosodi-n-butylamine	ND	10	ug/L
N-Nitrosodiethylamine	ND	10	ug/L
N-Nitrosodimethylamine	ND	10	ug/L
N-Nitrosodi-n-propyl-amine	ND	10	ug/L
N-Nitrosodiphenylamine	ND	10	ug/L
N-Nitrosomethylethylamine	ND	10	ug/L
N-Nitrosopiperidine	ND	10	ug/L
N-Nitrosopyrrolidine	ND	10	ug/L
5-Nitro-o-toluidine	ND	20	ug/L
Pentachlorobenzene	ND	10	ug/L
Pentachloronitrobenzene	ND	50	ug/L
Pentachlorophenol	ND	10	ug/L
Phenacetin	ND	20	ug/L
Phenanthrene	ND	10	ug/L
Phenol	ND	10	ug/L
p-Phenylene diamine	ND	100	ug/L
Phorate	ND	50	ug/L
Pronamide	ND	20	ug/L
Pyrene	ND	10	ug/L
Safrole	ND	20	ug/L
1,2,4,5-Tetrachloro-benzene	ND	10	ug/L
2,3,4,6-Tetrachlorophenol	ND	50	ug/L
1,2,4-Trichloro-benzene	ND	10	ug/L
2,4,5-Trichloro-phenol	ND	10	ug/L
2,4,6-Trichloro-phenol	ND	10	ug/L
O,O,O-Triethylphosphoro-thioate	ND	50	ug/L
1,3,5-Trinitrobenzene	ND	50	ug/L
Chlorobenzilate	ND	10	ug/L

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MKM ENGINEERS INC

Client Sample ID: FIELD BLANK

GC/MS Semivolatiles

Lot-Sample #...: A1I210297-004 **Work Order #...:** EKW3T1AV **Matrix.....:** WQ

SURROGATE	PERCENT RECOVERY	RECOVERY LIMITS
Nitrobenzene-d5	72	(32 - 112)
2-Fluorobiphenyl	69	(30 - 110)
Terphenyl-d14	88	(10 - 144)
Phenol-d5	68	(10 - 113)
2-Fluorophenol	69	(13 - 110)
2,4,6-Tribromophenol	59	(21 - 122)

MKM ENGINEERS INC

Client Sample ID: FIELD BLANK

GC Semivolatiles

Lot-Sample #...: A1I210297-004 **Work Order #...:** EKW3T1AX **Matrix.....:** WQ
Date Sampled...: 09/20/01 08:05 **Date Received..:** 09/20/01
Prep Date.....: 09/24/01 **Analysis Date..:** 09/30/01
Prep Batch #...: 1267178
Dilution Factor: 1 **Method.....:** SW846 8081A

PARAMETER	RESULT	REPORTING LIMIT	UNITS
Aldrin	ND	0.050	ug/L
alpha-BHC	ND	0.050	ug/L
beta-BHC	ND	0.050	ug/L
delta-BHC	ND	0.050	ug/L
gamma-BHC (Lindane)	ND	0.050	ug/L
Chlordane (technical)	ND	0.50	ug/L
4,4'-DDD	ND	0.050	ug/L
4,4'-DDE	ND	0.050	ug/L
4,4'-DDT	ND	0.050	ug/L
Dieldrin	ND	0.050	ug/L
Endosulfan I	ND	0.050	ug/L
Endosulfan II	ND	0.050	ug/L
Endosulfan sulfate	ND	0.050	ug/L
Endrin	ND	0.050	ug/L
Endrin aldehyde	ND	0.050	ug/L
Heptachlor	ND	0.050	ug/L
Heptachlor epoxide	ND	0.050	ug/L
Isodrin	ND	0.10	ug/L
Kepone	ND	1.0	ug/L
Methoxychlor	ND	0.10	ug/L
Toxaphene	ND	2.0	ug/L

SURROGATE	PERCENT RECOVERY	RECOVERY LIMITS
Tetrachloro-m-xylene	43	(39 - 130)
Decachlorobiphenyl	78	(10 - 147)

MKM ENGINEERS INC

Client Sample ID: FIELD BLANK

GC Semivolatiles

Lot-Sample #...: A1I210297-004 **Work Order #...:** EKW3T1A0 **Matrix.....:** WQ
Date Sampled...: 09/20/01 08:05 **Date Received..:** 09/20/01
Prep Date.....: 09/24/01 **Analysis Date..:** 09/30/01
Prep Batch #...: 1267179
Dilution Factor: 1 **Method.....:** SW846 8082

PARAMETER	RESULT	REPORTING LIMIT	UNITS
Aroclor 1016	ND	1.0	ug/L
Aroclor 1221	ND	1.0	ug/L
Aroclor 1232	ND	1.0	ug/L
Aroclor 1242	ND	1.0	ug/L
Aroclor 1248	ND	1.0	ug/L
Aroclor 1254	ND	1.0	ug/L
Aroclor 1260	ND	1.0	ug/L

SURROGATE	PERCENT RECOVERY	RECOVERY LIMITS
Tetrachloro-m-xylene	48	(45 - 120)
Decachlorobiphenyl	80	(24 - 128)

MKM ENGINEERS INC

Client Sample ID: FIELD BLANK

GC Semivolatiles

Lot-Sample #...: A1I210297-004 **Work Order #...:** EKW3T1AN **Matrix.....:** WQ
Date Sampled...: 09/20/01 08:05 **Date Received..:** 09/20/01
Prep Date.....: 09/24/01 **Analysis Date..:** 09/25/01
Prep Batch #...: 1267188
Dilution Factor: 1 **Method.....:** SW846 8141A

PARAMETER	RESULT	REPORTING LIMIT	UNITS
Methyl parathion	ND	1.0	ug/L
Parathion	ND	1.0	ug/L

SURROGATE	PERCENT RECOVERY	RECOVERY LIMITS
Triphenyl phosphate	148	(41 - 155)

MKM ENGINEERS INC

Client Sample ID: FIELD BLANK

GC Semivolatiles

Lot-Sample #...: A1I210297-004 **Work Order #...:** EKW3T1AW **Matrix.....:** WQ
Date Sampled...: 09/20/01 08:05 **Date Received..:** 09/20/01
Prep Date.....: 09/24/01 **Analysis Date..:** 10/05/01
Prep Batch #...: 1267107
Dilution Factor: 1 **Method.....:** SW846 8151A

PARAMETER	RESULT	REPORTING LIMIT	UNITS
2,4-D	ND	4.0	ug/L
Dinoseb	ND	0.70	ug/L
2,4,5-TP (Silvex)	ND	1.0	ug/L
2,4,5-T	ND	1.0	ug/L

SURROGATE	PERCENT RECOVERY	RECOVERY LIMITS
2,4-Dichlorophenylacetic acid	73	(43 - 111)

MKM ENGINEERS INC

Client Sample ID: FIELD BLANK

Dissolved Trace Level Organic Compounds

Lot-Sample #...: A1I210297-004 **Work Order #...:** EKW3T1CT **Matrix.....:** WQ
Date Sampled...: 09/20/01 08:05 **Date Received..:** 09/20/01
Prep Date.....: 09/27/01 **Analysis Date..:** 10/05/01
Prep Batch #...: 1270314
Dilution Factor: 1 **Method.....:** NONE UV/HPLC per

PARAMETER	RESULT	REPORTING LIMIT	UNITS
Nitroguanidine	ND	20	ug/L

MKM ENGINEERS INC

Client Sample ID: FIELD BLANK

HPLC

Lot-Sample #...: A1I210297-004 **Work Order #...:** EKW3T1CQ **Matrix.....:** WQ
Date Sampled...: 09/20/01 08:05 **Date Received..:** 09/20/01
Prep Date.....: 09/25/01 **Analysis Date..:** 09/27/01
Prep Batch #...: 1268126
Dilution Factor: 1 **Method.....:** SW846 8330

PARAMETER	RESULT	REPORTING LIMIT	UNITS
1,3-Dinitrobenzene	ND	0.20	ug/L
2,4-Dinitrotoluene	ND	0.13	ug/L
2,6-Dinitrotoluene	ND	0.13	ug/L
Nitrobenzene	ND	0.20	ug/L
Nitroglycerin	ND	2.5	ug/L
1,3,5-Trinitrobenzene	ND	0.20	ug/L
2,4,6-Trinitrotoluene	ND	0.20	ug/L
HMX	ND	0.50	ug/L
RDX	ND	0.50	ug/L
Tetryl	ND	0.20	ug/L
2-Nitrotoluene	ND	0.20	ug/L
3-Nitrotoluene	ND	0.20	ug/L
4-Nitrotoluene	ND	0.20	ug/L
4-Amino-2,6-dinitrotoluene	ND	0.20	ug/L
2-Amino-4,6-dinitrotoluene	ND	0.20	ug/L

SURROGATE	PERCENT RECOVERY	RECOVERY LIMITS
1-Chloro-3-nitrobenzene	59	(53 - 133)

MKM ENGINEERS INC

Client Sample ID: FIELD BLANK

TOTAL Metals

Lot-Sample #...: A1I210297-004 **Matrix.....:** WQ
Date Sampled...: 09/20/01 08:05 **Date Received..:** 09/20/01

PARAMETER	RESULT	REPORTING LIMIT	UNITS	METHOD	PREPARATION-ANALYSIS DATE	WORK ORDER #
Prep Batch #...: 1267112						
Silver	ND	0.010	mg/L	SW846 6010B	09/24-09/25/01	EKW3T1AE
		Dilution Factor: 1				
Arsenic	ND	0.0050	mg/L	SW846 6010B	09/24-09/25/01	EKW3T1A3
		Dilution Factor: 1				
Barium	ND	0.010	mg/L	SW846 6010B	09/24-09/25/01	EKW3T1A7
		Dilution Factor: 1				
Beryllium	ND	0.0040	mg/L	SW846 6010B	09/24-09/25/01	EKW3T1A8
		Dilution Factor: 1				
Calcium	ND	5.0	mg/L	SW846 6010B	09/24-09/25/01	EKW3T1AK
		Dilution Factor: 1				
Cadmium	ND	0.0050	mg/L	SW846 6010B	09/24-09/25/01	EKW3T1A9
		Dilution Factor: 1				
Cobalt	ND	0.050	mg/L	SW846 6010B	09/24-09/25/01	EKW3T1AA
		Dilution Factor: 1				
Chromium	ND	0.010	mg/L	SW846 6010B	09/24-09/25/01	EKW3T1AJ
		Dilution Factor: 1				
Copper	ND	0.010	mg/L	SW846 6010B	09/24-09/25/01	EKW3T1AC
		Dilution Factor: 1				
Iron	ND	0.10	mg/L	SW846 6010B	09/24-09/25/01	EKW3T1AL
		Dilution Factor: 1				
Potassium	ND	5.0	mg/L	SW846 6010B	09/24-09/25/01	EKW3T1CA
		Dilution Factor: 1				
Magnesium	ND	5.0	mg/L	SW846 6010B	09/24-09/25/01	EKW3T1CC
		Dilution Factor: 1				
Manganese	ND	0.015	mg/L	SW846 6010B	09/24-09/25/01	EKW3T1CD
		Dilution Factor: 1				
Sodium	**138**	**5.0**	**mg/L**	**SW846 6010B**	**09/24-09/25/01**	**EKW3T1AF**
		Dilution Factor: 1				

(Continued on next page)

MKM ENGINEERS INC

Client Sample ID: FIELD BLANK

TOTAL Metals

Lot-Sample #...: A1I210297-004 **Matrix.....:** WQ

PARAMETER	RESULT	REPORTING LIMIT	UNITS	METHOD	PREPARATION-ANALYSIS DATE	WORK ORDER #
Nickel	ND	0.040	mg/L	SW846 6010B	09/24-09/25/01	EKW3T1AD
		Dilution Factor: 1				
Lead	ND	0.0030	mg/L	SW846 6010B	09/24-09/25/01	EKW3T1A4
		Dilution Factor: 1				
Antimony	ND	0.060	mg/L	SW846 6010B	09/24-09/25/01	EKW3T1A6
		Dilution Factor: 1				
Selenium	ND	0.0050	mg/L	SW846 6010B	09/24-09/25/01	EKW3T1A5
		Dilution Factor: 1				
Tin	ND	0.10	mg/L	SW846 6010B	09/24-09/25/01	EKW3T1CE
		Dilution Factor: 1				
Thallium	ND	0.0020	mg/L	SW846 7841	09/24-09/25/01	EKW3T1CF
		Dilution Factor: 1				
Vanadium	ND	0.050	mg/L	SW846 6010B	09/24-09/25/01	EKW3T1AG
		Dilution Factor: 1				
Zinc	ND	0.050	mg/L	SW846 6010B	09/24-09/25/01	EKW3T1AH
		Dilution Factor: 1				
Mercury	ND	0.00020	mg/L	SW846 7470A	09/24-09/25/01	EKW3T1CG
		Dilution Factor: 1				

MKM ENGINEERS INC

Client Sample ID: FIELD BLANK

General Chemistry

Lot-Sample #...: A1I210297-004 Work Order #...: EKW3T Matrix.....: WQ
Date Sampled...: 09/20/01 08:05 Date Received..: 09/20/01

PARAMETER	RESULT	RL	UNITS	METHOD	PREPARATION-ANALYSIS DATE	PREP BATCH #
pH (liquid)	8.3		No Units	MCAWW 150.1	09/22/01	1267393
		Dilution Factor: 1				
Chloride	25.6	1.0	mg/L	MCAWW 300.0A	09/25/01	1269389
		Dilution Factor: 1				
Hexavalent Chromium	ND	0.02	mg/L	SW846 7196A	09/21/01	1268450
		Dilution Factor: 1				
Nitrate-Nitrite	ND	0.1	mg/L	MCAWW 353.2	09/24/01	1268415
		Dilution Factor: 1				
Nitrocellulose	ND	0.50	mg/L	MCAWW 353.2	09/29-10/04/01	1274466
		Dilution Factor: 1				
Nitrogen, as Ammonia	0.3	0.2	mg/L	MCAWW 350.3	10/01/01	1275093
		Dilution Factor: 1				
Sulfate	73.1	1.0	mg/L	MCAWW 300.0A	09/25/01	1269392
		Dilution Factor: 1				
Total phosphorus	ND	0.1	mg/L	MCAWW 365.2	09/26/01	1269445
		Dilution Factor: 1				
Total Alkalinity	190	5.0	mg/L	MCAWW 310.1	09/22/01	1267433
		Dilution Factor: 1				
Total Dissolved Solids	330	10	mg/L	MCAWW 160.1	09/25-09/26/01	1268169
		Dilution Factor: 1				
Total Organic Carbon	ND	1	mg/L	SW846 9060	09/24/01	1268207
		Dilution Factor: 1				
Total Phenols	ND	0.040	mg/L	SW846 9065	10/03/01	1276408
		Dilution Factor: 1				
Total Sulfide	1.4	1.0	mg/L	MCAWW 376.1	09/24/01	1268591
		Dilution Factor: 1				

(Continued on next page)

MKM ENGINEERS INC

Client Sample ID: FIELD BLANK

General Chemistry

Lot-Sample #...: A1I210297-004 **Work Order #...:** EKW3T **Matrix.....:** WQ

PARAMETER	RESULT	RL	UNITS	METHOD	PREPARATION-ANALYSIS DATE	PREP BATCH #
Turbidity	ND	0.5	NTU	MCAWW 180.1	09/21/01	1264521

Dilution Factor: 1

MKM ENGINEERS INC

Client Sample ID: FIELD BLANK

General Chemistry

Lot-Sample #...: A1I280133-003 **Work Order #...:** EK9E5 **Matrix.....:** WG
Date Sampled...: 09/26/01 10:38 **Date Received..:** 09/27/01

PARAMETER	RESULT	RL	UNITS	METHOD	PREPARATION-ANALYSIS DATE	PREP BATCH #
Total Cyanide	ND	0.010	mg/L	MCAWW 335.2	10/02/01	1275384

Dilution Factor: 1

MKM ENGINEERS INC

Client Sample ID: TRIP BLANK

GC/MS Volatiles

Lot-Sample #...: A1I210297-005 **Work Order #...:** EKW3W1AA **Matrix.....:** WQ
Date Sampled...: 09/20/01 **Date Received..:** 09/20/01
Prep Date.....: 10/01/01 **Analysis Date..:** 10/01/01
Prep Batch #...: 1274204
Dilution Factor: 1 **Method.....:** SW846 8260B

PARAMETER	RESULT	REPORTING LIMIT	UNITS
Dichlorodifluoromethane	ND	1.0	ug/L
Acetonitrile	ND	20	ug/L
Acrolein	ND	20	ug/L
Allyl chloride	ND	2.0	ug/L
1,3-Dichloropropane	ND	1.0	ug/L
2,2-Dichloropropane	ND	1.0	ug/L
1,1-Dichloropropene	ND	1.0	ug/L
Ethyl methacrylate	ND	1.0	ug/L
Isobutyl alcohol	ND	50	ug/L
Methyl methacrylate	ND	2.0	ug/L
Propionitrile	ND	4.0	ug/L
4-Methyl-2-pentanone (MIBK)	ND	10	ug/L
Acetone	ND	10	ug/L
Acrylonitrile	ND	20	ug/L
Benzene	ND	1.0	ug/L
Bromochloromethane	ND	1.0	ug/L
Bromodichloromethane	ND	1.0	ug/L
Bromoform	ND	1.0	ug/L
Bromomethane	ND	1.0	ug/L
2-Butanone	ND	10	ug/L
Carbon disulfide	ND	1.0	ug/L
Carbon tetrachloride	ND	1.0	ug/L
Chlorobenzene	ND	1.0	ug/L
Dibromochloromethane	ND	1.0	ug/L
1,2-Dibromo-3-chloro-propane	ND	7.0	ug/L
Chloroethane	ND	1.0	ug/L
Chloroform	ND	1.0	ug/L
Chloromethane	ND	1.0	ug/L
1,2-Dibromoethane	ND	1.0	ug/L
Dibromomethane	ND	1.0	ug/L
1,2-Dichlorobenzene	ND	1.0	ug/L
1,4-Dichlorobenzene	ND	1.0	ug/L
trans-1,4-Dichloro-2-butene	ND	1.0	ug/L
1,1-Dichloroethane	ND	1.0	ug/L
1,2-Dichloroethane	ND	1.0	ug/L
1,1-Dichloroethene	ND	1.0	ug/L

(Continued on next page)

MKM ENGINEERS INC

Client Sample ID: TRIP BLANK

GC/MS Volatiles

Lot-Sample #...: A1I210297-005 **Work Order #...:** EKW3W1AA **Matrix.....:** WQ

PARAMETER	RESULT	REPORTING LIMIT	UNITS
cis-1,2-Dichloroethene	ND	1.0	ug/L
trans-1,2-Dichloroethene	ND	1.0	ug/L
1,2-Dichloropropane	ND	1.0	ug/L
cis-1,3-Dichloropropene	ND	1.0	ug/L
trans-1,3-Dichloropropene	ND	1.0	ug/L
Ethylbenzene	ND	1.0	ug/L
Trichlorofluoromethane	ND	1.0	ug/L
2-Hexanone	ND	10	ug/L
Iodomethane	ND	1.0	ug/L
Methylene chloride	ND	1.0	ug/L
Styrene	ND	1.0	ug/L
1,1,1,2-Tetrachloroethane	ND	1.0	ug/L
1,1,2,2-Tetrachloroethane	ND	1.0	ug/L
Tetrachloroethene	ND	1.0	ug/L
Toluene	ND	1.0	ug/L
1,1,1-Trichloroethane	ND	1.0	ug/L
1,1,2-Trichloroethane	ND	1.0	ug/L
Trichloroethene	ND	1.0	ug/L
1,2,3-Trichloropropane	ND	1.0	ug/L
Vinyl acetate	ND	10	ug/L
Vinyl chloride	ND	1.0	ug/L
Xylenes (total)	ND	1.0	ug/L
Chloroprene	ND	2.0	ug/L
1,3-Dichlorobenzene	ND	1.0	ug/L
Methacrylonitrile	ND	2.0	ug/L

SURROGATE	PERCENT RECOVERY	RECOVERY LIMITS
Dibromofluoromethane	107	(73 - 122)
1,2-Dichloroethane-d4	106	(61 - 128)
Toluene-d8	95	(76 - 110)
4-Bromofluorobenzene	90	(74 - 116)

Chain of Custody Record

SEVERN TRENT SERVICES — Severn Trent Laboratories, Inc.

STL-4124 (1200)

Client: MKM Engineers, Inc	Project Manager: Stan Levenger	Date: 9/20/01	Chain of Custody Number: 078040
Address: 8451 State Route 5	Telephone Number (Area Code)/Fax Number: 330-358-2920 / 330-358-2924	Lab Number:	Page 1 of 2
City: Ravenna — State: OH — Zip Code: 44266	Site Contact: Mike Samelak	Lab Contact: Debbie Budd	
Project Name and Location (State): Ramsdell Quarry Landfill, NIAP, Ravenna, OH	Carrier/Waybill Number: STL Courier		
Contract/Purchase Order/Quote No.: PO # LA902-G00089			

Sample I.D. No. and Description (Containers for each sample may be combined on one line)	Date	Time	Matrix: Air	Aqueous	Sed.	Soil	Other	Containers & Preservatives: Unpres.	H2SO4	HNO3	HCl	NaOH	ZnAc/NaOH	Other	Analysis (Attach list if more space is needed): VOC (8260)	BNA (8270)	Metals (6010/7470/7471)	Herbicides (8151A)	Pesticides (8081A) PCB's only	Explosives (8330)	Propellents	Cyanide (9012/335.2)	Sulfide (376.1)	Ammonia (350.2) Nitrate (353.2)	Alkalinity (310.1)	TDS (160.1)	Turbidity (180.1)	Hexavalent Chromium	Special Instructions/ Conditions of Receipt
RQLMW-06	9/20/01	0915		X					X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	
RQLMW-07	9/20/01	1010		X					X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	MS/MSD Bottle Sets included
Duplicate	9/20/01	1020		X					X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	*See Attached
Field Blank	9/20/01	0805		X					X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	Sheet for
Trip Blank	LAB			X							X				X													Additional Analysis. *

Possible Hazard Identification: ☐ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☒ Unknown

Sample Disposal: ☐ Return To Client ☒ Disposal By Lab ☐ Archive For _____ Months (A fee may be assessed if samples are retained longer than 3 months)

Turn Around Time Required: ☐ 24 Hours ☐ 48 Hours ☐ 7 Days ☐ 14 Days ☒ 21 Days ☐ Other _____

QC Requirements (Specify):

	Date	Time		Date	Time
1. Relinquished By: Michael G. Bell	9-20-01	1600	1. Received By: Al Haidet	9-20-01	1600
2. Relinquished By: Al Haidet	9-20-01	1705	2. Received By: Terry Burns	9/20/01	1705
3. Relinquished By:	Date	Time	3. Received By:	Date	Time

Comments: MS/MSD Bottle Sets included for RQL MW-07, Metals Filtered in the Field. Preservative Added in Field

DISTRIBUTION: WHITE - Stays with the Sample. CANARY - Returned to Client with Report. PINK - Field Copy

ADDITIONAL PARAMETERS

PAGE 2 OF 2

Sample I.D.	Date	Time	Matrix	Sulfate/Chloride (300.0)	pH (150.1)	Total Phosphorus (365.2)	TOC (9060)	Phenolics (9065)
RQLMW-06	9/20/01	0915	water	x	x	x	x	x
RQLMW-07	9/20/01	10:10	water	x	x	x	x	x
Duplicate	9/20/01	10:20	water	x	x	x	x	x
Field Blank	9/20/01	08:05	water	x	x	x	x	x

Chain of Custody Record

SEVERN TRENT SERVICES — Severn Trent Laboratories, Inc.

STL-4124 (1200)

Client: MKM Engineers, Inc.	Project Manager: Stan Levenger	Date: 9/26/01	Chain of Custody Number: 078041
Address: 8451 State Route 5	Telephone Number (Area Code)/Fax Number: 330-558-2920/330-358-2924	Lab Number:	Page 1 of 1
City: Ravenna; State: OH; Zip Code: 44266	Site Contact: Mike Jamelak	Lab Contact: Debbie Budd	
Project Name and Location (State): Ramsdell Quarry Landfill, Ravenna, OH	Carrier/Waybill Number: FedEx 8246 5213 8536		
Contract/Purchase Order/Quote No.			

Sample I.D. No. and Description (Containers for each sample may be combined on one line)	Date	Time	Matrix: Air	Aqueous	Sed	Soil	Containers & Preservatives: Unpres	H2SO4	HNO3	HCl	NaOH	ZnAc/NaOH	Analysis: Cyanide	Special Instructions/ Conditions of Receipt
RQL MW-06	9/26/01	13:55		X							X		X	Resample of cyanide to replace misanalyzed samples from 9/20/01
Duplicate	9/26/01	13:27		X							X		X	
Field Blank	9/26/01	10:38		X							X		X	

Possible Hazard Identification
☐ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☒ Unknown

Sample Disposal
☐ Return To Client ☒ Disposal By Lab ☐ Archive For _____ Months (A fee may be assessed if samples are retained longer than 3 months)

Turn Around Time Required
☐ 24 Hours ☐ 48 Hours ☐ 7 Days ☐ 14 Days ☐ 21 Days ☒ Other Report delivery

QC Requirements (Specify)
In same time frame as original samples (~Oct-12)

	Date	Time		Date	Time
1. Relinquished By: Michael G Bl	9/26/01	1530	1. Received By: FedEx		
2. Relinquished By			2. Received By: [signature]	9/27/01	9:20
3. Relinquished By			3. Received By		

Comments

DISTRIBUTION: WHITE - Stays with the Sample; CANARY - Returned to Client with Report; PINK - Field Copy

Received 11-5-01

Data Validation Report
for

MKM Engineers

Date: 10/24/01

Location: Ravenna Arsenal, Ravenna, Ohio
Project #: RVAAP Ramsdell Landfill
Laboratory Project #: A1I280133 & A1I210297
Laboratory: Severn Trent

Data Validator: _____
William W. Purves

Table of Contents

Data Validation Report

Project: Ravenna Arsenal, Ravenna Ohio
Project #: RVAAP Ramsdell Landfill
Laboratory Project #: A1I280133 & A1I210297
Laboratory: Severn Trent
Reviewer: Purves Environmental for MKM Engineers Inc. (Ravenna, OH)
Analysis: Method:8270C, 8260B, 8330, 8151A, 8141A, 8082, 8081A, 6010B, 7470A, 7841, 7196A, 9060, 410.4, 350.3, 310.1, 353.2, 365.2 , 376.1, 335.2, 300.0A 150.1, 180.1, 160.1, HPLC
Matrix: Water
Date: October 24, 2001

I Introduction

Five samples (5 water samples) for the analysis of 8270C, 8260B, 8330, 8151A, 8141A, 8082, 8081A, 6010B, 7470A, 7841, 7196A, 9060, 410.4, 350.3, 310.1, 353.2, 365.2 , 376.1, 335.2, 300.0A 150.1, 120.1, 180.1, 160.1, HPLC were shipped on September 20, 2001 from MKM Engineers, Inc. Ravenna, Ohio to Severn Trent Laboratories (STL) North Canton, Ohio. The samples were collected and relinquished by MKM field personnel at the Ravenna Arsenal, Ravenna, Ohio to STL on September 20, 2001. STL North Canton Sent the samples for method 8330 to STL Knoxville, TN. Analytical data for all samples were validated and included in this report. The samples were analyzed utilizing SW-846 Methods as published in the third addition of Test Methods for Evaluating Solid Waste Physical/Chemical Methods (See Table 1 below for Rev numbers) and US EPA Methods for Chemical analysis of Water and Wastes EPA 600/4-79-020 March1983 edition. The quality control and flagging convention is consistent with the National Functional Guidelines. The review process was a level three validation effort. One hundred percent of the package was reviewed.

Table 1 Analytical Methods

Method 8270C	Rev 3, December 1996
Method 8260B	Rev 2, December 1996
Method 8330	Rev 0, September 1994
Method 8151A	Rev 1, September 1994
Method 8141A	Rev 1, September 1994
Method 8082	Rev 0, September 1994
Method 8081A	Rev 1, September 1994
Method 6010B	Rev 2, December 1996
Method 7470A	Rev 1, September 1994
Method 7841	Rev 0, September 1986
Method 7196A	Rev 1, September 1994
Method 9060	Rev 0, September 1986
Method 9065	Rev 0, September 1994
Method 150.1	Rev 0, March 1983
Method 160.1	Rev 0, March 1983

Method 180.1	Rev 0, March 1983
Method 300.0A	Rev 1, March 1983
Method 310.1	Rev 0, March 1983
Method 335.2	Rev 0, March 1983
Method 350.3	Rev 0, March 1983
Method 353.2	Rev 0, March 1983
Method 365.2	Rev 0, March 1983
Method 376.1	Rev 0, March 1983
Method 410.4	Rev 0, March 1983

The field sample numbers and the laboratory sample numbers correlated with the field chain of custody and the analytical reports. One MS/MSD water was provided. Table 2 is a list of the field sample numbers, corresponding laboratory identification, and matrix type.

Table 2 Sample Identification Table

Field Sample Number	Laboratory Sample Number	Matrix
RQLMW-06	EKW2Q-001	Water
RQLMW-07	EKW3G-002	Water
DUPLICATE	EKW3P-003	Water
FIELD BLANK	EKW3T-004	Water
TRIP BLANK	EKW3W-005	Water

II Data Qualifications

1.0 Sampling Documentation

The chain of custody (COC) documentation met QAPP and National Functional Guidelines requirements. Cooler temperature was slightly above the upper limit because the cooler was packed received at the laboratory in less than two hours. This does not provide enough time for the cooler and some of the contents to drop to the 4C temperature. The temperature does not affect any data.

1.1 Report Documentation

Correctable Errors
All correctable errors are errors that do not affect data quality and are verified by e-mail with the laboratory and corrected by the data validator.

Non-correctable Errors
All non-correctable errors are errors that affect data quality and require professional judgement and qualification by the data validator. No verification with the laboratory is required.
Non-correctable errors (if found) were examined to determine the usability of the data and

documented in this report..

2.0 Technical Holding Times
All holding times met QAPP and National Functional Guidelines requirements for all.

3.0 Organic Analysis

3.1 Method 8260B Volatiles (Waters)

3.1.1 The Method Blanks
The Method or Prep Blank, met method requirements. Analytes detected between the Reporting Limit (RL) and Method detection Limit are noted but do not affect data.

3.1.2 Laboratory Control (LCS)
The LCS met method requirements.

3.1.3 Matrix Spike and Matrix Spike Duplicate (MS/MSD) and or Sample Duplicate
The MS/MSD met method requirements.

3.1.4 Surrogate Spikes
The Surrogate Spikes met method requirements

3.2 Method 8330 Explosives & Propellents HPLC(Waters)

3.2.1 The Method Blanks
The Method or Prep Blank met method requirements.

3.2.2 Laboratory Control (LCS)
The LCS met method requirements.

3.2.3 Matrix Spike and Matrix Spike Duplicate (MS/MSD) and or Sample Duplicate
The MS/MSD met method requirements.

3.2.4 Surrogate Spikes
The Surrogate Spikes met method requirements

3.3 Method 8270C Semi-Volatiles (Waters)

3.3.1 The Method Blanks
The Method or Prep Blank, met method requirements.

3.3.2 Laboratory Control (LCS)
The LCS met method requirements.

3.3.3 Matrix Spike and Matrix Spike Duplicate (MS/MSD) and or Sample Duplicate

The MS/MSD met method requirements.

3.3.4 Surrogate Spikes
The Surrogate Spikes met method requirements except for two acid fraction surrogates in sample 1. Both surrogates recovered low. Though two out of four surrogates recovered low, the data reflects historical data and it is the professional judgment of the data validator that the is valid.

3.4 Method 8151A Chlorinated Herbicides (Waters)

3.4.1 The Method Blanks
The Method or Prep Blank, met method requirements.

3.4.2 Laboratory Control (LCS)
The LCS met method requirements.

3.4.3 Matrix Spike and Matrix Spike Duplicate (MS/MSD) and or Sample Duplicate
The MS/MSD met method requirements.

3.4.4 Surrogate Spikes
The Surrogate Spikes met method requirements

3.5 Method 8141A Organophosphorous Compounds (Waters)

3.5.1 The Method Blanks
The Method or Prep Blank, met method requirements.

3.5.2 Laboratory Control (LCS)
The LCS met method requirements.

3.5.3 Matrix Spike and Matrix Spike Duplicate (MS/MSD) and or Sample Duplicate
The MS/MSD met method requirements.

3.5.4 Surrogate Spikes
The Surrogate Spikes met method requirements

3.6 Method 8082 PCBs (Waters)

3.6.1 The Method Blanks
The Method or Prep Blank, met method requirements.

3.6.2 Laboratory Control (LCS)
The LCS met method requirements.

3.6.3 Matrix Spike and Matrix Spike Duplicate (MS/MSD) and or Sample Duplicate

The MS/MSD met method requirements.

3.6.4 Surrogate Spikes
The Surrogate Spikes met method requirements

3.7 Method 8081A Pesticides (Waters)

3.7.1 The Method Blanks
The Method or Prep Blank, met method requirements.

3.7.2 Laboratory Control (LCS)
The LCS met method requirements.

3.7.3 Matrix Spike and Matrix Spike Duplicate (MS/MSD) and or Sample Duplicate
The MS/MSD met method requirements. The MS/MSD recoveries for one sample and MSD for another had all analytes no meet spike recovery requirements. This is a very unusual event and strongly indicates a preparation error. In the professional judgment of the data validator the MS/MSD data is not valid. However, the sample data is not affected.

3.7.4 Surrogate Spikes
The Surrogate Spikes met method requirements

4.0 Inorganics (Waters)

4.1 Method 6010B Metals (Waters)

4.1.1 Laboratory Method/Preparation Blanks
All blanks met method requirements.

4.1.2 Laboratory Control Sample (LCS)
The LCS met method requirements.

4.1.3 Matrix Spike and Matrix Spike Duplicate
The MS/MSD met method requirements.

4.2 Method 7470A Mercury (Waters)

4.2.1 Laboratory Method/Preparation Blanks
All blanks met method requirements.

4.2.2 Laboratory Control Sample (LCS)
The LCS met method requirements.

4.2.3 Matrix Spike and Matrix Spike Duplicate
The MS/MSD met method requirements.

4.3 Method 7841 Thallium (Waters)

4.3.1 Laboratory Method/Preparation Blanks
All blanks met method requirements.

4.3.2 Laboratory Control Sample (LCS)
The LCS met method requirements.

4.3.3 Matrix Spike and Matrix Spike Duplicate
The MS/MSD met method requirements.

5.0 General Chemistry

5.1 Method 150.1 pH (Waters)

5.1.2 Sample Duplicate
The Sample Duplicate met method requirements.

5.2 Method 160.1 Total Dissolved Solids (Waters)

5.2.1 Laboratory Method/Preparation, Initial, and Continuing Calibration Blanks
All blanks met method requirements.

5.2.2 Laboratory Control Sample (LCS)
The LCS met method requirements.

5.2.3 Sample Duplicate
The Sample Duplicate met method requirements.

5.3 Method 180.1 Turbidity (Waters)

5.3.1 Laboratory Method/Preparation, Initial, and Continuing Calibration Blanks
All blanks met method requirements.

5.3.2 Laboratory Control Sample (LCS)
The LCS met method requirements.

5.3.3 Sample Duplicate
The Sample Duplicate met method requirements.

5.4 Method 300.0A Chloride and Sulfate (Waters)

5.4.1 Laboratory Method/Preparation, Initial, and Continuing Calibration Blanks
All blanks met method requirements.

5.4.2 Laboratory Control Sample (LCS)
The LCS met method requirements.

5.4.3 Matrix Spike Matrix Spike Duplicate MS/MSD
The MS/MSD met method requirements.

5.5 Method 310.1 Total Alkalinity (Waters)

5.5.1 Laboratory Method/Preparation, Initial, and Continuing Calibration Blanks
All blanks met method requirements.

5.5.2 Laboratory Control Sample (LCS)
The LCS met method requirements.

5.5.3 Matrix Spike Matrix Spike Duplicate MS/MSD
The MS/MSD met method requirements.

5.6 Method 335.2 Total Cyanide (Waters)

5.6.1 Laboratory Method/Preparation, Initial, and Continuing Calibration Blanks
All blanks met method requirements.

5.6.2 Laboratory Control Sample (LCS)
The LCS met method requirements.

5.6.3 Matrix Spike Matrix Spike Duplicate MS/MSD
The MS/MSD met method requirements.

5.7 Method 350.3 Nitrogen as Ammonia (Waters)

5.7.1 Laboratory Method/Preparation, Initial, and Continuing Calibration Blanks
All blanks met method requirements.

5.7.2 Laboratory Control Sample (LCS)
The LCS met method requirements.

5.7.3 Matrix Spike Matrix Spike Duplicate MS/MSD
The MS/MSD met method requirements.

5.8 Method 353.2 Nitrate-Nitrite and Nitrocellulose (Waters)

5.8.1 Laboratory Method/Preparation, Initial, and Continuing Calibration Blanks
All blanks met method requirements.

5.8.2 Laboratory Control Sample (LCS)
The LCS met method requirements.

5.8.3 Matrix Spike Matrix Spike Duplicate MS/MSD
The MS/MSD met method requirements.

5.9 Method 365.2 Total Phosphorus (Waters)

5.9.1 Laboratory Method/Preparation, Initial, and Continuing Calibration Blanks
All blanks met method requirements.

5.9.2 Laboratory Control Sample (LCS)
The LCS met method requirements.

5.9.3 Matrix Spike and Matrix Spike Duplicate MS/MSD
The MS/MSD met method requirements.

5.10 Method 376.1 Total Sulfide (Waters)

5.10.1 Laboratory Method/Preparation, Initial, and Continuing Calibration Blanks
All blanks met method requirements.

5.10.2 Laboratory Control Sample (LCS)
The LCS met method requirements.

5.10.3 Matrix Spike Matrix Spike Duplicate MS/MSD
The MS/MSD met method requirements.

5.11 Method 7196A Hexavalent Chromium (Waters)

5.11.1 Laboratory Method/Preparation, Initial, and Continuing Calibration Blanks
All blanks met method requirements.

5.11.2 Laboratory Control Sample (LCS)
The LCS met method requirements.

5.11.3 Matrix Spike Matrix Spike Duplicate MS/MSD
The MS/MSD met method requirements. Another set of MS/MSDs had no recovery. This is very unusual unless the matrix converts the hex chrom or the analyst did npot spike the sample. Because no raw data is available, the data validator must consider the

MS/MSD data of the second set of no value.

5.12 Method 9060 Total Organic Carbon TOC (Waters)

5.12.1 Laboratory Method/Preparation, Initial, and Continuing Calibration Blanks
All blanks met method requirements.

5.12.2 Laboratory Control Sample (LCS)
The LCS met method requirements.

5.12.3 Matrix Spike Matrix Spike Duplicate MS/MSD
The MS/MSD met method requirements.

5.13 Method 9065 Total Phenols (Waters)

5.13.1 Laboratory Method/Preparation, Initial, and Continuing Calibration Blanks
All blanks met method requirements.

5.13.2 Laboratory Control Sample (LCS)
The LCS met method requirements.

5.13.3 Matrix Spike Matrix Spike Duplicate MS/MSD
The MS/MSD met method requirements.

6.0 Compound Identification and Quantitation

All samples were properly analyzed, diluted as needed, and quantitated. No changes in data values were required.

7.0 System Performance

No problems were encountered with the system performance of any of the instruments.

8.0 Data Summary

No quantified data has been changed. All data is valid. The data user should use historical data to determine the usefulness of the data when evaluating the Pesticide data. It is the professional judgment of the data validator that all pesticide data is valid.

This Level III data is validated based upon criteria developed by the data user, method requirements, National Functional Guidelines and experience of the data validator.

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Completeness Table **Date: 10/24/01**
MKM Project #: Ramsdell Landfill **Matrix: Water**
STL Project #: A1I210297 & A1I280133

Method: 7196A	**Number**		
Analyte	**of Tests**	**R Qualifiers**	**% Completeness**
Hexavalent Chromium	4	0	100%

Method: 9060	**Number**		
Analyte	**of Tests**	**R Qualifiers**	**% Completeness**
Total Organic Carbon	4	0	100%

Method: 9065	**Number**		
Analyte	**of Tests**	**R Qualifiers**	**% Completeness**
Phenolics	4	0	100%

Method: 7841	**Number**		
Analyte	**of Tests**	**R Qualifiers**	**% Completeness**
Thallium	4	0	100%

Method: 300.0A	**Number**		
Analyte	**of Tests**	**R Qualifiers**	**% Completeness**
Chloride	4	0	100%

Method: 150.1	**Number**		
Analyte	**of Tests**	**R Qualifiers**	**% Completeness**
pH	4	0	100%

Method: 160.1	**Number**		
Analyte	**of Tests**	**R Qualifiers**	**% Completeness**
Total Dissolved Solids	4	0	100%

Method: 180.1	**Number**		
Analyte	**of Tests**	**R Qualifiers**	**% Completeness**
Turbidity	4	0	100%

Method: 365.2	**Number**		
Analyte	**of Tests**	**R Qualifiers**	**% Completeness**
Total Phosphorus	4	0	100%

Method: 350.3	**Number**		
Analyte	**of Tests**	**R Qualifiers**	**% Completeness**
Ammonia Nitrogen	4	0	100%

Method: 310.1	**Number**		
Analyte	**of Tests**	**R Qualifiers**	**% Completeness**
Alkalinity	4	0	100%

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Completeness Table **Date: 10/24/01**
MKM Project #: Ramsdell Landfill **Matrix: Water**
STL Project #: A1I210297 & A1I280133

Method: 8082	**Number**		
Analyte	**of Tests**	**R Qualifiers**	**% Completeness**
Arochlor 1016	4	0	100%
Arochlor 1221	4	0	100%
Arochlor 1232	4	0	100%
Arochlor 1242	4	0	100%
Arochlor 1248	4	0	100%
Arochlor 1254	4	0	100%
Arochlor 1260	4	0	100%

Method: 8081A	**Number**		
Analyte	**of Tests**	**R Qualifiers**	**% Completeness**
alpha-BHC	4	0	100%
beta-BHC	4	0	100%
delta-BHC	4	0	100%
gamma-BHC	4	0	100%
Heptachlor	4	0	100%
Aldrin	4	0	100%
Heptachlor epoxide	4	0	100%
Endosulfan I	4	0	100%
Dieldrin	4	0	100%
4,4'-DDE	4	0	100%
Endrin	4	0	100%
Endosulfan II	4	0	100%
Endosulfan sulfate	4	0	100%
4,4'-DDT	4	0	100%
Endrin ketone	4	0	100%
Isodrin	4	0	100%
Kepone	4	0	100%
Methoxychlor	4	0	100%
Endrin aldehyde	4	0	100%
Chlordane	4	0	100%
4,4'-DDD	4	0	100%
Toxaphene	4	0	100%

Method: HPLC	**Number**		
Analyte	**of Tests**	**R Qualifiers**	**% Completeness**
Nitroguanidine	4	0	100%

Method: 8141	**Number**		
Analyte	**of Tests**	**R Qualifiers**	**% Completeness**
Methyl parathion	4	0	100%
Parathion	4	0	100%

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Completeness Table **Date: 10/24/01**
MKM Project #: Ramsdell Landfill **Matrix: Water**
STL Project #: A1I210297 & A1I280133

Method: 6010 **Analyte**	**Number of Tests**	**R Qualifiers**	**% Completeness**
Aluminum	4	0	100%
Antimony	4	0	100%
Arsenic	4	0	100%
Beryllium	4	0	100%
Barium	4	0	100%
Cadmium	4	0	100%
Calcium	4	0	100%
Chromium	4	0	100%
Cobalt	4	0	100%
Copper	4	0	100%
Iron	4	0	100%
Lead	4	0	100%
Magnesium	4	0	100%
Manganese	4	0	100%
Nickel	4	0	100%
Potassium	4	0	100%
Selenium	4	0	100%
Silver	4	0	100%
Sodium	4	0	100%
Thallium	4	0	100%
Vanadium	4	0	100%
Zinc	4	0	100%

Method: 7470 **Analyte**	**Number of Tests**	**R Qualifiers**	**% Completeness**
Mercury	4	0	100%

Method: 335.2 **Analyte**	**Number of Tests**	**R Qualifiers**	**% Completeness**
Cyanide	4	0	100%

Method: 376.1 **Analyte**	**Number of Tests**	**R Qualifiers**	**% Completeness**
Sulfide	4	0	100%

Method: 353.2 **Analyte**	**Number of Tests**	**R Qualifiers**	**% Completeness**
Nitrate Nitrite	4	0	100%

Method: 300.0A **Analyte**	**Number of Tests**	**R Qualifiers**	**% Completeness**
Sulfate	4	0	100%

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Completeness Table **Date: 10/24/01**
MKM Project #: Ramsdell Landfill **Matrix: Water**
STL Project #: A1I210297 & A1I280133

Method: 8330 **Analyte**	**Number of Tests**	**R Qualifiers**	**% Completeness**
HMX	4	0	100%
RDX	4	0	100%
1,3,5-Trinitrobenzene	4	0	100%
1,3-Dinitrobenzene	4	0	100%
Tetryl	4	0	100%
Nitrobenzene	4	0	100%
2,4,6-Trinitrotoluene	4	0	100%
2,4-Dinitrotoluene	4	0	100%
2,6-Dinitrotoluene	4	0	100%
2-Nitrotoluene	4	0	100%
3-Nitrotoluene	4	0	100%
4-Nitrotoluene	4	0	100%
Nitroglycerin	4	0	100%
4-Amino-2,6-dinitrotoluene	4	0	100%
2-Amino-4,6-dinitrotoluene	4	0	100%

Method: 8151 **Analyte**	**Number of Tests**	**R Qualifiers**	**% Completeness**
2,4-D	4	0	100%
Dinoseb	4	0	100%
2,4,5-TP (Silvex)	4	0	100%
2,4,5-T	4	0	100%

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Completeness Table
MKM Project #: Ramsdell Landfill
STL Project #: A1I210297
Date: 10/24/01
Method: 8260
Water

Analyte	Number of Tests	R Qualifier	% Completeness
1,1,1,2-Tetrachloroethane	5	0	100%
1,1,1-Trichloroethane	5	0	100%
1,1,2,2-Tetrachloroethane	5	0	100%
1,1,2-Trichloroethane	5	0	100%
1,1-Dichloroethane	5	0	100%
1,1-Dichloroethene	5	0	100%
1,1-Dichloropropene	5	0	100%
1,2,3-Trichloropropane	5	0	100%
1,2-Dibromo-3-Chloropropane	5	0	100%
1,2-Dibromoethane	5	0	100%
1,2-Dichloroethane	5	0	100%
1,2-Dichlorobenzene	5	0	100%
1,2-Dichloropropane	5	0	100%
1,3-Dichlorobenzene	5	0	100%
1,3-Dichloropropane	5	0	100%
1,4-Dichlorobenzene	5	0	100%
2,2-Dichloropropane	5	0	100%
2-Butanone	5	0	100%
2-Hexanone	5	0	100%
4-Methyl-2-pentanone	5	0	100%
Acetonitrile	5	0	100%
Acrolein	5	0	100%
Allyl Chloride	5	0	100%
Acetone	5	0	100%
Acrylonitrile	5	0	100%
Benzene	5	0	100%
Bromochloromethane	5	0	100%
Bromodichloromethane	5	0	100%
Bromoform	5	0	100%
Bromomethane	5	0	100%
Carbon Disulfide	5	0	100%
Carbon Tetrachloride	5	0	100%
Chlorobenzene	5	0	100%
Chloroethane	5	0	100%
Chloroform	5	0	100%
Chloromethane	5	0	100%
cis-1,2-Dichloroethene	5	0	100%
cis-1,3-Dichlorpropene	5	0	100%
Chloroprene	5	0	100%
Dibromochloromethane	5	0	100%

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Completeness Table
MKM Project #: Ramsdell Landfill
STL Project #: A1I210297
Date: 10/24/01
Method: 8260
Water

Analyte	Number of Tests	R Qualifier	%Completeness
Dibromomethane	5	0	100%
Dichlorodifluoromethane	5	0	100%
Dibromochloromethane	5	0	100%
Ethylbenzene	5	0	100%
Ethyl Methacrylate	5	0	100%
Iodomethane	5	0	100%
Isobutyl alcohol	5	0	100%
Methyl Methacrylate	5	0	100%
Methylene Chloride	5	0	100%
Methylacrylonitrile	5	0	100%
Propionnitrile	5	0	100%
Total Xylene	5	0	100%
Trans-1,4-Dichloro-2-butene	5	0	100%
Styrene	5	0	100%
Tetrachloroethene	5	0	100%
Toluene	5	0	100%
trans-1,2-Dichloroethene	5	0	100%
trans-1,3-Dichloropropene	5	0	100%
Trichloroethene	5	0	100%
Trichlorofluoromethane	5	0	100%
Vinyl Chloride	5	0	100%
Vinyl Acetate	5	0	100%

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Completeness Table
MKM Project #: Ramsdell Landfill
STL Project #: A1I210297
Date: 10/24/01
Method: 8270
Water

Analyte	Number of Tests	R Qualifier	% Completeness
1,2,4,5-Tetrachlorobenzene	4	0	100%
2,3,4,6-Trichlorobenzene	4	0	100%
1,2,4-Trichlorobenzene	4	0	100%
2,4,5-Trichlorophenol	4	0	100%
2,4,6-Trichlorophenol	4	0	100%
1,3,5-Trinitrobenzene	4	0	100%
1,3-Dinitrobenzene	4	0	100%
1,4-Naphthoquinone	4	0	100%
2,4-Dichlorophenol	4	0	100%
2,4-Dimethylphenol	4	0	100%
2,4-Dinitrophenol	4	0	100%
2,4-Dinitrotoluene	4	0	100%
2,6-Dinitrotoluene	4	0	100%
2,6-Dichlorophenol	4	0	100%
3,3'-Dichlorobenzidine	4	0	100%
3,3'-Dimethylbenzidine	4	0	100%
7,12-Dimethylbenz(a)anthracene	4	0	100%
4,6-Dinitro-2-methylphenol	4	0	100%
1-Naphthylamine	4	0	100%
2-Chloronaphthalene	4	0	100%
2-Chlorophenol	4	0	100%
2-Acetylaminofluorene	4	0	100%
2-Methylnaphthalene	4	0	100%
2-Methylphenol	4	0	100%
2-Naphthylamine	4	0	100%
2-Nitroaniline	4	0	100%
2-Nitrophenol	4	0	100%
3-Methylchloroanthrene	4	0	100%
3-Nitroaniline	4	0	100%
3-Methylphenol	4	0	100%
4-Bromophenyl-phenylether	4	0	100%
4-Methylphenol	4	0	100%
4-Nitroaniline	4	0	100%
4-Nitrophenol	4	0	100%
4-Chloro-3-methylphenol	4	0	100%
4-Aminobiphenyl	4	0	100%
4-Chlorophenyl-phenylether	4	0	100%
5-Nitro-o-toluidine	4	0	100%
Acenaphthene	4	0	100%

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Completeness Table
MKM Project #: Ramsdell Landfill
STL Project #: A1I210297
Date: 10/24/01
Method: 8270
Water

Analyte	Number of Tests	R Qualifier	%Completeness
Acenaphthylene	4	0	100%
Anthracene	4	0	100%
Acenaphthene	4	0	100%
Acetophenone	4	0	100%
Benzo(a)anthracene	4	0	100%
Benzo(a)pyrene	4	0	100%
Benzo(b)fluoranthene	4	0	100%
Benzo(g,h,I)perylene	4	0	100%
Benzo(k)fluoranthene	4	0	100%
Benzoic Acid	4	0	100%
Benzyl alcohol	4	0	100%
bis(2-Chloroethyoxy)methane	4	0	100%
bis(2-Chloroethy)ether	4	0	100%
bis(2-Chloro-1-methylethyl)ether	4	0	100%
bis(2-Ethylhexyl)phthalate	4	0	100%
Butylbenzylphthalate	4	0	100%
Chrysene	4	0	100%
Diallate	4	0	100%
Dimethoate	4	0	100%
Diphenylamine	4	0	100%
Disulfoton	4	0	100%
Di-n-butylphthalate	4	0	100%
Di-n-octylphthalate	4	0	100%
Dibenz(a,h)anthracene	4	0	100%
Dibenzofuran	4	0	100%
Diethylphthalate	4	0	100%
Dimethylphthalate	4	0	100%
Ethyl methanesulfonate	4	0	100%
Famphur	4	0	100%
Fluoranthene	4	0	100%
Fluorene	4	0	100%
Hexachlorobenzene	4	0	100%
Hexachlorobutadiene	4	0	100%
Hexachlorocyclopentadiene	4	0	100%
Hexachloroethane	4	0	100%
Hexachloropropene	4	0	100%
Indeno(1,2,3-cd)pyrene	4	0	100%
Isophorone	4	0	100%
Isosafrole	4	0	100%

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Completeness Table
MKM Project #: Ramsdell Landfill
STL Project #: A1I210297
Date: 10/24/01
Method: 8270
Water

Analyte	Number of Tests	R Qualifier	%Completeness
Methylpyrilene	4	0	100%
Methyl methanesulfonate	4	0	100%
Naphthalene	4	0	100%
Nitrobenzene	4	0	100%
N-Nitrosodi-n-butylamine	4	0	100%
N-Nitrosodiethylamine	4	0	100%
N-Nitrosodimethylamine	4	0	100%
N-Nitroso-di-n-propylamine	4	0	100%
N-Nitrosodiphenylamine	4	0	100%
N-Nitrosopiperdine	4	0	100%
N-Nitrosopyrrolidine	4	0	100%
O,O,O-Triethylphosphoro-thioate	4	0	100%
O-Toluidine	4	0	100%
Pentachlorobenzene	4	0	100%
Pentachloronitorbenzene	4	0	100%
Pentachlorophenol	4	0	100%
Phenacetin	4	0	100%
Phenanthrene	4	0	100%
Phenol	4	0	100%
Pyrene	4	0	100%
p-Phenylene diamine	4	0	100%
Phorate	4	0	100%
Pronamide	4	0	100%
p-Dimethylaminoazobenzene	4	0	100%
p-Chloroaniline	4	0	100%
Safrole	4	0	100%
Thionzin	4	0	100%

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Field Sampling Report

MKM

Date: 20Sept01

Sample ID: RQLMW-06

Project: Ramsdell Quarry Landfill

MKM Engineers, Inc.
RVAAP, 8451 St. Rt. 5
Ravenna, OH 44266

Sampling Information

Source	Groundwater / Product		Surface Water		Soils / Sediments / Sludge			
Method	Bailer	X	Sample Bottle		Scoop		Trowel	
	Pump		Bacon Bomb		Bowl		Hand Auger	
					Stainless Steel			
Type/Construction	Teflon							
Miscellaneous	Well Purging Form (Yes) - No							

Time of Sample Collection: 0915 hrs **Sample Type:** Discrete - (Grab) **Location:** Plotted on Map - Staked in Field - Estimated - Measured - (Surveyed)

Sample Depth: ~40 FT (below ground surface) **Decon:** (Dedicated) - Each Day - Each Location

Field Parameters (at time of sample)		Analytical Parameters				Other Parameters			
PID / FID Readings:		Herbicides	X	Sulfide	X	Corrosivity			
Background:	ppm 0.0	Ammonia	X	Nitrate/Nitrite	X				
		Alkalinity	X	TDS	X	Reactivity Sulfide/Cyanide			
		Turbidity	X	pH	X				
Sample:	0.0 ppm	Sulfate/Chloride	X	Total Phosphorus	X	Ignitability			
Water Level	38.02 FT	VOC	X	Phenolics	X	**QA Samples**			
Temperature	14.5 °C	SVOC	X	Hexavalent Chromium	X	MS/MSD			
Sp. Conductance:	1.33 ~~mS/cm~~ µS/cm	EXPLOSIVES	X	Pest/PCB	X	Duplicate ID			
pH	6.37 units	PROPELLANTS	X	TAL Dissolved Metals	X	Field Blank ID			
Turbidity	0.66 ppt ~~NTUs~~	TOC	X	Cyanide	X	Trip Blank ID			

Sample Description

Clear, Low Turbidity, No odor, No sheen

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:

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

Logged By: Mark Dunlevy (Please Print)

Signature: Mark D. Dunlevy

Reviewed by: Michael J. Saunders

Signature: Michael J. Saunders Date: 11-6-01

Monitoring Well Purging Form

Well ID : RQLMW-06
Date: 9/19/01
Weather: 70° overcast

Ravenna Army Ammunition Plant
Ravenna, Ohio
Project No.: 39551.01

WELL OBSERVATIONS

Protective Casing: (Intact) Damaged
Concrete Base: (Intact) Damaged
Vapor Readings : PID Photovac 2020

Locked : (Yes) - No
Inner Casing : (2") - 4" - 6" - 8" Other: _____
Background: 0.0 Inside Well Casing: 0.0

	Present	Depth
LNAPL	Yes - (No)	
DNAPL	Yes - (No)	

Decontamination Procedure:
* Nonphosphate detergent scrub
* Tap water rinse
* Distilled water rinse
* Air dry

CALCULATIONS

(A) Depth to Well Bottom 41.90 (ft) TOC - TIC - BGS (Measured) Previously Measured (circle one)
(B) Depth to Water 37.98 (ft) TOC - TIC - BGS Time Measured : 1015
(C) Water Column Height (A-B) 3.92 (ft)
(D) Well Diameter Factor 0.16 (gal/ft) (2" = 0.16, 4" = 0.65, 6" = 1.47 , 8" = 2.61 GAL / FT)
(E) One Well Volume (C * D) 0.63 (gal)
(F) Volumes to be Evacuated 5
(G) **TOTAL VOLUME TO BE EVACUATED (E * F)** 3.15 **(gal)**

1.9
0.5

EVACUATION METHOD

Well Evacuation Method : (Bailer) - Submersible Pump - Other: _____

Purge Water Disposition : 1. Discharge Onsite 2. Collected And: (Stored) - Disposed (Onsite) - Offsite

Well Yield : High or (Low) Collected In : Tanks - (Drums) No. of Containers : 1

Comments: Hanna HI 991301 Water Quality Meter Used

Time	Depth to Water (ft.)	Purge Volume (gal)	0.50 Field Measurements PID	Spec. Cond. mS/cm	Temp. °C	pH	Turb. ppt	Comments
1020	37.98	Initial	0.0	2.10	13.6	6.05	0.90	
1025	39.35	1	0.0	1.50	12.2	5.91	0.76	
1030	40.42	2	0.0	1.36	12.3	5.91	0.67	
1035	41.13	3	0.0	1.14	12.4	5.91	0.58	
1045	41.35	4	0.0	1.02	12.9	5.95	0.51	
1100	41.38	5	0.0	0.99	14.3	5.93	0.48	

Personnel Performing Purging Mark Dunlevy

Logged By: James Panozzo (print)
Date: 9/19/01
Signature: [signature]

Reviewd By : Michael Samchuk (print)
Date: 11-6-01
Signature: [signature]

Field Sampling Report

MKM

Date: 20 Sept 01

Sample ID: RQLMW-07

Project: Ramsdell Quarry Landfill

MKM Engineers, Inc.
RVAAP, 8451 St. Rt. 5
Ravenna, OH 44266

Sampling Information

Source	Groundwater / Product		Surface Water		Soils / Sediments / Sludge			
Method	Bailer	X	Sample Bottle		Scoop		Trowel	
	Pump		Bacon Bomb		Bowl		Hand Auger	
					Stainless Steel			
Type/Construction	Teflon							
Miscellaneous	Well Purging Form (Yes) - No							

Time of Sample Collection: 1010 hrs **Sample Type:** Discrete - (Grab) **Location:** Plotted on Map - Staked in Field Estimated - Measured - (Surveyed)

Sample Depth: ~14 FT (below ground surface) **Decon:** (Dedicated) - Each Day - Each Location

Field Parameters (at time of sample)

PID / FID Readings:		
Background:	0.0	ppm
Sample:	0.0	ppm
Water Level	11.26	FT
Temperature	17.5	°C
Sp. Conductance:	1.74	~~MHOS~~ mS/cm
pH	6.56	units
Turbidity	0.88	~~NTU~~

Analytical Parameters

Herbicides	X	Sulfide	X	Corrosivity	
Ammonia	X	Nitrate/Nitrite	X		
Alkalinity	X	TDS	X	Reactivity Sulfide/Cyanide	
Turbidity	X	pH	X		
Sulfate/Chloride	X	Total Phosphorus	X	Ignitability	
VOC	X	Phenolics	X		
SVOC	X	Hexavalent Chromium	X		
EXPLOSIVES	X	Pest/PCB	X		
PROPELLANTS	X	TAL Dissolved Metals	X		
TOC	X	Cyanide	X		

QA Samples

MS/MSD	RQLMW-07-MS/MSD
Duplicate ID	Duplicate
Field Blank ID	Field Blank
Trip Blank ID	Trip Blank

Sample Description

Slightly orange color, Petroleum Odor
~~Some~~ No Sheen, Low Turbidity

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:

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

Logged By: Mark Dunlap (Please Print)

Signature: Mark D. Dunlap

Reviewed by: Michael Gobla

Signature: Michael Samelak Date: 11-6-01

Monitoring Well Purging Form

Well ID : RQLMW-07
Date: 9/19/01
Weather: 70° overcast

Ravenna Army Ammunition Plant
Ravenna, Ohio
Project No.: 39551.01

WELL OBSERVATIONS

Protective Casing: (Intact) - Damaged
Concrete Base: (Intact) - Damaged
Vapor Readings : PID Photovac 2020

Locked : (Yes) - No
Inner Casing : (2") - 4" - 6" - 8" Other: _____
Background: 0.0 Inside Well Casing: 0.0

	Present	Depth
LNAPL	Yes - (No)	
DNAPL	Yes - (No)	

Decontamination Procedure:
* Nonphosphate detergent scrub
* Tap water rinse
* Distilled water rinse
* Air dry

CALCULATIONS

(A) Depth to Well Bottom 18.47 (ft) TOC - TIC - BGS (Measured) - Previously Measured (circle one)
(B) Depth to Water 11.27 (ft) TOC - TIC - BGS Time Measured : 11:10
(C) Water Column Height (A-B) 7.2 (ft)
(D) Well Diameter Factor 0.16 (gal/ft) (2" = 0.16, 4" = 0.65, 6" = 1.47 , 8" = 2.61 GAL / FT)
(E) One Well Volume (C * D) 1.15 (gal)
(F) Volumes to be Evacuated 5
(G) **TOTAL VOLUME TO BE EVACUATED (E * F)** 5.75 **(gal)**

EVACUATION METHOD

Well Evacuation Method : (Bailer) - Submersible Pump - Other: _____

Purge Water Disposition : 1. Discharge Onsite 2. Collected And: (Stored) - Disposed (Onsite) - Offsite

Well Yield : High or Low Collected In : Tanks - (Drums) No. of Containers : 1

Comments: Hanna HI 991301 Water Quality Meter Used

Time	Depth to Water (ft.)	Purge Volume (gal)	Field Measurements					Comments
			PID	Spec. Cond. mS/cm	Temp. °C	pH	Turb. ppt	
1115	11.27	Initial	0.0	1.77	18.7	6.09	0.88	
1120	11.40	1	0.0	1.73	18.0	6.13	0.86	
1125	11.44	2	0.0	1.74	17.9	6.13	0.86	
1130	11.43	3	0.0	1.69	18.0	6.14	0.86	
1135	11.45	4	0.0	1.79	18.0	6.16	0.89	
1140	11.52	5	0.0	1.72	17.8	6.16	0.85	

Personnel Performing Purging Mark Danley

Logged By: James Panozzo (print)
Date: 9/19/01
Signature : James Panozzo

Reviewd By : Michael Simelak (print)
Date: 11-6-01
Signature: Michael Simelak

Chain of Custody Record

SEVERN TRENT SERVICES — **Severn Trent Laboratories, Inc.**

STL-4124 (1200)

Client: MKM Engineers, Inc	Project Manager: Stan Levenger	Date: 9/20/01	Chain of Custody Number: 078040
Address: 8451 State Route 5	Telephone Number (Area Code)/Fax Number: 330-358-7920 / 330-358-2924	Lab Number:	Page 1 of 2
City: Ravenna — State: OH — Zip Code: 44266	Site Contact: Mike Sumelak	Lab Contact: Debbie Budd	
Project Name and Location (State): Ramsdell Quarry Landfill, AVLAP, Ravenna, OH	Carrier/Waybill Number: STL Courier		
Contract/Purchase Order/Quote No.: PO # LA902-G00089			

Sample I.D. No. and Description (Containers for each sample may be combined on one line)	Date	Time	Matrix: Air	Aqueous	Sed.	Soil	Containers & Preservatives: Unpres.	H2SO4	HNO3	HCl	NaOH	ZnAc/NaOH	VOC (8260)	BNA (8270)	Metals (6010/7470)	Herbicides (8151A)	Pesticides (8081A)	Explosives (8330)	Propellents	Cyanide (9010/335.2)	Sulfide (376.1)	Ammonia (350.2) Nitrate/Nitrite (353.2)	Alkalinity (310.1)	TDS (160.1)	Turbidity (180.1)	Hexavalent Chromium	Special Instructions/ Conditions of Receipt
RQLMW-06	9/20/01	09:15		X				X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		
RQLMW-07	9/20/01	10:10		X				X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		MS/MSD Bottle Sets included
Duplicate	9/20/01	10:20		X				X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		*See Attached
Field Blank	9/20/01	08:05		X				X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		Sheet for
Trip Blank	LAB			X						X			X													Additional Analysis.*

Possible Hazard Identification: ☐ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☒ Unknown

Sample Disposal: ☐ Return To Client ☒ Disposal By Lab ☐ Archive For _____ Months (A fee may be assessed if samples are retained longer than 3 months)

Turn Around Time Required: ☐ 24 Hours ☐ 48 Hours ☐ 7 Days ☐ 14 Days ☒ 21 Days ☐ Other _____

QC Requirements (Specify):

	Date	Time		Date	Time
1. Relinquished By: Michael Bell	9-20-01	1600	1. Received By: Al Haidit	9-20-01	1600
2. Relinquished By			2. Received By		
3. Relinquished By			3. Received By		

Comments: MS/MSD Bottle Sets included for RQL MW-07, Metals Filtered in the Field. Preservative Added in Field.

DISTRIBUTION: WHITE - Stays with the Sample; CANARY - Returned to Client with Report; PINK - Field Copy

ADDITIONAL PARAMETERS

Sample I.D.	Date	Time	Matrix	Sulfate/Chloride (300.0)	pH (150.1)	Total Phosphorus (365.2)	TOC (9060)	Phenolics (9065)
RQLMW-06	9/20/01	09:15	water	x	x	x	x	x
RQLMW-07	9/20/01	10:10	water	x	x	x	x	x
Duplicate	9/20/01	10:20	water	x	x	x	x	x
Field Blank	9/20/01	08:05	water	x	x	x	x	x

Monitoring Well Purging Form

Well ID: MW006

Date : 26 Sept 01

Ravenna Army Ammunition Plant
Ramsdell Quarry Landfill(1048)

WELL OBSERVATIONS

Protective Casing: (Intact) · Damaged **Locked:** (Yes) · No **Key No:** 10G012

Concrete Base: Intact · Damaged **Inner Casing:** (2") · 4" · 6" · 8" **Other:** _____

Stickup Height: _____ (ft) **TIC · TOC Difference:** _____ (ft)

Vapor Readings : ~~HNu OVA~~ Photo Vac 2020 Background: 0.0 Inside Well Casing: 0.0

	Present	Depth	Sampled	Sample ID
LNAPL	Yes · (No)	_____	Yes (No)	_____
DNAPL	Yes · (No)	_____	Yes (No)	_____

CALCULATIONS

(A) **Depth to Well Bottom** 41.90 (ft) TOC · TIC · BGS **Measured · Previously Measured** (circle one)

(B) **Depth to Water** 38.17 (ft) TOC · TIC · BGS **Time Measured:** 1115

(C) **Water Column Height (A-B)** 3.73 (ft)

(D) **Well Diameter Factor** 0.16 (gal/ft) (2" = 0.16, 4" = 0.65, 6" = 1.47, 8" = 2.61 GAL/FT)

(E) **One Well Volume (C*D)** 0.597 (gal)

(F) **Volumes to be Evacuated** 5

(G) TOTAL VOLUME TO BE EVACUATED (E * F) 2.98 (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: 1

Comments: Horiba U-22 Water Quality Meter Used

TIME	DEPTH TO WATER (ft)	PURGE RATE (gpm)	Field Measurements						Comments
			~~Photovac 2020 HNu~~	pH	Spec. Cond. mS/cm ~~µS/cm~~	Turb. ppt	DO	Temp °C	
1119	38.17		0.0	6.27	0.70	0.34		11.3	Initial
1121	40.35	1 volume	0.0	6.31	0.66	0.33		11.1	
1127	40.92	2 volumes	0.0	6.31	0.66	0.33		11.0	
1132	41.35	3 volumes	0.0	6.33	0.68	0.34		11.2	Stopped at 2 gal
1344	38.49	2nd Initial	0.0	6.36	0.61	6.33		11.3	went dry. Restarted
1352	39.92		0.0	6.33	0.63	6.31		10.7	

Logged By: Mark Dunlay (Please Print) Reviewed By: Michael Bell

Signature: Mark D. Dunlay Date : 11-6-01

Field Sampling Report

MKM

Sample ID: RQL-MW-00C

Date: 26 Sept 01 Project: Ramsdell Quarry Landfill

MKM Engineers, Inc.
RVAAP, 8451 St. Rt. 5
Ravenna, OH 44266

Sampling Information

Source	Groundwater / Product		Surface Water		Soils / Sediments / Sludge			
Method	Bailer	X	Sample Bottle		Scoop		Trowel	
	Pump		Bacon Bomb		Bowl		Hand Auger	
					Stainless Steel			
Type/Construction	Teflon							
Miscellaneous	Well Purging Form (Yes) No							

Time of Sample Collection: 1355 hrs Sample Type: Discrete (Grab) Location: Plotted on Map - Staked in Field Estimated - Measured - (Surveyed)

Sample Depth: ~40 FT (below ground surface) Decon: (Dedicated) - Each Day - Each Location

Field Parameters (at time of sample)		Analytical Parameters				Other Parameters			
PID / FID Readings: Background:	ppm	PP / RCRA Metals		TCLP		Corrosivity			
0.0		Soluble		VOC					
						Reactivity Sulfide/Cyanide			
Sample: 0.0	ppm	Totals				Ignitability			
Water Level 39.92	FT	VOC				QA Samples			
Temperature 10.7	°C	SVOC				MS/MSD			
Sp. Conductance: 0.63	~~mhos~~ MS/CM	EXPLOSIVES		Pest/PCB		Duplicate ID			
pH 6.33	units	PROPELLANTS		TAL Dissolved Metals		Field Blank ID			
Turbidity 0.31 ppt	~~N.T.U.~~	TOC		Cyanide	X	Trip Blank ID			

Sample Description

Clear, Low Turbidity, No Odor, No Sheen

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:

QA/QC Provided: MS/MSD - Duplicate - Trip Blanks - Field Blanks

Parameters: Same as Above - As Listed

Logged By: Mark Dunlap (Please Print) Reviewed by: Michael Samelak

Signature: Mark Dunlap Signature: Michael Samelak Date: 11-6-01

Monitoring Well Purging Form

Well ID: RQLmw-02

Ravenna Army Ammunition Plant
Ramsdell Quarry Landfill(1048)

Date : 26Sept01

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~~ Photovac 2020 Background: 0.0 Inside Well Casing: 0.0

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

CALCULATIONS

(A) Depth to Well Bottom 18.47 (ft) TOC · TIC · BGS Measured Previously Measured (circle one)

(B) Depth to Water 11.32 (ft) TOC · TIC · BGS Time Measured: 1318

(C) Water Column Height (A-B) 7.15 (ft)

(D) Well Diameter Factor 0.16 (gal/ft) (2" = 0.16, 4" = 0.65, 6" = 1.47, 8" = 2.61 GAL/FT)

(E) One Well Volume (C*D) 1.14 (gal)

(F) Volumes to be Evacuated 5

(G) TOTAL VOLUME TO BE EVACUATED (E * F) 5.72 (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: 5

Comments: Hanna HI 991301 Water Quality Meter Used

TIME	DEPTH TO WATER (ft)	PURGE RATE (gpm)	Field Measurements						Comments
			Photovac ~~HNu~~ 2020	pH	mS/cm Spec. Cond.	Turb. ppt	DO	Temp °C	
1313	11.32		0.0	6.57	1.42	0.70		15.6	Initial
1316	11.60	1 volume	0.0	6.57	1.43	0.71		15.1	
1318	11.71	2nd volume	0.0	6.58	1.45	0.72		16.0	
1321	11.81	3rd volume	0.0	6.59	1.45	0.72		16.0	
1323	11.83	4th volume	0.0	6.59	1.46	0.72		16.2	
1326	11.80	5th volume	0.0	6.58	1.46	0.73		16.3	Final

Logged By: Mark Dunlevy (Please Print) Reviewed By: Michael Bole

Signature: Mark J. Dunlevy Date : 11-6-01

Field Sampling Report

MKM

Sample ID: RQLMW07

Date: 26 Sept 01 Project: Ramsdell Quarry Land fill

MKM Engineers, Inc.
RVAAP, 8451 St. Rt. 5
Ravenna, OH 44266

Sampling Information

Source	Groundwater / Product		Surface Water		Soils / Sediments / Sludge			
Method	Bailer	X	Sample Bottle		Scoop		Trowel	
	Pump		Bacon Bomb		Bowl		Hand Auger	
					Stainless Steel			
Type/Construction	Teflon							
Miscellaneous	Well Purging Form (Yes) No							

Time of Sample Collection: 1327 hrs **Sample Type:** Discrete - (Grab) **Location:** Plotted on Map - Staked in Field - Estimated - Measured - (Surveyed)

Sample Depth: ~12 FT (below ground surface) **Decon:** (Dedicated) - Each Day - Each Location

Field Parameters (at time of sample)		Analytical Parameters				Other Parameters			
PID / FID Readings: Background: 0.0	ppm	PP / RCRA Metals Soluble		TCLP VOC		Corrosivity			
						Reactivity Sulfide/Cyanide			
Sample: 0.0	ppm	Totals				Ignitability			
Water Level 11.80	FT	VOC				QA Samples			
Temperature 16.4	°C	SVOC				MS/MSD			
Sp. Conductance: 1.46 ~~mMHO~~ mS/cm		EXPLOSIVES		Pest/PCB		Duplicate ID			
pH 6.58	units	PROPELLANTS		TAL Dissolved. Metals		Field Blank ID			
Turbidity 0.73 ppt ~~N.T.U.~~		TOC		Cyanide	X	Trip Blank ID			

Sample Description

Clear Slight Hydrocarbon odor No Sheen

Low Turbidity

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:

QA/QC Provided: MS/MSD - Duplicate - Trip Blanks - Field Blanks

Parameters: Same as Above - As Listed

Logged By: Mark Dunlevy (Please Print) Reviewed by: Michael Sawdon

Signature: Mark D. Dunlevy Signature: Michael Sawdon Date: 11-6-01

Chain of Custody Record

SEVERN TRENT SERVICES — **Severn Trent Laboratories, Inc.**

STL-4124 (1200)

Client	Project Manager	Date	Chain of Custody Number
MKM Engineers, Inc.	Stan Levenger	9/26/01	078041
Address	**Telephone Number (Area Code)/Fax Number**	**Lab Number**	**Page 1 of 1**
8451 State Route 5	330-358-2920/330-358-2924		
City / **State** / **Zip Code**	**Site Contact**	**Lab Contact**	
Ravenna / OH / 44266	Mike Samelak	Debbie Budd	
Project Name and Location (State)	**Carrier/Waybill Number**		
Ramsdell Quarry Landfill, Ravenna, OH	FedEx 8246 5213 8536		
Contract/Purchase Order/Quote No.			

Sample I.D. No. and Description (Containers for each sample may be combined on one line)	Date	Time	Matrix: Air	Aqueous	Sed.	Soil	Containers & Preservatives: Unpres.	H2SO4	HNO3	HCl	NaOH	ZnAc/NaOH	Analysis: Cyanide	Special Instructions/ Conditions of Receipt
RQL MW-06	9/26/01	13:55		X							X		X	Resample of cyanide to Replace misanalyzed samples from 9/20/01
Duplicate	9/26/01	13:27		X							X		X	
Field Blank	9/26/01	10:38		X							X		X	

Possible Hazard Identification
☐ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☒ Unknown

Sample Disposal
☐ Return To Client ☒ Disposal By Lab ☐ Archive For _____ Months (A fee may be assessed if samples are retained longer than 3 months)

Turn Around Time Required
☐ 24 Hours ☐ 48 Hours ☐ 7 Days ☐ 14 Days ☐ 21 Days ☒ Other Report delivery in same timeframe as original samples (~Oct. 12)

QC Requirements (Specify)

1. Relinquished By	Date	Time	1. Received By	Date	Time
Michael G Bl	9/26/01	1530	FedEx		
2. Relinquished By	Date	Time	2. Received By	Date	Time
3. Relinquished By	Date	Time	3. Received By	Date	Time

Comments

DISTRIBUTION: WHITE - Stays with the Sample; CANARY - Returned to Client with Report; PINK - Field Copy

Field Equipment Calibration Log

Project Name: Ramsdell Quarry Landfill **Location: Ravenna, Ohio**

Field Reference Number: —

Equipment Type: Water Quality Meter

Model Name: Hanna HI 991301

Serial Number: 014180

Date of Last Calibration by Manufacturer: 9-17-01

Did Manufacturers Instructions Accompany Equipment: (Yes) / No

Date Equipment Arrived Onsite: 9-18-01

Calibration Frequency: (Daily) / Prior to each Reading

Calibration Standard(s): (1) 4pH (2) 7pH (3) 12.88 mS/cm

Initial Calibration Verified: Yes / No

Date/Time of Calibration	Calibration Standard 1	Calibration Standard 2	Calibration Standard 3	Calibration Accept / Reject	Calibration By	Comments
~~19~~Sept01/0815	4.00	7.00	12.90	(Accept) / Reject	Mark Dunlevy	
~~20~~Sept01/0745	4.00	7.00	12.88	(Accept) / Reject	Mark Dunlevy	
26Sept01/0929	3.90	7.00	12.88	(Accept) / Reject	Michael B & R	
				Accept / Reject		
				Accept / Reject		
				Accept / Reject		
				Accept / Reject		
				Accept / Reject		
				Accept / Reject		
				Accept / Reject		
				Accept / Reject		
				Accept / Reject		
				Accept / Reject		

Field Equipment Calibration Log

Project Name: Central Burn Pits, Cobbs Pond, Ramsdell Quarry **Location:**

Field Reference Number: –

Equipment Type: PE Photovac PID

Model Name: 2020

Serial Number: DQFM 208

Date of Last Calibration by Manufacturer: –

Did Manufacturers Instructions Accompany Equipment: (Yes) / No

Date Equipment Arrived Onsite: NA

Calibration Frequency: Daily / Prior to each Reading

Calibration Standard(s): (1) 100 ppm Isobutylene

(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
5-10-01 12:33	100ppm			Accept / Reject		
7/13/930	100ppm			Accept / Reject		100ppm
7-30-01	100ppm			Accept / Reject		100 ppm
8-27-01	100ppm			Accept / Reject		100ppm
8-28-01	100ppm			Accept / Reject		100ppm
8-29-01	100ppm			Accept / Reject		99.8ppm
8-30-01	100ppm			Accept / Reject		100 ppm
8-30-01	100ppm			Accept / Reject		100 ppm
9-4-01	100ppm			Accept / Reject		99.7 ppm
9-5-01	100ppm			Accept / Reject		99.7 ppm
9-6-01	100ppm			Accept / Reject		100 ppm
9-7-01	100ppm			Accept / Reject		99.8 ppm
9-19-01	100ppm			Accept / Reject		99.8 ppm

Field Equipment Calibration Log

Project Name: RVAAP – Ramsdell Quarry Landfill **Location: Ravenna, Ohio**

Field Reference Number: —

Equipment Type: PE PhotovacPID

Model Name: 2020

Serial Number: DQFM 208

Date of Last Calibration by Manufacturer: —

Did Manufacturers Instructions Accompany Equipment: (Yes) / No

Date Equipment Arrived Onsite: NA

Calibration Frequency: (Daily) / Prior to each Reading

Calibration Standard(s): (1) 100ppm Isobutylene

(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
9/26/01/1050	100 ppm			(Accept) / Reject	Michael GBS	100ppm
				Accept / Reject		
				Accept / Reject		
				Accept / Reject		
				Accept / Reject		
				Accept / Reject		
				Accept / Reject		
				Accept / Reject		
				Accept / Reject		
				Accept / Reject		
				Accept / Reject		
				Accept / Reject		
				Accept / Reject		